The Role of Professional Context in Enabling and Constraining Out-of-field Teachers' Engagements with System-initiated Professional Learning

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In hard-to-staff subjects like secondary school mathematics, out-of-field teaching—where teachers are required to teach subjects outside their expertise—is a necessary reality. While strategic investments in continuous professional learning by education authorities seem an obvious way to ensure that teachers are better prepared for such assignments, teachers' local realities and professional contexts can impact their ability to engage with and derive benefit from system-initiated programs. This article draws on empirical data generated as part of a partnership between an Australian education authority and a university to examine factors that shape teachers' professional learning engagements and outcomes. The conceptual lens of professional context was applied to illustrate similarities and differences in the reported experiences of ten teachers who completed the first iteration of a Graduate Certificate of Secondary Mathematics. Analysis of these teachers' accounts revealed the power of relational dynamics, including support from school principals, mentoring by in-field mathematics teachers, and opportunities to connect with out-of-field teachers of mathematics working in different school settings.

Keywords: mathematics education · out-of-field teaching · policy enactment · professional contexts · teacher professional learning

Background

In the two decades since the Organisation for Economic Cooperation and Development (OECD) first warned that teacher shortages would become a significant policy challenge for member countries (OECD, 2003), effective responses have been elusive. Rising student enrolments, the retirement of older teachers and inadequate teacher recruitment and retention strategies have generated a crisis for education systems. In hard-to-staff subjects like mathematics, out-of-field teaching assignments—where teachers are required to teach subjects outside their expertise (Ingersoll, 2019)—are a necessary reality. In Australia, prior to the COVID-19 pandemic, reports estimated that around two in five teachers of Year 7–10 mathematics did not study discipline-specific curriculum and pedagogy as part of their initial teacher education (Weldon, 2016) and around one in four Year 8 students was being taught by an out-of-field teacher of mathematics (Thomson et al., 2021). Out-of-field teaching not only disrupts the integrity of a subject but also contributes to lower student engagement and academic growth (Van Overschelde, 2022). It is therefore unsurprising that out-of-field teaching of mathematics has been identified as contributing to Australia's declining OECD Programme for International Student Assessment (PISA) mathematical literacy results (Shah et al., 2022) and decreasing enrolments in more challenging senior secondary mathematics pathways (Wienk, 2022).

In the Australian state of Victoria, 2021 figures revealed that, while mathematics was the second most in-demand specialisation of secondary school vacancies, 27% of positions advertised were not filled (Victorian Department of Education, 2023, pp. 51–52). Amid this persistent teacher shortage, designing and researching system-initiated professional learning programs can help to identify which course design elements are effective and what additional support teachers may find useful (Bosse & Törner, 2015). The value of access to continuous professional learning is mentioned across Australian government reports, issues papers, and action plans. For example, the *Through Growth to Achievement* report (Commonwealth of Australia, 2018) identified the need to value and support the teaching profession, including through "high quality professional learning" (p. 61) that enables "tailored teaching for maximum impact" (p. 66); the *Teacher Workforce Shortages* issues paper (Commonwealth of Australia, 2022) identified that "evidence-based professional learning for teachers" (p. 12) can support "quality and retention" (p. 12); and the *National Teacher Workforce Action Plan* (Education Ministers, 2022) identified professional learning among a range of strategies for "keeping the teachers we have in the classroom" (p. 3). Goos et al. (2023) argued that "out-of-field teaching presents substantial challenges for teacher professional development because out-of-field teachers need to learn new content and new ways of teaching" (p. 416). Although the Australian Professional Standards for Teachers (Australian Institute for Teaching and School Leadership, 2017) include a national requirement to complete a minimum of 20 hours per annum professional learning to maintain registration to teach, these hours often comprise mandatory compliance training (such as occupational health and safety, first aid, and child protection certification).

Out-of-field teachers of secondary mathematics inevitably need more specialised and sustained opportunities to develop mathematical content knowledge than any fraction of 20 hours annually can possibly afford. Requirements to maintain accreditation to teach in Victoria include ongoing engagement in professional learning, with the local regulatory authority listing possible activities ranging from conference attendance to practitioner action research (Victorian Institute of Teaching, 2021). While the possibilities are consistent with expansive understandings of professional learning as encompassing diverse opportunities for teachers to reflect on, critique, and transform educational practice (Timperley et al., 2008), common conceptions and enactments lean towards shorter-term activities that are not necessarily supported by educational research and tend to diminish teacher agency (Netolicky, 2019; Priestley et al., 2012).

Policy, regulatory and motivational factors explain why teachers do and do not opt into professional learning on discipline-specific knowledge that they find challenging and discomforting. Even when teachers have agency to shape their own professional learning choices, they can "play it safe" by making arrangements that align with and affirm their existing professional identity (Sawatzki et al., 2024). To entice participation, initiatives targeting out-of-field teachers of mathematics typically involve partnerships between governments and universities and focus on the development of curricular, content, and pedagogical content knowledge (Goos et al., 2019).

Leading international approaches have created opportunities for teachers to experience challenge, process new learning with others, translate these ideas into practice, and move from current to future professional identities (Timperley et al., 2008). In a transnational study across Australia and South Africa, Du Plessis et al. (2015) found that both systemic and collegial support are essential if out-of-field teachers are to develop the competence and confidence needed to teach unfamiliar subjects well. In Ireland, a nationally consistent, government-funded, university-accredited Professional Diploma in Mathematics for Teaching was made available to teachers throughout the country (see Goos et al., 2023). Almost 1100 teachers completed the two-year course part-time, leading to a substantial decrease in the prevalence of out-of-field teaching of mathematics in Irish post-primary schools. In Australia, Vale et al. (2011) developed a program to extend out-of-field teachers of junior secondary mathematics' knowledge and confidence related to aspects of the senior secondary mathematics curriculum. They found that program elements that connected teachers' knowledge of mathematics with knowledge of mathematics on the horizon (Ball et al., 2009) helped participants to develop an appreciation of the importance of structure for both mathematics learning and mathematics teaching practice.

Yet little is known about how contextual factors can enable and constrain out-of-field teachers' engagements with system-initiated professional learning, and what course design elements are most impactful. With a view to addressing this research gap, this article reports data and findings associated with a Graduate Certificate of Secondary Mathematics that was designed for Victorian government secondary school teachers whose workload allocations included teaching mathematics out-of-field. The course was designed and delivered by Deakin University and fully funded by the Victorian Department of Education. This article contributes to knowledge about out-of-field secondary mathematics teachers' diverse professional contexts and how these can influence and interact with engagement with system-initiated courses. It does so through the application of Braun et al.'s (2011) conception of professional context to examine the accounts of ten teachers who completed the first iteration of the course. The research questions guiding the inquiry were:

1. *How do professional contexts enable and constrain out-of-field mathematics teachers' engagements with system-initiated professional learning programs?*
2. *What course design elements can ameliorate constraining factors?*

Research-informed Course Design

The Graduate Certificate of Secondary Mathematics course was designed to adhere to Victorian Department of Education specifications and Level 8 of the Australian Qualifications Framework (Australian Qualifications Framework Council, 2013). It aimed to improve teachers' knowledge of curriculum, content, and pedagogy for teaching mathematics through four 15-week units of study (two per semester) totalling 600 hours of professional learning within one year. Schools received a payment of 0.2 full-time equivalent (FTE) teaching position per participant to meet costs associated with supporting teachers to meet the course requirements (i.e., teaching relief to enable attendance at face-to-face intensives and study leave to complete assignments). Teachers were recruited from across the state with the goal that half would be from regional and rural schools. School principals were encouraged to nominate multiple out-of-field teachers from their schools to complete the course in pairs or small groups.

The work of mathematics education researchers and teacher educators at Deakin University is grounded in a substantial body of academic literature. This is evident in the course design elements employed that support high quality professional learning and guide efforts to develop teachers' knowledge and practice. For example, mathematics education research emphasises the importance of teachers learning by doing high quality mathematical tasks themselves as part of anticipating and planning for expected student approaches (see Smith & Stein, 2018). Experiencing this approach as learners during teacher education can shift teachers' instructional visions or image of how they intend to teach in the future (Jansen et al., 2020). Alternative instructional visions can also be fostered through engagement with a community of mathematics teachers (Quinn & Hobbs, 2024), encompassing both in-field mathematics colleagues and mathematics education researchers. Masuda (2010) identified teacher study groups (termed *home groups* in the course) as important sites of professional dialogue, where teachers can develop critical perspectives on instructional practices while benefiting from opportunities to represent and re-position themselves as professionals.

The course was designed to reflect these research insights as well as principles for effective mathematics teacher education. Shulman's (1986) seminal thinking about teachers' professional knowledge of curriculum, content, and pedagogical content, together with Ball et al's (2009) conceptualisation of mathematical knowledge for teaching were drawn upon to frame participants' engagement in various learning activities. Learning activities included scaffolded engagement with readings and video recordings, interactive lectures, explicit modelling and discussion of research-informed pedagogies, learning by doing and reflecting on high quality mathematical tasks, and engagement with digital technologies to solve mathematical problems. Teachers were assigned to workshop groups of approximately 25 people, as well as home groups of up to five people. The out-of-field teachers were encouraged to seek an in-field mathematics colleague from within their own school or professional network, to act as their mentor. As reformists, the course designers intended to position

and support teachers as reflective practitioners and researchers of their own practice, as much as was possible given the COVID-19 pandemic forced university and school teaching and learning largely online.

Conceptual Framework for Understanding Teachers' Engagements in the Course

Although participation in the Graduate Certificate of Secondary Mathematics course was elicited via teacher-initiated expression of interest, the participants varied in personal motivation and engagement with learning opportunities offered. The Victorian Department of Education colleagues leading the initiative and the university teacher educators and course designers (authors of this article) initially assumed ideal environments for policy enactment and program implementation. In practice, a range of complex and varied factors affected the extent to which the intentions and ambitions associated with the course were realised. Our experience reflected Saunders' (2014) assertion that "when it comes to professional development, one size does not fit all" (p. 180) because traditions, cultures, policies, and school-related conditions vary from context to context. Faulkner et al. (2019) noted that "systemic issues, local school circumstances and identity issues can all affect how teachers approach being an out-of-field teacher and the benefits they may gain for participating in professional development opportunities" (p. 273). Braun et al. (2011) described four contextual dimensions—external contexts, material contexts, situated contexts, and professional contexts—that provide a heuristic for considering the specific and dynamic ways that school communities respond to system-initiated policies and programs:

External contexts refer to pressures and expectations from the broader policy environment that drive compliance, accountability, and improvement. External factors influencing individual teachers' orientations towards and learning practices within the course might include external school review processes and standardised assessment data that impact school-level professional contexts. Course design specifications were also stipulated by the Victorian Department of Education when the tender for designing the course was advertised, requiring alignment with local curriculum and school improvement frameworks and resources.

Material contexts relate to the management of school resources, such as staffing, budgets, buildings, technology, and infrastructure. These factors are managed by school principals, upon whom out-of-field teachers rely greatly to provide material and professional support (Du Plessis et al., 2015). With respect to the teachers enrolled, material contexts included funding provided to schools to support teachers to engage in study, existing teaching resources such as school-level curriculum scope and sequence documentation, commercial teaching packages, and timetables.

Situated contexts describe the historical and geographic particularities of schools, including the student demographic being served and local educational priorities. For example, the cultural capital of students and their families with respect to formal education, and patterns of student attendance and achievement in the school.

Professional contexts refer to school culture and ethos, including school principals' and teachers' values, experiences, and commitments, and their views on their work rights and duties. For example, the relational interactions between school principals, teachers, and their colleagues.

The Research Design

Case study research allows in-depth analysis of social phenomena in context. In this study, a multiple case study design (Gagnon, 2010)—with each teacher being a case—was suitable for comparing and contrasting the ways that out-of-field mathematics teachers' school settings influenced their ability to engage, learn and grow professionally. Presented in this article is an integrated narration identifying patterns within ten teacher interviews where the unit of analysis is the impact of professional contexts on practising teachers' professional learning opportunities and experiences in the course.

Course Participants

The teachers who participated in the course were diverse. The first iteration of the course attracted expressions of interest from more than 170 teachers and an eventual enrolment of 126 from 84 Victorian government secondary schools. Sixty-three percent of teachers were from metropolitan areas, with the remainder working at schools in the state's regional areas. The number of teachers enrolled per school ranged from 1 to 5—one third completed the course together with at least one colleague from their school. Diversity was also evident in the specialisations of the course participants, with teachers originally trained in English, humanities and social sciences, science, and the arts wanting to upskill.

One of the eligibility criteria was 1–5 years of experience teaching mathematics out-of-field. However, as is often the case with contracted initiatives, the pursuit of enrolment targets led to a diminution of entrance requirements and approximately one in four had never taught mathematics before or were teaching it for the first time. These teachers were seeking a qualification that would help them to secure ongoing work in this in-demand subject area. By contrast, the majority (two-thirds) had been teaching mathematics between 2 and 9 years and approximately 10% had taught mathematics for 10 or more years. These teachers brought practice-based strengths and insights to course participation but had also adopted problematic teaching habits "on the job." As a consequence, the participants' curriculum knowledge and classroom experience varied greatly.

The Research Environment

The COVID-19 pandemic produced a challenging research environment, particularly in the Australian State of Victoria, where the researchers and research participants live and work. Victoria endured six lockdowns totalling 262 days and the longest lockdown in the world (Macreadie, 2022). Lockdowns prevented on-campus intensives (the preferred mode of delivery, which was included in the original course plan) and limited access to schools, teachers, and students to conduct research. These factors affected the methodology and methods adopted for this study, but also the ability to recruit and retain research participants. The small sample size reflects the realities for qualitative educational researchers whose professional work relies on empirical fieldwork (e.g., Roy & Uekusa, 2020) and for practising teachers managing competing commitments (e.g., Zonca & Ambrosy, 2021).

Research Participants

The findings presented in this article are based on data collected from the first cohort of teachers to complete the course in 2021. Of the 126 teachers enrolled, 10 volunteered to be involved in the research. These participant teachers consented to be interviewed about their professional learning experiences in the course.

Data Collection and Analysis

Ethics approval was provided by Deakin University Human Research Ethics Committee (DUHREC). It was a stipulation of the ethics approval that course and research processes be managed separately. Those involved in the course design and delivery were not involved in recruiting participants or collecting data. Rather, an independent academic lead and research assistant oversaw the research process. All data collected were de-identified and pseudonyms assigned prior to the commencement of data analysis.

Teachers' experiences of the Graduate Certificate of Secondary Mathematics course were accessed via individual, semi-structured interviews conducted midway through and following completion of the course. The use of semi-structured interviews intended to elicit teachers' experiences and perspectives while allowing for flexibility to pursue emerging ideas (Kvale & Brinkmann, 2015). These interviews were conducted online by the research assistant via Zoom. Each interview was approximately 30–45 minutes in duration. Teachers were asked questions about their professional backgrounds, study motivations, experiences engaging in the course, learning outcomes and professional practice impacts of

participation. Zoom video recording and transcription were enabled. Transcripts were subsequently checked and edited verbatim by the research assistant.

Demographic Analysis

Table 1 describes the professional characteristics and school settings of the teachers. School information was sourced from the My School website (www.myschool.edu.au). The Index of Community Socio-Educational Advantage (ICSEA)—created by the Australian Curriculum Assessment and Reporting Authority—was used to understand the socioeconomic profile of the communities served by the teachers' schools. An ICSEA value below this scale's median of 1,000 is somewhat indicative of socio-educational disadvantage. The schools varied in terms of their location, size, and enrolment profile.

Table 1
Teacher Cases and School Contexts

Teacher	Years of teaching experience	Regionality	Year range	Approximate school enrolment	ICSEA	Students belonging to lower and upper halves of the distribution of socio-educational advantage (%)		First Nations students (%)	LBOTE (%)
						Lower	Upper		
Nancy	>10	Regional	F–12	300	980	76	24	5	2
Jacinta	<1	Metro	F–9	3200	1,120	17	83	1	78
Kelli	>10	Metro	7–12	1200	930	86	14	2	63
Adam	5–10	Metro	7–12	1400	1130	17	83	0	28
Alice	5–10	Metro	7–12	2000	1065	41	59	1	22
Brendan	>10	Regional	7–12	1100	930	89	11	11	9
Jennifer	>10	Regional	7–12	800	990	72	28	3	5
Oliver	<1	Regional	7–12	300	980	76	24	5	2
Shauna	5–10	Metro	7–12	200	960	76	24	2	11
Susan	>10	Regional	F–12	850	950	87	13	7	2

Note: ICSEA = Index of Community Socio-Educational Advantage; LBOTE = Language background other than English.

The teachers interviewed represented diverse personal and professional biographies, circumstances and study motivations. Their diversity and positive dispositions towards mathematics and mathematics teaching are highlighted in the descriptions that follow.

Nancy left school at the end of Year 11 and trained as a chef before making a career change to teach food studies and business management later in life. She was aware of the struggles to staff mathematics classes at her school, and reflected, "I was a straight-A maths student. I like doing maths and I like trying to understand how to do it." Similarly, Susan had spent more than 30 years working as a qualified chef and food business manager. She had taught vocational hospitality courses before transitioning to teach in mainstream and special education settings. A self-described "numbers person", Susan said, "I like all things maths. And I'm in a positive and professional team of people."

Jacinta was a recent graduate, in her second year of teaching. She had completed a Bachelor of Zoology and Animal Science and a Master of Teaching with a science specialisation. While she stopped studying mathematics at the start of Year 11, she was offered and accepted a graduate position to teach science and mathematics. She enrolled in the course following what she described as some stressful and embarrassing classroom experiences where students had pointed out, "You're a maths teacher, you should know this!"

Kelli was also a career changer who became a teacher following 15 years working in the finance industry. As a qualified economics and business teacher, she was motivated by her observation that students struggled to apply mathematics to economics and business problems in her classes. She

explained, "Maths has always been a passion of mine because I think we do it a massive injustice ... I'm coming from a field that relies on mathematical thinking and seeing that kids just don't have it." She noted that this was even the case with students who had elected to study more challenging senior mathematics subjects, exclaiming, "and they're supposed to be smart in maths." For her, the idea of a qualification that would prepare her to teach mathematics was very appealing. Likewise, Alice had been teaching accounting, business management, Chinese language and mathematics since graduating 10 years prior. She described herself as having relatively strong mathematical knowledge and feeling competent to teach the subject but looking for new ideas and strategies to enhance her practice.

By contrast, Adam had been teaching physical education for a decade and was looking to "add a string to my bow" while on 12 months parental leave. He described enjoying and doing well at mathematics at school himself and repeatedly asking of his school principal to be assigned to teach the subject. As the school had an adequate supply of qualified mathematics teachers, his school principal preferred not to assign out-of-field mathematics teaching. Adam hoped that completing the course would enable him to teach the subject at Year 7–10 but if not, described being prepared to move schools.

Oliver had a 10-year science career in the timber industry. He was an early career teacher who had been teaching Year 7 and 8 Mathematics out-of-field for three years. Oliver described wanting to develop his mathematical content knowledge and locating online videos to study in preparation for lessons, saying, "I've gone out of the way to find a few different ways of doing [mathematics] so I can show the kids several different ways." Similarly, Shauna had completed Masters-level studies in engineering before qualifying as a physics teacher. While she described her disciplinary knowledge as advanced, she was motivated to strengthen her mathematical knowledge for teaching young and diverse learners. Two participants, Brendan and Jennifer, trained as primary school teachers, but transitioned to secondary school teaching based on appealing job opportunities within their regional communities.

Thematic Analysis

The interviews evidenced diverse experiences as teachers negotiated interrelations between their professional contexts and engagements with the course. In this article, the analytic focus is the participants' accounts of their professional contexts. When reading the data with this focus, aspects of professional context reported by teachers to influence their engagement in the course concerned interactions with space, time, and other teachers. The most successful interview questions for eliciting this information were:

- In what ways was your school principal supportive, or perhaps unsupportive, of your studies?
- Were there ways that other teachers of mathematics at your school supported your learning?
- Is there anything about the course that has surprised you? Tell me more about that …

The aim of the analysis was to surface rich detail about how each teachers varied local realities interacted with course features and which course design elements helped to ameliorate constraining factors of the professional context.

Four salient descriptive themes were developed from the data: 1. time release to study, 2. flexible study arrangements, 3. mentoring within the school, and 4. active learning within course home groups. Teachers' discussion of the material arrangements associated with their teaching and study loads (e.g., time and physical locations) were closely bound up with and often a proxy for school-level leadership and policy enactments that shaped the professional context they experienced in their schools. Notably, the teachers reported interactions with other teachers that show how participation in the course effectively extended some teachers' professional context beyond the individual school setting. For example, active learning within home groups (a key course design element) provided opportunities for teacher-to-teacher collaboration, peer-learning, and emotional support.

Examination of the data within the descriptive themes supported a conceptual grouping (Braun & Clarke, 2006) into three relational categories: 1. support from the school principal, 2. access to in-field

mathematics teachers, and 3. access to out-of-field teacher of mathematics working in different school settings. These relational categories reflect the importance of relationships with other practitioners and resources that may be distributed across systems to support one's aspirations and actions in the world (Edwards, 2005).

Relational categories and descriptive themes are presented in Table 2. Together, they form a significant contribution to understanding optimal course design elements targeting out-of-field teachers of mathematics. Each relational category is illustrated in the next section using interview excerpts to distil and discuss key insights.

Table 2
Relational Categories and Descriptive Themes Emerging from Examination of Teachers' Professional Contexts

Relational categories	Descriptive themes
Support from the school principal	Time release to study Flexible study arrangements
Access to in-field mathematics teachers	Mentoring within the school
Access to out-of-field teachers of mathematics working in different school settings	Active learning within home groups

Findings and Discussion

The findings are organised by relational category. Data excerpts are used to illustrate how aspects of teachers' professional contexts either supported or limited teachers' professional learning, and how these experiences connected to course design elements. Participants' interviews are cited together with school size and regionality, not to reduce teachers' accounts to these characteristics, but as a way to situate participants' stories against their professional contexts. Braun et al. (2011) explain that their four contexts overlap and interconnect, and this is reflected in the reporting of the teacher interview data.

Support from the School Principal

School principals' implementation of guidelines for supporting the enrolled teachers was a key factor influencing these teachers' ability to participate fully in the course. Teachers needed time, space, and infrastructure to prepare for and attend synchronous intensives and complete course assignments. Supportive responses, such as guaranteeing a reduced teaching load and/or approving dedicated time to study, positively influenced teachers' ability to engage in the course. Less supportive or dismissive responses generated challenges for teachers in balancing their classroom and professional learning obligations, with negative consequences for well-being. This finding coheres with Du Plessis et al's (2015) argument that school leaders and the environment they create can influence out-of-field teachers' experiences and outcomes greatly.

While all teachers interviewed expressed gratitude that their school principal agreed for them to participate in the course, the level of practical support they described being afforded within each of their schools varied. School principals' varied responses reflected the devolved financial and operational management of Victorian government schools and the range of circumstances across school settings. For example, despite a directive and funding by the Department of Education, not all schools used the 0.2 FTE allocation to reduce participants' teaching load in favour of time to study.

Variation with respect to reduced teaching load translated into differences in teachers' capacity to engage in coursework learning. In the excerpt below, Nancy (small regional school) explains that her school principal fully understood and enacted advice to create time and space for teachers to study:

> *It was pretty clear that your school would be paid 0.2 FTE. That means the teachers* [are] *teaching 0.8 FTE and the rest is their study load. [My colleague] and I have the time to do it because our boss has*

> *been fantastic about it … As soon as we found out we would have classes on Tuesdays, we set that aside. We're not expected to be at school—that's your study day.*

Shauna (small metropolitan school), who was completing the course with two colleagues from her school, explained that her school principal used the funding allocated to hire a 0.6 FTE to cover their classes:

> *Our school chose to hire a staff member to cover the three of us that are doing the course, so that's a* [fixed term] *staff member for a year to cover our subjects.*

This arrangement showed a proactive stance toward supporting teacher professional learning without compromising teaching continuity. Such careful workforce planning inevitably minimised disruption to student learning.

While Nancy and Shauna spoke of highly supportive school principals, others reported being afforded only enough teaching relief to attend face-to-face intensives. For example, Jacinta (large school in urban growth corridor) was not given time to complete asynchronous learning activities or write assignments:

> *My school didn't really understand. They thought they would just release us on the days we had to attend online classes. I haven't been getting all my Tuesdays* [to study]*. We're meant to get 40 days throughout the year to use, and if we just use the days to go to classes, that won't add up to 40 days … That's what I should have, yeah. 10 days online doing the intensives with the lecturers. And then next term will be 10 days in person, that's 20/40. And the extra 20 days really should be to do your assignments or take a study day when you need to, but that's negotiable with the school, and* [the school] *likes to point that out, that it's negotiable … it's not the university's fault, and it's not necessarily the school's fault. Everyone's got their own version of events.*

Jennifer (large regional school) spoke positively of her school principal's support but was also pragmatic that, to meet the course requirements, she had to study beyond the 0.2 FTE allocation:

> *My principal is great. There's three of us doing the course, and we're struggling at different times … but we just have to make the time. No one can physically give you time, you just have to do it. And you can't be expected to do it all in your 0.2* [FTE] *days.*

Jennifer's matter-of-factness contrasted with other teachers who described the challenge of balancing work, study and personal responsibilities. Alice (large metropolitan school) explained that her workload was amplified by the requirement to prepare lesson plans to guide replacement teachers in her absence:

> *When my school was creating my timetable, they really didn't take into consideration how* [the course is] *going to impact on my teaching load … So, I still had to write extras. So, for me, and I don't like to leave my class, I constantly feel guilty about leaving my class, but at the same time, I have to, so it's really stressful for me to be honest. I just felt like I'm not studying as hard as I could for uni because I have this job. At the same time, I'm not teaching as well as I could either. So, this is one of my major concerns.*

On the issue of feeling torn, Jacinta was diplomatic in her appraisal that nobody was to blame, but both her professional learning and wellbeing were compromised by her school principal's lack of understanding and support:

> *That's probably the biggest struggle … I have no work-life balance right now. Every time I take a Tuesday* [to study]*, I have to write lesson plans for the classes I'm missing. I've asked for a meeting with the principal to map out the rest of my study days properly … But yeah, it feels like I have to beg for a day when actually, they're getting funded to give us these days … If this course does run again, I think it should be explained better to principals.*

Jacinta's account highlights a hard managerial line being taken in the organisation of human resources based on a difficult reality for school principals—particularly in urban growth corridors where the situated context is one of burgeoning student enrolments and low teacher supply (including contract relief teachers). Here, the professional and material contexts at the school interacted such that requesting time for study felt like begging in a highly constrained external context.

Kelli (large metropolitan school) reported similar frustrations:

> *They approved three of us to do it, which is great. We got the time release, so that's good. But then they haven't allowed us to work off-campus. So, I'm a leader in the school, so I have to sit at my desk where students and teachers come and seek my advice regularly. I can't be in an all-day* [university] *workshop and do that. And then also the school network didn't allow access to [the university's learning management system], so I was hot-spotting off my phone. So that's just crazy to me. That's not, that is supportive but it's not supportive and in this …* [gesturing to public health directives associated with COVID] *you know, we've all learnt everybody working from home, I don't really understand* [why I can't do] *that.*

Kelli's reflections speak to a professional context with a managerial commitment to presenteeism that was prioritised over flexible study arrangements. While teachers at Nancy's small regional school were afforded flexibility, it was more common that teachers faced challenges. Consistent with findings by Faulkner et al. (2019), local challenges inevitably mediated teachers' professional learning experiences and outcomes. In the unique position of studying while on parental leave, Adam (large metropolitan school) provided insights into the predicament faced by teachers whose school principals positioned participation in the course as a personal choice in tension with teaching duties:

> *Not many of us have principals that are saying "You must do this" … A lot of us are established in our teaching careers … A lot of us actually have families. We're at that stage. We've got leadership positions in the school. So, undertaking this course is adding to a pretty high workload. I know a lot of my colleagues have said, once they've gone back to their principal about the 0.2 FTE study allocation, that the principal goes, "You don't have to do it if you don't want to. If you pull out, it's your call. I'm not forcing you to do this" … It's really putting those people that don't have the time release in a very tough position.*

Tensions associated with varied provision of time release from teaching were present across interviews, as participants were aware of the range of circumstances their fellow students were experiencing in their respective schools and made explicit reference to this when explaining the impacts and interrelations of their own situation. In the excerpt below, Nancy (small regional school) acknowledges that her home life was more conducive to study than some of her home group colleagues. At various times during her interview, she revealed an awareness that her peers were juggling roles as teacher, learner and carer with little practical support from their school principal and other colleagues:

> *There's lots of teachers thinking it's a lot of work. I'm a daily organiser. I'm used to doing a lot of work.* [But] *I've got no kids at home either. So, I can sit here for two hours at night and it's not a hassle. And I'm interested, or I wouldn't put my hand up. No one made me do it… I did notice on Day 4 that often I was the only one that had done all of the readings and stuff … when you go into your group, they just say, "I haven't done it." Whereas I had done it.*

Oliver (small regional school) spoke on behalf of colleagues to explain:

> *Some teachers in some schools weren't getting the allocated 0.2 FTE loading, so they were expected to teach as per a regular schedule. You know, the program was never designed for that, so there was just a little bit of misunderstanding on the administration side.*

This insight suggests that communication between system leaders and school administrators may not have been sufficiently clear or emphatic. Inconsistency undermined equity in teachers' professional learning experience. This highlights the importance of ensuring that policy intentions are well-understood and enacted consistently at the local level.

Brendan (large regional school), however, described a range of emotions associated with striving to be successful:

> *I was angry about it … It's actually disappointing, because I would love to do as much as I can because the stuff I have picked up has been really good. But, even doing the readings before the intensive days, it's near impossible. It's been really hard. Yeah, to be honest, last week I was pretty close to just pulling the pin.*

Shauna (small metropolitan school) was more matter of fact when she explained:

> *None of us want to quit, I can promise you that. And those that have are devastated. And it was a very, very difficult decision to make.*

These insights confirm that school principals were an influential determinant of professional learning experiences and outcomes. Despite the Department of Education providing the schools of enrolled teachers with funding for 0.2 FTE allocation to allow teachers to study as part of their demarcated workloads, the teacher workforce crisis meant policy enactment was constrained. This reinforces Braun et al's (2011) argument that professional and material contexts intersect in policy enactment. These interview conversations were emotive because the COVID-19 pandemic also heightened the potential for work and study to encroach on home and family life. Many participants reported that the circumstances at the time were at odds with their desire to pursue university study as a self-actualising project.

Access to Mentoring by In-field Mathematics Teachers

Another important determinant of professional learning experiences and outcomes was access to local mentoring by in-field mathematics teachers. The course designers encouraged out-of-field teachers to engage with in-field mathematics colleagues by identifying a local mentor within their school. For a range of reasons, few schools enacted this suggestion. Access to mentoring varied among participants—some gained valuable guidance from supportive in-field mathematics colleagues, but others struggled to find appropriate support and had to rely on ad hoc assistance only.

In the excerpt below, Nancy (small regional school) describes how valuable access to a middle leader with numeracy expertise was to her success in the course:

> *I've been really lucky* [at my school]*. We've got a middle years literacy and numeracy specialist who's helped me to... like to actually do the maths, to make sure it's correct. You've got to have the two* [solution] *strategies. And he said to me ... "You haven't really got two strategies there. You've done the same thing twice. You've done it with pencil and paper, and you've done it on the computer, but you haven't actually done it two different ways. You could do it this way. "You know that sort of support's been really good.*

Nancy's account of the professional context at her school contrasted sharply with that of Jacinta (large school in urban growth corridor), who was struggling to navigate the transition from preservice to beginning teacher and the demands of teaching a subject outside her field of qualification and expertise. Jacinta conveyed apprehension but also self-motivation to improve her practice when she explained:

> *I said, "I don't know if I could teach maths." But they were like, "No, its Year 8 maths, you'll be fine, you'll get help." I got the job. But I didn't get a mentor until like halfway through my first year, and even then, she was an English and humanities teacher ... So, I really had to run to all the other maths teachers and be like, "What do I do? I don't understand this!" And I would be learning the thing I had to teach the week before. Just scrambling.*

Jacinta's account highlights the precarity for beginning teachers, who are increasingly likely to be assigned to teach out-of-field (Weldon, 2016) and rely on school principals to assign more experienced colleagues to support them. While Jacinta was not assigned an in-field mathematics colleague to act as her mentor, she identified the need for and value of access to more knowledgeable others with specialised knowledge of mathematics curriculum, content, and pedagogy. By taking initiative and seeking help she was generally able to access guidance ad hoc. Informal arrangements rely on the agency of the teacher seeking help and the goodwill of more experienced teachers. A more formal arrangement would have been to her and her students' benefit.

Adam (large metropolitan school), who was completing the course while on parental leave, explained that assessment tasks that required him to experiment with different approaches to teaching and learning and reflect on the experience, meant he was reliant on in-field mathematics colleagues to agree for him to teach a class or two of theirs:

> *I emailed the Head of Maths and said, "Look, this is my situation. Can I come in? These are the requirements, I need to teach this, this, that, that." Eventually one guy replied and he said, "Yeah, come on in." Even that small amount, those few lessons that I got to teach … that was the first time that I've focused on the types of questions that I ask students,* [trying] *to draw out their reasoning and draw out their answers rather than me just telling them.*

These accounts highlight that even the most well-intentioned ideas by policymakers and teacher educators face challenges when being embedded within schools where conditions are less than ideal for policy enactment. However, when teachers act as agents of change by establishing local mentoring arrangements, the resulting relational interactions can strengthen professional identities and distribute learning across professional contexts (see Edwards, 2005; Goos et al., 2019, 2023).

Access to Out-of-field Teachers of Mathematics in Different School Settings

Difficulties accessing an in-field mathematics colleague to act as local mentor were somewhat ameliorated by assigning teachers to home groups within the course. As course director, the second author strategically assigned home group membership to bring together colleagues from different schools at different points in their career trajectories and professional learning journeys as out-of-field teachers. Diversity within home groups was intended to enable access to perspectives that might not have otherwise been available. For example, Kelli (large metropolitan school) reported that belonging to a home group helped her to access and experience an alternative instructional vision (Jansen et al., 2020) and culture of mathematics teaching and learning, where productive struggle (Warshauer, 2015) was normalised:

> *I know for a lot of us, we were really surprised at the start by the way that* [the Deakin team] *were talking to us, because that way of teaching maths was not necessarily what we've seen in our own high schools. We had a perception of what maths is. That's not what* [they] *presented … We were in different home groups, which the university got us into on purpose, I think. The other members of my home group were from a science background. So yeah, we looked at things quite differently … So, we solved tasks together and people just became more comfortable in being uncomfortable doing maths.*

This comment illustrates how the research-informed course design expanded teachers' knowledge for teaching mathematics through ambitious pedagogies and collective participation with out-of-field teachers of mathematics in different school settings. Similarly, in the excerpt below, Nancy (small regional school) explains that a cohesive home group provided access to more knowledgeable others, saved her time, and made workshops more accessible and enjoyable:

> *In our group, we sort of developed a bit of a groove of who would do what task. And so, we were working together collaboratively … rather than all of us doing the work independently … it was really easy when you were all familiar with each other … They teach a lot more maths than me too. Because I only teach* [vocational] *numeracy.*

Jacinta (large urban growth corridor school), who had difficulties accessing support in her professional context, reported similar benefits:

> *I always feel like I'm on the back foot. But my home group, I think I'm pretty lucky to be in this group because* [I'm with] *two experienced teachers. So, they just take me on like I'm the student. So, I'll be like, "I don't understand this!" and they'll be like, "We'll show you!" and then they'll show me, and I'll get it, and we'll celebrate!*

Susan (large regional school) was similarly emphatic that the camaraderie she experienced within the course amplified her professional learning experience:

> *Doing mini-investigations with people, so actually unpacking it from, not a teacher's point of view, but a student's point of view. In break-out groups, going and actually working on something together… what tools you would need to do it and how you could actually then formulate a working solution back. As a teacher, that was huge for me in how to understand and help my kids to learn.*

These accounts cohere with previous research findings that teacher study groups can provide powerful spaces of professional agency (Masuda, 2010) and help to reduce the isolation that many out-of-field mathematics teachers feel (Quinn & Hobbs, 2024). The assignment of teachers to home groups comprising colleagues from different schools and at varying stages of their career and professional learning trajectories fostered collective relationality extending beyond individual school settings. Such cross-school collaborations enabled generative engagement with the values, perspectives, and professional commitments of others, contributing to shifts in teachers' orientations toward mathematics curriculum enactment and, in some cases, compensating for limitations within their local professional contexts.

Conclusion and Implications

This article reports on experiences of ten teachers who successfully completed the first iteration of a Graduate Certificate of Secondary Mathematics. The course was designed to develop out-of-field mathematics teachers' specialised knowledge of mathematics curriculum, content, and pedagogy and strengthen their professional identities and practices. Interview data pointed strongly to teachers' professional contexts as shaping their engagements with the course (e.g., capacity to read academic literature or give full attention to synchronous learning sessions). Reported in this article are three main findings, which are consistent with larger international studies (e.g., Du Plessis et al., 2015; Goos et al., 2019, 2023).

The first finding was that school principals were an important determinant of professional learning experiences and outcomes, but their ability to facilitate support was constrained by the teacher workforce crisis. Schools where the principal provided teachers with dedicated time and space to engage with the course were considered highly enabling. The second finding was that access to in-field mathematics teachers as local mentors was highly enabling, but also variable, again due to resource constraints. The third finding was that specific course design elements were able to ameliorate negative impacts where local arrangements were less than ideal. A particularly useful enabler was access to out-of-field teachers of mathematics in different school settings via course home groups. Learning by doing high quality mathematical tasks together with colleagues was a mechanism for the supportive development of mathematical content knowledge.

The analysis supports and extends existing research that shows that upskilling out-of-field teachers is not simply a matter of "fixing" individuals but requires cooperation among policy actors across the education ecosystem. The findings demonstrate the importance of formal mechanisms to ensure key stakeholders (i.e., school principals and in-field mathematics colleagues) are effectively engaged and recognised for the value they can add to supporting and developing out-of-field teachers of mathematics. From the participants' points of view, relationalities with school principals, in-field mathematics teachers and other out-of-field teachers either enabled or constrained their professional learning and growth. This research suggests that the promotion and enactment of these relationalities can genuinely professionalise teachers by recognising their agency to seek out, question, develop, and affirm knowledge in ways that extend what is possible for them and their students. Yet while some school principals may be able to facilitate this, most currently face constraints that arise as a function of the teacher workforce crisis. Ultimately, the insights reinforce previous research that argued that professional learning is inherently social in nature (Timperley et al., 2008), with the sociality evident within courses, contexts, and relationships (Netolicky, 2019).

Braun et al.'s (2011) heuristic allowed for the consideration of contextual influences and their interactions, but the analysis of the accounts of teachers from different school settings also helped to identify the necessary limits of this heuristic. The four contextual dimensions emanate from education policy research that seeks to understand educational practice in nuanced ways that do not blame teachers for policy failure, but the four contexts are not simply interacting containers of practice. They, too, are enacted through the practices of teachers, school principals, and teacher education providers, including through professional learning relationalities that extend beyond the school site. Our analysis supports existing research identifying the professional context as an important source of variation with

respect to how teacher professional learning is enacted, but it also suggests that the professional context is amenable to the actions of some individuals and, as emphasised by Braun et al. (2011), warrants serious consideration by those pursuing reform in school education. The findings extend upon Braun et al.'s (2011) model by revealing how professional context can be reconstituted through cross-school relationalities fostered in system-initiated professional learning.

While education authorities, universities, and schools try to work together to create the conditions necessary for out-of-field teachers of mathematics to learn and grow, this is not easy to do given that the problem being addressed (a shortage of knowledgeable and confident mathematics teachers) only continues to worsen, compromising schools' ability to make the necessary arrangements (i.e., time, teacher replacement, mentoring within the school) for teacher professional learning. In this study, the realisation of policymakers' and teacher educators' ambitions were moderated by the COVID-19 pandemic and a teacher shortage across the education sector. The role of school principals in mediating the impacts of these external factors on teachers' professional contexts inevitably varied. At the time of this initiative, the Victorian Department of Education's approach was to support devolved and autonomous school leadership related to local matters like staffing. Teachers' aspirations were often a casualty of stark resourcing realities.

The findings indicate that the dominant culture of professional learning in Australia requires transformation to more fully recognise research-informed models of teacher learning and growth as integral components of teacher designated workloads. As Netolicky (2019) and Timperley et al. (2008) argue, this is a challenge faced internationally, where systems also struggle to resource the kinds of sustained, collaborative learning known to impact classroom practice. Given that out-of-field teaching in mathematics is likely to remain a structural feature of the Australian education workforce, the findings indicate the value of ongoing strategic intervention paired with guaranteed resourcing to support teachers to learn and grow. National and jurisdictional policies such as the *Teacher Workforce Shortages* issues paper (Commonwealth of Australia, 2022) and the *National Teacher Workforce Action Plan* (Education Ministers, 2022) provide a foundation for such reform but require stronger mechanisms. Policy frameworks must position professional learning as essential work that is core to teachers' entitlement, accountability, and growth. This will mean rightsizing teacher workloads so that more ambitious and locally impactful forms of professional learning can be undertaken. Without this recalibration, system-initiated projects risk reproducing inequities in opportunities and outcomes for out-of-field teachers and their students.

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Competing interests

The authors declare there are no competing interests.

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