Pre-service teachers becoming researchers: the role of professional learning groups in creating a community of inquiry

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Abstract

Contemporary schools seek to employ teachers who are curious learners, who can employ practitioner inquiry skills to investigate, inform and grow their own classroom practice, responsive to their circumstances. As a profession, the question we must ask is how do we best prepare and continue to equip teachers with the necessary research skills to investigate and inform their own practice? In this study, we share our pedagogical stance and features of our approach in a new core undergraduate subject for pre-service teachers (PSTs). We discuss professional learning groups (PLGs) for initial teacher education students as the main intervention in the subject, and, more specifically, we elaborate how regular participation in PLGs formed in an on-campus subject can help PSTs to become researchers. We draw on 183 student exit tickets and student feedback surveys to consider broader implications for how to engage teachers in research. This study poses questions about the nature of practitioner research and investigates the role that PLGs play in disrupting the challenges universities face in preparing teachers to engage in and with research.

Keywords Professional learning groups · Pre-service teachers · Teacher education · Practitioner research · Action research

Introduction

Teachers need to retain their sense as learners and as inquirers for numerous reasons. It can enhance their sense of agency, refresh their openness to new knowledge and ways of seeing and thinking, sharpen their reliance on valid evidence and

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model inquiry learning for their students. Perhaps most fundamentally, remaining open to learning familiarises teachers with their students and their learning contexts, and with their own professional practice with a view to improving it. In establishing professional learning communities in schools, a culture of inquiry, innovation and exploration amongst teachers is regarded as a distinguishing element (Admiraal et al., 2021). Such professional communities of inquiry are characterised by a collective open-mindedness to doing things differently (Admiraal et al., 2021) through curiosity-driven, evidence-informed, contextualised collaborative endeavours (Timperley et al., 2014). However, teachers are reputed at times to be hesitant to engage in research. Gutierez and Kim (2017) attribute this to time pressures and associated priorities and motivations and a "belief that research results are irrelevant to the immediate needs of the teaching and learning situation" (p. 444). Giralt-Romeu et al., (2021, p. 1) define teacher-initiated research as "systematic analysis of their own educational practices with the goal of improving them", while Badia et al. (2020) describe teacher inquiry as "ways in which teachers carry out inquiries in order to affect [*sic*] changes in educational practice"' (p. 865).

This paper explores and evaluates the use of PLGs drawing on interpretive phenomenological analysis (IPA) and case study methodologies. This approach served to disrupt some of the above dynamics, while not being too disruptive. Two authors of this study co-designed a new fourth-year university core subject for PSTs 'Teacher as Researcher' in an Australian university. The subject was underpinned by an important, yet challenging aim: how to prepare PSTs to become researchers.

The subject comprised weekly workshops wherein our students developed, implemented and evaluated individual action research projects (McNiff, 2017), sometimes called action learning projects (Aubusson et al., 2009). Revans (2011) defines action research, at its simplest, as "learning by doing" (p. 5). In 'doing', the PSTs learned through designing, experimenting, implementing, as well as refining, potentially erring and evaluating a research project. Individual projects were developed over nine weeks through experiential in-class activities, requiring PSTs to develop a guiding inquiry question, engage with scholarly literature and theories, discuss ethical considerations and decide on data collection and analysis methods.

Having prepared the action research proposal, our students participated in a three-week in-school professional experience (PE), where they conducted their research. Before starting the 'Teacher as Researcher' subject, the students had undertaken at least four prior PEs. The placements typically take place in each year during the degree and create opportunities for PSTs to apply and extend their campus-based learning. During this PE the PSTs implemented lessons and their action research projects.

Individual research projects aligned with the *Australian Professional Standards for Teachers* (Australian Institute for Teaching and School Leadership (AITSL), 2018). Seven Standards comprise domains of professional knowledge, professional practice and professional engagement:

1. Knowing students and how they learn;
2. Knowing the content and how to teach it;

3. Implementing effective teaching and learning;
4. Creating safe and supportive learning environment;
5. Assessing, reporting and providing feedback on student learning;
6. Engaging in professional learning;
7. Engaging professionally with colleagues and the community.

PSTs designed, conducted and evaluated their projects as an embedded element of class activities and assessments. An integral part of the subject design was professional learning groups (PLGs)—a fixed cluster of 3–5 members with similar professional research interests. We define PLGs as a capacity-building means for practitioners to enhance teacher learning, competency and practice (Hairon et al., 2017). The groups were formed voluntarily based on PSTs' individual, subjective research interests and their alignment to a specific professional Standard (AITSL, 2018). PLGs provided opportunities to offer and receive peer feedback, discuss weekly challenges and garner support through emphasising a collective open-mindedness towards contextualised professional inquiry. The small-group time (10–20 min) was embedded in the weekly workshop design and allowed students to collaboratively apply freshly acquired knowledge to their projects and support one another. Despite being one of several educational design innovations in the subject, PLGs had a significant impact on the students' action research projects, community building and professional learning within their initial teacher education degree.

Background

Over the past 30 years a new paradigm has been moving teacher professional development beyond solely the acquisition of new knowledge and skills. This shift prompts scholars and practitioners to rethink teaching practices and construct new classroom roles and expectations (Timperley et al., 2014; Vescio et al., 2008). Teachers are increasingly expected to be more active in curriculum development, directing their own professional learning and engagement with research. The notion of teacher-as-researcher has been commonly discussed both in relation to practitioner research and the research-engaged teacher (Furlong, 2014; Priestley & Drew, 2019).

The promotion of research in pre-service education presents challenges. Many PSTs harbour negative attitudes towards conducting research (Puustinen et al., 2018). PSTs would rather focus on teaching than conducting research and perceive that conducting research demands too much cognitive effort, which is typically a compulsory, assessment-related exercise (van Katwijk et al., 2021). This is nested in a wider socio-political context. Charest (2019) argues that many universities and schools teach reproduction of colonial practices and imported knowledges, methodologies and curricula. Charest questions why PSTs should focus their efforts on how to improve classroom management to attain higher scores on standardised examinations, rather than on ways to make schools more democratic, equitable, just, sustainable and inviting. PSTs have little, if any, say in the what, how, or why of

teaching. This can be problematic as these teachers then pass on to their students the values, strategies and practices that they internalise during pre-service. Accordingly, some PSTs enter this subject with an instrumental mindset, presuming that the course should serve to help them *teach* rather than to *undertake research*, which some see as peripheral at best. One student teacher in our study stated: "Teach us how to teach, not how to research". How, then, should teachers learn research skills? In this paper we ask what role PLGs can play in this process.

Teachers-as-researchers

The nexus between learning, teaching and research is crucial. Both research and teaching create something that is systematic, not haphazard, and new knowledge is thereby acquired. Accordingly, the processes of inquiry, data collection, analysis and dissemination, need to be systematic, purposeful and meaningful. These practices should mean something to those they serve, and to those from whom they glean data. In these aspects, research parallels learning; its dissemination equates to teaching.

Action research can "contribute to knowledge and to *practice*" (Coughlan & Coughlan, 2002, p. 222, emphasis added). Teachers-as-researchers undertake intentional, focussed and systematic collection of data to inform (their) learning and teaching. Evidence-based practice is important for ongoing improvement, as is practice-based evidence (Cochran-Smith & Lytle, 2009). Teaching serves its immediate and distal communities well as a "research-informed" and "research informing" profession (Lingard & Renshaw, 2010, p. 26). The teaching profession also seeks constantly to evaluate, improve and transform both itself (Campbell & McNamara, 2010), and its students. One way of doing this is through investigating issues or problems relevant to local—and broader—practice (Ravitch, 2014) through engaging in individual and collective inquiry. Le Fevre et al. (2015) refer to *genuine* inquiry, characterised by an "open-minded stance and desire to learn" (p. 1). They lament the infrequency with which it is practised among teachers as part of their professional learning.

We frame the teacher-as-researcher around relationship as follows: relationship with research inquiry, with peers, with teachers, with literature and with self. Relationship is crucial to teaching, learning and research, and this definition encapsulates connection with the student-selected research questions, with peers and teachers, and with PSTs' own identity and agency. These bear some resonance with Brookfield's (2017) four lenses of critical reflection: students' eyes (how do students experience learning?), colleagues' perceptions (how would colleagues deal with/address/interpret your challenges?), personal experience (what is your view/standpoint/experience?) and theory (what literature/sources of knowledge discuss the inquiry?). Student participation in PST education can affect how these relationships emerge. Bergmark and Westman (2018) define student participation as "students being active and engaged in the classroom; students impacting on curriculum design; and students' feeling of belonging to a community" (p. 1352).

Relationship with the research inquiry—engagement and authenticity

Engagement is a *sine qua non* of effective education, piquing students' curiosity and triggering their interest towards active involvement in learning (Buchanan, Pressick-Kilborn, & Maher, 2018). One of the highest quests for teachers is the generation of 'buy-in', or student investment in the subject at hand. Some systems have attempted this through high-stakes testing, but the risk with mostly extrinsic rewards (and punishments) is that student investment might be superficial, instrumental and grudging (Olson, 2009). Formal education environments have struggled with drawing the students into deep learning (Zeivots, 2015). Associated student behaviour might successfully mimic engagement, but could have the opposite effect, of preparing students for lifelong disengagement from the topic. Such regimes might also compromise student wellbeing.

One means of increasing engagement is the adoption of authentic learning tasks. Such tasks need to be relevant to students' worlds, while extending learners beyond those worlds. Authentic learning is characterised by, *inter alia*, real-world similitude, sustained engagement, collaboration, inbuilt ambiguity and uncertainty of outcomes, and metacognitive reflection (Lombardi, 2007). It engages learners with the real worlds of work and life, through tailored associated activities. Similarly, at its best it requires and enables engagement with peers and teachers, within and beyond the classroom, preferably over a sustained period. It also demands and rewards reflection on action and outcomes. It is accompanied by authentic assessment, which also presents complexities and ambiguities that may be daunting for the teacher and student, particularly if the stakes are high.

Relationship with others—peers and teachers

Learners will inevitably interact with others in the room, and, increasingly, beyond the room, to take 'next steps' in developing their skills, knowledge and understanding. Vygotsky (1978) termed this as the Zone of Proximal Development, defined as the gap between actual capabilities and potential achievements "under adult guidance or in collaboration with more capable peers" (p. 86). Groupwork is one effective means of achieving such collaboration. This approach enables learners to identify a problem and to devise responses accordingly, acquiring interpersonal skills thereby. Such skills have been identified as important for 21st-century teaching/learning contexts (Fiore et al., 2018).

Learners and teachers form part of a community, or perhaps overlapping communities, of practice with a specific focus on knowledge building which can be co-created through collaborative inquiry. As Lave and Wenger (1991) explain, members contribute to such a community through developing "knowledge, skill and discourse" (p. 122). Universities and schools are communities of (learning and teaching) practice. Wenger (2000) stipulated that all organisations need to "design themselves as social learning organisations" (p. 225) within a broader learning context.

How much more then should initial teacher education programs function as learning organisations that seek to tackle and interrogate the profession's social practices?

Relationship with self—teacher identity and reflection

Final-year PSTs are at a crucial point of their identity development. They are soon to pivot from being primarily learners to being, first and foremost, teachers. Nevertheless, the latter (i.e. teaching) should not be allowed to displace the former (learning), and graduates should retain an identity of teacher-as-learner. Schön (1983) outlined the centrality of practitioner reflection. Such reflection sheds light on and de-camouflages tacit professional knowledge, leveraging it to inform, shape and improve practice. For learners, reflection is sometimes couched as metacognition. Hacker et al. (2009) nominate two core components of metacognition: associated understanding and beliefs; and monitoring and regulation of thinking. More recently, the narrative has transcended its primary focus on cognition and acknowledges a range of reflective practices, which include embodied, emotional, problem-posing and collaborative characteristics (Forgasz, 2019; Yang, 2019).

The above elements interrelate. Lave and Wenger (1991) note that identity/membership is strongly tied to motivation. One possible limitation of Lave and Wenger's community of practice framework is its tendency to reproduce, rather than renew or revolutionise. Lave and Wenger address this in observing that making an impact on the world is facilitated, "if a person is both a member of a community and an agent of activity" (p. 122).

Agency

Agency arguably draws together all the above relationships—with the inquiry, with others and with self. Agentic learners "take charge of their own learning" (Hacker et al., 2009, p. 1). As Bandura (2006) explains, "through cognitive self-regulation, human beings create visualized futures that act on the present; construct, evaluate, and modify alternative courses of action to secure valued outcomes; and override environmental influences" (p. 164). Self-regulation underscores the centrality of the individual in owning control, in a context of evidence-based perceptions that one can make a difference in pursuit of a worthy goal. While agency enables an overriding of environmental factors according to Bandura, the provision of a favourable learning environment will further lubricate agency. A sense of agency, through ownership and responsibility, is likely to stimulate engagement; responsibility is its own worthy pursuit in learning.

We adopt an ontological view that PSTs should be subjects of action and responsibility instead of objects to be moulded and disciplined. Biesta (2013) argues that agency, or as he calls it "subjectivity", is an ethical phenomenon that deserves an important place in education. Biesta warns that education inevitably entails risk as it is an encounter among humans. Instead of presuming that agency happens, universities should offer PSTs authentic situations in which to practise agency.

A PLG is an established peer learning strategy to support students to gain confidence in their own ability to take charge of their learning. Small teams of students, with a common interest, interact and learn with and from one another, which is vital for PLGs (Boud et al., 2014). Typically, PLGs are not one-off groupwork activities. Rather, the peer collaboration proceeds for an extended period, often the entire project or semester, allowing students to form and sustain relationships with peers and their prior knowledge (Riese et al., 2012). Beyond PST education, PLGs are often termed peer learning groups (Rasheed et al., 2021). We argue that PLGs exemplify a pedagogical approach that sustains student agency, supports risk taking and professional learning through engagement with peers, research inquiry and self. Students can be asked to *do* rather than passively *absorb* the relationships through regular tasks, experimentation and collaborative project development (Wilkinson & Kemmis, 2015). Further details on PLGs are discussed under Methodology, below.

Methodology

The principal question of this paper investigates how regular participation in PLGs formed in an on-campus subject can help PSTs to become researchers by equipping them to inquire into their own practice. This study combines theoretical and empirical approaches that permit an examination of the students' insights and experiences of PLGs. The investigative focus draws on two methodologies: IPA and case study. Both approaches enrich the study by illuminating students' in-depth experiences and unmasking their perspectives and the sociocultural aspects related to the inquiry.

IPA, a qualitative research approach, was selected to explore and analyse PST experiences. With roots in phenomenology, symbolic interactionism and discourse, IPA explores how students, being experts of their own experience, make sense of their PLG experiences (Smith et al., 2009). Through IPA, researchers give voice to a specific target group who otherwise may remain unheard; in this case, PSTs who engaged with research and participated in PLGs.

A case study enables close examination of data within a specific context, for example, in a distinct university, subject or experience. This study examined final-year PSTs who formed and engaged in PLGs in a 'Teacher as Researcher' subject. Typically, case studies involve analyses of experiences and events that are studied holistically and a commitment to consider real-life complexities (Thomas, 2011). Applying IPA and a case study to the data examination process offered a methodology that gathered specific PST experiences with PLGs and leveraged epistemic means to engage with the research inquiry. The authors conducted analysis by (1) immersing themselves in the data, (2) independently exploring the content through initial noting and coding, (3) identifying emerging themes and (4) collaboratively looking across themes and developing deeper interpretations regarding the research question.

Research methods

Two sources of participant data were collected: (1) exit tickets and (2) anonymised, aggregated student feedback survey data. Exit tickets are an educational method allowing students to provide anonymous responses relating to that day's session and are typically collected at the conclusion of a class (Kirzner et al., 2021). Tickets were collected on three occasions during the semester (9 weeks), in weeks 2, 5 and 8, at the conclusion of those face-to-face workshops. Each exit ticket comprised different questions based on the course development and progress, as outlined in Table 1. Overall, 183 exit tickets were collected across four workshop/class groups: Week 2 and 5 tickets elicited individual PST responses from everyone who attended the workshop, while Week 8 responses were collected collectively from the PLGs. Blank A5 sheets were provided for PSTs to write their reflections. Table 1 outlines the questions that were asked in each exit ticket. The questions were designed to assess student learning experience throughout the semester, particularly since this was a new subject. None of the questions enquired specifically about PLGs.

Student feedback data were routinely collected and anonymised by the university during ($n=30$; 31% response rate) and at the end of the semester ($n=43$; 47% response rate). Only those comments that referred to PLGs are reported on here.

Context of the study: 'Teacher as Researcher' subject

'Teacher as Researcher' was a newly designed, fourth-year undergraduate subject in an education-focussed faculty at an Australian university. The subject comprised a one-off welcome and orientation lecture for the whole cohort, followed by weekly 2-hour workshops over the 9-week semester delivered in class groups. During this time, PSTs were tasked with designing individual action research projects which required the identification of a clear problem in their own practice, research question(s), a suitable methodology, ethical considerations, and proposed data collection and analysis.

PSTs designed and evaluated their projects as part of class activities (2-h workshops) and assessment tasks (2 assignments: the action research project proposal; and examination and presentation of action research project findings as Poster

Table 1 Exit ticket response rate and questions

Weeks	Number of collected exit tickets	Ticket questions
2	87 individual tickets	What are you enjoying so far about this subject? What has surprised you? What questions do you have that you are hoping coming workshops will help you to answer?
5	72 individual tickets	What are three key experiences during workshops so far that have influenced your ideas about teaching and learning?
8	24 group tickets	What are sticky take aways [learnings that have stuck] from this subject?

presentations). The topics of projects varied widely, including non-verbal communication, positive reward programs, supporting students with autism and differentiation strategies for English as additional language students. More specifically, PSTs selected inquiries such as how different coloured pens affect student perception of teacher feedback, or how can teachers use Sphero coding robots during maths classes to address students' learning difficulties.

Each week, the PSTs learned about a specific step applicable to their action research project design. In-class activities included, *inter alia*, experiential tasks, simulation activities, multimodal participation, technology activities involving mobile devices, individual, group or whole-class reflections via live polling tools and panel discussions with external practitioner teacher–researchers. Once the action research project design was complete and assessed, PSTs engaged in a three-week PE in-school placement and teaching, where they collected data on their individual inquiry. A few weeks after the placement PSTs presented their action research projects and empirical findings in a Poster session, aligned with the second assignment. In this activity, they shared their inquiry, methodology, findings and engaged in Q&A with peers. This constituted the final stage of their action research project and was typified by excitement, ownership, pride and professional agency.

The PLG was an essential design pattern in the subject development (Goodyear, 2005). The groups were established during the first workshop. PSTs with similar research inquiries self-assigned to a PLG based on Professional Standards for Teachers (AITSL, 2018). For example, those students interested in supportive and safe learning environments (Standard 4) were grouped together. If more than five PSTs chose the same Standard, then mini-groups within the Standard were created based on the commonality of inquiries. PLG membership remained consistent to one group throughout the semester. Each week PSTs spent at least 10 min in the selected groups allowing critical discussions on a weekly focus, inter alia, research question development, methodology and on applications for their own research projects. For example, in week 3, PSTs learned about various methods of data collection. After exploring and testing interviews, surveys and other data collection strategies in class, the PSTs could decide which techniques most effectively suited their projects. PLG discussions afforded a sensemaking time which provided a safe space to observe how other group members discussed these methods and their application. During the semester, PLG members gradually developed their individual action research projects and also witnessed, learned from and contributed to, the development of others' projects.

Findings

This section presents accounts of undergraduate students and their experience with PLGs in the 'Teacher as Researcher' subject, collected through exit tickets and anonymised university student feedback data. The PSTs shared a broad range of lived experiences and their interpretations relating to our research question on how PLGs can help PSTs to become researchers. This findings section derives from data collected in two layers: first, overall statistics on frequency of student references to

PLGs, and second, reflections and feedback that discuss PLGs and their impact on learning.

We observed that well over 50% of PST responses discussed PLGs in the dataset, despite an absence of any prompt reflection questions on these groups. Forty-eight per cent of individual student exit tickets discussed PLGs in Week 2; almost half of the cohort perceived the groups as integral to their learning in the early stages. In Week 5, this increased to 68%, and remained above 50% in week 8 (54%). The Week 8 exit tickets were produced in PLGs and, despite fewer tickets (Table 1), the proportion of PLG references was significant. This section will comprise direct quotes about PLGs as well as related narratives where PSTs addressed critical discussions and collaboration with peers. We found it intriguing that the PLGs attracted no criticisms. Instead, participants' responses exemplified achievement and pride in their contributions, and benefits.

The remainder of the findings are summarised across themes that emerged from analysis of the student data. Three distinct themes comprised: PLGs co-create meaningful communities; build professional identity and practices through collaboration and scaffolding; and change practices of learning (and teaching).

PLGs co-create meaningful communities

A notable thread observed across data is PSTs describing PLGs as useful, beneficial and helpful to their subject learning and, in particular, the research project. Ability to discuss relevant matters and learn from group members was cited across the dataset. What is noticeable is that PSTs did not anticipate the extent to which other group members helped them with thinking, research questions and project development, as typified in the following comment.

> PLG is underrated & extremely beneficial. Surprised how quickly I could formulate a research question by discussing it with my peers.

Several evaluative accounts showcased attributes that made PLGs meaningful. Typical responses described PLGs as "mutually informative", "specified + related discussions", "with the same people" or, as others put it, a "small, comfortable" context. The latter excerpt illustrates an affective space, which assists with understanding the socio-emotional features of the strategy.

Groupwork activities are often assumed to result in discussions and sharing; however this does not necessarily ensue organically and meaningfully. Indeed, group assignments rarely offer students the opportunity to engage with collaboration unrelated to competition or individualism. The extended nature of the PLGs enabled deeper connections and knowledge about members and their authentic, personal projects to emerge. PLGs demonstrated a different, more extended functioning of authentic groupwork, which were described as: "we are *actually* having discussions", "[surprised about] the perspective of others and their take on different Standards" and "everyone is sharing ideas". These experiences underpin and assist with modelling strategies and activities that PSTs designed for their own students. PLGs provided the necessary "safety net" to unpack the given aspect of research projects

and safely integrate them into the project designs. These factors contributed to the success of participation in collaborative professional learning (Cloonan, 2019).

As the PSTs recounted their PLG experiences in the feedback, they used strong positive verbs such as "really like" and "enjoy". Common aspects that they enjoyed were "the amount of collaboration", "encouraged group chats", "vitality", and the opportunity to "gain an understanding of others' views". In other instances, the enjoyment was linked to the surprise of, and gratitude for, working on one's professional development during class time. Common sentiment comprised "a lot of class time to construct and share our ideas" and "the subject does not guide us specifically on how to teach but how to improve our teaching", where PSTs melded the notions of working on their research project and their professional development, saying that:

> We are choosing something to investigate & work on improving [underlined in original] on practicum—one of the few class experiences that will improve my teaching strategy based on research & inquiry.

Enjoyment and relevance of the learning process diminishes the need to extrinsically engage students. Working on research projects in PLGs served to "stop me [from] 'switching off' in class". While historically positive experiences are commonly seen as superficial and hedonistic aspects of learning (Zeivots, 2015), this study demonstrated that these positive moments linked to student learning through participation, engagement and motivation. A combination of PLGs and authentic learning activities, for example, action research project development, can meaningfully engage students with their learning, assessments and professional development.

PLGs build professional identity and practices through collaboration and scaffolding

PLGs contribute to the development of professional identity. Such identities can incorporate values, beliefs, attitudes, skillsets and experiences. Our students typically referred to PLGs as "learning groups" and positioned deep learning as a pivotal component of the group dynamics. Group membership allowed PSTs to explore different viewpoints and thus better articulate and challenge their own perspectives: "I loved how much I was able to learn from my group members and really define my own research question with their help". The process entailed learning and sharing: "I enjoy sharing ideas with colleagues (collaboration)".

Learning from the group's wisdom occasionally meant becoming a critical teacher–researcher. Observations such as "I have found it surprising how diverse each of our inquiries are" and "sometimes the things we think are effective, or are effective for others, might not be [effective] for you" position the teacher-as-researcher as a connected member of a diverse learning community. Although the development, implementation and evaluation of PST projects were linked to individual assignments, this process did not occur in silos. PLGs provided safe, interactive communities which scaffolded project development, alongside PST professional learning as practising researchers.

Respondents praised PLGs for being "small", "recurring", "productive", and "with the same people". Although each PST was responsible for their project, PLGs provided a space for agency and collaborative ownership to emerge. What made the groups professional, was the design that "force[d] us to interact with different people and have discussions/get perspectives from people outside of friendship groups". PLGs were seen as "a good way to develop our research projects in a small, comfortable setting", "lead[ing] to new approaches that I would not have experienced/ thought about myself", through "working with like-minded people with similar goals".

PLGs provided space for our students to grow their professional identity and shape their own learning outcomes. The groups helped participants to "clarify my understanding", "keep [me] accountable", and "reflect and improve my teaching styles". Furthermore, collaborative criticality and an analytical mindset became ingrained in their teaching and learning practices: "I can make better decisions based on the analysed data" and "build professional communication skills". As part of PLG activities the lines between individual and group, personal and professional, and fixed and flexible became blurred and permeable.

PLGs change practices of learning (and teaching)

The third emergent theme illuminated PLG practices, often unfamiliar and unexpected, where PSTs re-discovered how to *do* learning. PLGs provided positive avenues for the emergence of social capital, which included perceptions of how one experienced change in study and work. PSTs pointed out the aspects that challenged their assumptions about the ways that 'Teacher as Researcher' was taught and designed. For example, they were pleasantly surprised that the "development of assessment [was] done thoroughly in class with support" and there was "flexibility and choice for the assignment". Here an assessment task was identified not as a course feature developed in isolation; instead, it was intertwined in the course practices that offered support from academic and student partners.

"Intensity" and "challenge" were frequently invoked in student exit tickets, and both terms connoted benefits to student development. Illustrating this, PSTs reported that they "like that I find it a bit challenging, because I know that I am learning", "I wasn't expecting this to be this intense", and the subject "is already challenging me + my way of thinking; I find this the best way to learn". For many this course was the first time their undergraduate degree had required *them* to make decisions on a research topic and approach. It was not a topic for a one-off essay; instead, PSTs selected a specific inquiry which was sustained for the entirety of the semester, and which articulated with the subject's assessments, groupwork, readings and practicum activities. For some PSTs, this process was exciting; for others, unnerving: "In an environment where we are rarely motivated to truly think about our own interests being given the sudden freedom can be a daunting and scary process". Another participant wondered: "how do I know I'm on track/the right road?". These statements demonstrate the *fluid* rather than the *linear* nature of inquiry, which for many was a novel approach to their professional learning.

The content focus in many pre-service teaching subjects is pre-determined, for example, classroom management. PSTs were surprised to learn that in this subject they needed to select the focus themselves. This initiative positioned them as chief investigators requiring them to manage their project, which many found formidable. This prompted epistemic re-focus and re-engagement: "it's very much about us"; "I'm actively engaged in my learning". PSTs were surprised "how many people struggle with the same challenges in their teaching as me—[it] makes me feel less alone". Others concurred that "collaboration makes it less daunting". Support featured in several accounts: "the whole project feels well scaffolded, and I don't feel scared or stressed about it at all!". This demonstrates the proportional balance between challenge and support (Larkin & Richardson, 2013), both indispensable ingredients of PLGs and inquiry-driven learning.

For this final-year undergraduate unit, the students were required to apply experience from previous classes and practicums. This concept was new to many:

[This subject is] far more relevant and [has] concrete content. Previous PE tutes [tutorials] have been largely anecdotal and not based in academic study. This subject has been the complete opposite.
[Surprised] how well it relates to what actually happens on prac [practicum].
I'm enjoying how much I know already but how little I have researched further for understanding.

There was a shift to the new learning paradigm where previous knowledge and experience were enmeshed with critical research and professional identity development. PLGs triggered an interest in learning more: "I like the learning environment—group work that promotes learning effectively…It leaves you wanting to learn more".

PLGs influenced the process of learning. The PSTs valued the group discussions, which generated authentic personal and shared reflections, and enticement to explore new concepts and apply them to their contexts. The experience cha(lle)nged preconceived ideas harboured by some respondents: "it has surprised me how important research is for teachers" and "research doesn't have to be boring—[I] had a stigma associating research = hard & boring". Developing an action research project through PLGs highlighted the embedded and integral knowledge and practices of becoming a teacher–researcher: "research informs my teaching practice more than I had previously considered". PLG discussions within a community of inquiry were crucial in developing this level of critical thinking and, importantly, connecting "how to be a better educator in regard to using colleagues and peers to broaden my knowledge and understanding".

Discussion

Instead of approaching PST education as a problem-focussed field, we have sought emerging and disruptive insights through the PLG educational intervention observed in this study, challenging our thinking and taking advantage of "epistemic possibilities" (Ragni & Johnson-Laird, 2020, p. 1). We share three concerns of PST

education, and how strategic integration of PLGs may provide epistemic insights to disrupt them.

Disruption 1: competition versus collaboration

The environment created by the PLGs offered high support, resulting in PSTs' willingness to assist and advise one another on their assessable research projects. This atmosphere differs considerably from some aspects of university and, particularly, school education; it is characterised by competition through national and international testing regimes on which institutions through their students' performance are rated, and, ultimately, ranked. The PLGs also blended theory and practice, resulting in the development and testing of strategies—theory-informed approaches. Teacher educators, and teachers, can play an important role in engendering such an environment. PLGs enabled the PSTs to focus on *relating*, so essential to teaching and learning. One PST described the benefits of collaboration as, "tackling the issue that is daunting but ultimately rewarding". We posit here that such an approach might embolden our PSTs to be more confidently collaborative in their professional inquiries once they enter the workforce, neutralising some of its competitive pressures. We note particularly that this collaboration took place in production of an individual assignment, rather than one submitted in groups.

Disruption 2: shift away from work in silos

Educators are expected to provide scaffolding for their students, but teachers themselves are rarely placed in a scaffolded environment. The culture of working in silos has frequently been embedded in, and assumed of, educational institutions such as universities and schools (Troiani & Dutson, 2021). Nevertheless, a shift from silos does not necessarily induce collaboration; it requires systemic change. A related question is how to create an environment that prompts sustainable collaboration, support and scaffolding.

   We contend that PLGs operate as safe communities of practice where collaborative inquiry opportunities such as sharing, meaningful discussions and distributed effort and engagement in professional learning can flourish. PSTs demonstrated genuine surprise about the quality, support and usefulness of PLGs and how these directly benefitted their action research projects and professional growth. The PSTs commonly characterised PLGs as inspirational and enjoyable. The experiences described here link to the notion of emotional highs in learning (Zeivots, 2016, 2018, 2019) which is common in educational settings outside higher education, for example, in adult, experiential and outdoor learning. Although we are cautious of adopting these notions uncritically, we argue that they are meaningful experiences and practices contributing to a robust and sustainable educational environment. These are sites where teachers should not operate in isolation; instead, they must be supported by like-minded professionals who can share inquiries, insights, experiences and developmental opportunities.

Disruption 3: ownership as an individual phenomenon

Teachers are facing increasing levels of accountability without authority (Cochran-Smith, 2021). We argue that regular engagement with PLGs can challenge this. The ownership of accountability, power, competencies and relationships appeared more distributed and balanced through PLG involvement. The coordination and development of individual action research projects did not function on an individual basis; instead, the process was distributed through critical discussions, shared reflections and learning from peers, embedded in the collaborative inquiry process. We recommend integrating PLGs as an integral pattern of PST education, providing PSTs with necessary support and strategies to leverage later as teachers.

Conclusions

Education empowers and liberates. It also colonises by imposing ideas held dear by teachers and elders. Education disrupts and such disruptions can be met with learner resistance. The innovations in this subject appear to have been welcome disruptions for the PSTs. In a context of assessment, which is routinely the most instrumental, competitive element of the learning process, this approach fostered collaboration, and *breaches of discipline*, enabling PSTs to interact across subject areas. The innovations also had longer-term implications. They challenged some of the PSTs' identities as pure pedagogues, while setting out ways to be more agentic teachers and devolving some of this agency to their students.

In light of the above, we propose PLGs as a complementary approach to support and sustain PST education. Biesta (2013) indicates that if one sees the purpose in doing something, one is more invested in it through agency and subjectivity. The integration of PLGs identified knowledge and wisdom within the group, and so PLGs appeared as an effective second educator in the room behind teaching staff.

Education is increasingly being shoehorned into competition over collaboration at individual teacher, school, jurisdiction and national levels (Buchanan, 2020). This risks robbing education of the enrichment derived from collaboration and ideas sharing. We trust that graduating and early career teachers will join a movement that sets out to disrupt such competition.

Declarations

Conflict of interest The authors report there are no competing interests to declare.

Ethical approval The research was approved by the University of Technology Sydney, Approval Number ETH20-5516.

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