Mathematics Written Feedback for Pre-Service Teachers During Professional Experience

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In this study, the authors investigate the written feedback provided to primary and secondary pre-service teachers studying a specialisation in mathematics. The analysis focuses on 16 written reports completed by mentor teachers during the penultimate year placement of pre-service teachers. The evaluation employs a framework informed by the literature. Results indicate a scarcity of subject-specific written feedback concerning mathematics teaching and learning during pre-service teacher placements.

Feedback plays a pivotal role in the development of pre-service teachers (PST) during their professional experience placements, guiding them in shaping their future goals as they progress toward the completion of their courses (Grossman & McDonald, 2018). Constructive feedback not only provides valuable insights into strengths and areas for development but also guides PSTs in refining their teaching practices, building confidence, and fostering continuous professional development (Asregid et al., 2023). It creates a supportive learning environment, enhancing the overall effectiveness of their training and better preparing them for the challenges of the profession (Asregid et al., 2023). Feedback is an integral component of the broader practice of mentoring (Mullen et al., 2021), where effective embedded mentoring practice includes elements of feedback. Feedback can be in written or verbal forms, typically occurring within mentoring conversations or post lesson delivery between the mentor and mentee (Ellis & Loughland, 2017).

Mentors, also known as supervising teachers, both locally and internationally, are expected to provide crucial feedback to PSTs during their school based professional experience placements, fostering the professional development of PST growth. In the most recent Australian review, Strong Beginnings: Report of the Teacher Education Expert Panel 2023, there is mention of the need for PSTs to "receive regular observations, assessment and feedback to support their development" (Teacher Education Expert Panel, 2023, p. 62) during their professional experience placement.

Subject specific feedback is required for PSTs that are undertaking a course that requires explicit content and pedagogical knowledge. In Singapore, as part of professional development for experienced teachers, it is expected that all staff are involved in mentoring. The introduction of The Master Teacher program identifies experienced Singaporean teachers where mentoring is subject-specific, with a focus on content and pedagogical knowledge (Jensen et al., 2016). Internationally, it is common that feedback is provided post lesson observation to support ongoing improvement (e.g., in England, Shanghai, Finland, Jensen et al., 2016). For many Initial Teacher Education (ITE) programs, summative written feedback reports serve as a dual-purpose tool, fulfilling program accreditation requirements while also providing the platform for mentors to offer comprehensive written feedback to PSTs (White, 2007).

Presently in Australia, the workforce shortage has extended to impact the selection of mentors for PSTs during their professional experience placements. In Australia, teachers progress through four career stages: graduate, proficient, highly accomplished and lead. The current teacher demographic includes individuals in the early stages, often proficient, of their teaching career (up to 5 years), and occasionally, those teaching outside their subject area specialisation. Ideally, highly accomplished experienced teachers would be the optimal mentors for PSTs during their placements. However, among the 307,000 full-time equivalent teachers

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in the country, only 1211 hold certification at the highest accreditation levels, that is, Highly Accomplished or Lead (National Teacher Workforce Action Plan, 2022). Consequently, there is a need to consider how feedback can be effectively provided by mentors who are still developing professionally and may also be teaching outside their subject area.

This paper centres on examining a specific feedback approach, written feedback, for ITE primary PSTs specialising in mathematics and secondary mathematics PSTs. The focus extends to exploring subject-specific feedback. To streamline the information presented in this paper, only documents from the penultimate year PST reports will be included.

The Literature Informed Framework

Features of the theoretical framework can be categorised under five themes. They include: Australian Institute for Teaching and School Leadership (AITSL) governing standards; learner needs, feedback design, structure based on the written form/report and mentor provisions. For this paper, only five sub-themes are considered and further explained.

Sub-Theme 1: Use of AITSL Language in Written Feedback

In the Australian context, written feedback provided by mentors overseeing professional experience serves a dual purpose. It functions as a formative assessment, with a focus on continuous improvement, and as a summative assessment, serving accreditation objectives by determining if a PST meets the requirements for teacher accreditation (AITSL, 2019). The standards are structured into three domains of teaching: Professional Knowledge, Professional Practice, and Professional Engagement.

In the first domain, *Professional Knowledge*, teachers tailor instruction for diverse student needs, considering linguistic, cultural, and religious backgrounds. They adeptly integrate literacy, numeracy, and technology for enhanced learning (AITSL, 2019). In the second domain, *Professional Practice*, teachers create engaging and safe learning environments, using effective teaching strategies. They regularly evaluate their practice, interpret assessment data, and proficiently operate across all stages of the teaching and learning cycle (AITSL, 2019). In the final domain, *Professional Engagement*, teachers model effective learning and engage in ongoing professional development, demonstrating respect and professionalism in interactions with students, colleagues, and parents/carers, valuing connections between school, home, and community for students' development (AITSL, 2019).

The three domains comprise seven teaching standards which encompass 38 focus areas offering additional descriptors into each teaching standard and domain. These focus areas exhibit a progression aligned with the four career stages (graduate, proficient, highly accomplished and lead). The Australian Professional Standards for Teachers provide a foundational theoretical framework guiding teacher development.

Sub-Theme 2: Subject Specificity

Several studies highlight a notable omission in the feedback and evaluation forms provided to PSTs, specifically the neglect of subject or discipline-specific aspects of teaching. Schwartz et al., (2018) and Brett and Parks (2022) have drawn attention to this oversight. Despite the crucial role that subject or discipline-specific elements play in shaping teacher identity and defining the parameters of teaching practice, these dimensions are frequently disregarded in the feedback and evaluation processes directed towards PSTs. An Australian study that surveyed 147 primary PSTs during their mathematics subject specialisation placement found that mathematics specific feedback was provided through verbal feedback, teaching feedback, written feedback and reviews of lessons (Hudson, 2009).

From a mentor's perspective, factors which contribute to supporting PST subject-specialisation growth include: sufficient content knowledge; knowledge of the syllabus;

implementing feedback in subsequent lessons; positive outlook and attitude (Hudson, 2009). Msimango et al., (2020) extend this notion to include reciprocity in the mentoring process, where mentors and PSTs develop a shared understanding of mathematics-specific mentoring to enhance pedagogical and content knowledge. Therefore, mentors must offer subject-specific feedback to aid PSTs' development in their discipline and meet specialisation requirements.

Sub-Theme 3: Feedback is Actionable

The benefits of effective feedback in education have been well established in the research literature (Martínez, 2016; Moussaid & Zerhouni, 2017). For example, in a study of PST's responses to feedback from mentor teachers, Moussaid and Zerhouni (2017) found that "trainees preferred to receive plenty of feedback that is both written and oral, more performance-based than content-based, specific and helpful, honest and constructive, and encouraging and motivating" (p. 146). Similarly, in a study about Spanish student teachers, Martínez (2016) found that the student teachers expected detailed and constructive feedback focused on identifying areas of improvement.

Therefore, as PSTs seek feedback that aids their areas of improvement, this aspect will be included in the sub-theme focusing on actionable feedback.

Sub-Theme 4: Feedback Enhanced Knowledge and Sub-Theme 5: Feedback Improved Skills

Crucial to PSTs development are feedback mechanisms that enhance proficiencies in curriculum, teaching practices, and student management. Studies by Spear et al. (1997) and Akcan and Tatar (2010) revealed varying focuses on mentor feedback, with the former emphasising student engagement and behaviour and the latter concentrating on classroom activities and subject knowledge. These differences reflect diverse teaching identities and values across cultures (Kastberg et al., 2020). Despite these contrasts, mentors universally address practical concerns such as classroom strategies. Thus, feedback aimed at enriching PSTs' knowledge and skills in the teaching profession is integral to their development.

In order to ascertain the type of written feedback mentors are currently providing to PSTs, the study was underpinned by the following research question: What type of mathematics specific written feedback is found in written reports to PSTs?

Research Design

The data presented in this paper originates from a broader cross-university Australian study that primarily centred on non-subject-specific written feedback. Specifically, this paper delves into data obtained to gain a deeper understanding of the written feedback in mathematics education extended to both primary and secondary PSTs.

Participants

The study encompassed documentation from 13 primary and three secondary undergraduate PSTs in their third year from an Australian university. These PSTs completed their penultimate professional experience placements in schools spanning various systems and sectors (Catholic, Department, and Independent) in New South Wales. This placement was 15 days duration, with PSTs having already completed two, 15-day placements previously. A final 35-day placement followed in their final year. Professional Experience C (PEXC) Reports for each PST were checked to ensure mathematics was nominated as their primary subject specialisation or secondary teaching area. PEXC reports are used as a formative and summative assessment of a PST's achievement during placement.

Data Collection Methods

To investigate the type of subject-specific feedback found in PEXC Reports, document analysis was undertaken which involved examining and interpreting data in documents to extract meaning, achieve understanding, and generate empirical knowledge (Corbin & Strauss, 2008; Rapley & Rees, 2018). To make sense of the data, the analysis will be presented quantitively (Morgan, 2022). Qualitative data extracts or summaries from the researchers will be used to display illustrative examples to support the statistical data (Braun & Clarke, 2013).

Within the PEXC Reports, there are three main ways in which a supervising teacher/mentor can provide written feedback. The first is the identification of the grading the PST is working at against selected AITSL standards at the mid-point (formative) and end-point (summative) of the placement. The second are the written comments by the mentor at mid-point and end-point of the placement (Table 1). The Focus for Further Development provides mentors with an opportunity to provide specific guidance for the PST to improve practice during the placement and in the future. Additionally, both the mentors and PSTs are expected to add an overall reflective comment at the end of the report (Table 2). A review of the PEXC Report template was also conducted to identify how often and when prompts were provided to respond with subject specialisation feedback.

Table 1

Extract From the Professional Experience Report Written Feedback

Supervising teacher's comments re assessment of DOMAIN 1: Professional knowledge	
Mid-Point	End-Point
Evidence of development and achievement:	Evidence of development and achievement:
Focus for further development:	Focus for further development:

Table 2

Extract From the Professional Experience Report—Overall Comments From Supervising Teacher and PST

School supervising teacher's overall comments	**Pre-service teacher's reflective comments**
School supervising teacher signature:	Pre-service teacher signature:
Date:	Date:

The theoretical framework described earlier in the paper was used to guide data collection. Two coders reviewed mentor written feedback (Tables 1 and 2) independently. Using an excel worksheet, extracts or summaries from the report were aligned against the framework. Table 3 provides an example of the way in which the data was collected.

Table 3

Example of Data Analysis and Coding for PST 1

PST 1—Primary	**Coder A (Coder B completes a similar form for each placement report)**
Use of AITSL language in written feedback	☑ Mathematics Specific Comments ☐ General Comments *Example: "[PST] will be delivering a mathematics learning sequence on multiplicative relations in her final week." Mentor states that assessment and content knowledge will be enhanced. "This will provide her with an opportunity to demonstrate standard 2.3"*

PST 1— Primary	**Coder A (Coder B completes a similar form for each placement report)**
Subject specificity	☑ Mathematics Specific Comments ☐ General Comments *Example: Mentor has provided growth feedback from mid to end point for maths. Feedback focuses on the maths content, resources developed and assessment implemented. The mentor writes that student results indicate success in the PSTs teaching. No future goals set*
Feedback is actionable	☑ Mathematics Specific Comments ☐ General Comments *Example: Feedback can be actioned within the given time of the placement*
Feedback enhanced knowledge	☑ Mathematics Specific Comments ☐ General Comments *Example: Specific components of the primary maths syllabus are mentioned i.e. fractions, chance and multiplicative relations*
Feedback improved skills	☑ Mathematics Specific Comments ☐ General Comments *Example: Increase in selecting appropriate maths strategies and providing feedback*

Table 3 displays Coder A's collection of data from the PEXC Report for PST 1. PST 1 is a primary PST with a specialisation in mathematics.

Results

The analysis of the PEXC Report identified only one instance of the term "specialisation". PSTs were required to state their primary specialisation on the cover page. The PEXC Report includes a comment about the PST meeting a minimum requirement of 6 hours to observe, assist, teach in their named specialisation across the 15 days. The analysis of the PEXC Report completion rate revealed insights into the specific areas where mentors offered feedback. Table 4 provides an overview of what was evidenced in each report. It is noted that report completions varied across the components of the written report. The end-point focus for further development section (see Table 1) was not always completed. Further, within this section, 63% of reports had a comment that provided feedback on the professional engagement domain. The overall comment section (see Table 1) was completed by all mentor teachers and PSTs.

Table 4

*Completed Components Within the Reports Analysed (*n = *16)*

	Evidence of development and achievement		**Focus for further development**	
	Mid-point	**End-point**	**Mid-point**	**End-point**
Professional knowledge	100%	100%	100%	88%
Professional practice	94%	100%	100%	81%
Professional engagement	100%	100%	88%	63%

Results were further categorised into the three AITSL teaching domains: (1) *Professional Knowledge* (PK); (2) *Professional Practice* (PP); and (3) *Professional Engagement* (PE).

This aligns with the university's structured feedback template, organised by these domains. The analysis of each professional experience report was then conducted against each sub-theme (use of AITSL language in written feedback; subject specificity; feedback is actionable; feedback enhanced knowledge; feedback improved skills). The findings are presented in Table 5.

Table 5

Analysis of the Reports by AITSL Teaching Domains and Sub-Themes

Sub-theme		Primary (*n=13*)			Secondary (*n=3*)		
		PK	**PP**	**PE**	**PK**	**PP**	**PE**
Sub-theme 1: use of AITSL language in written feedback	Mathematics Specific Feedback	**1**	**1**				
	Mathematics Specific and General Feedback	**2**			**1**		
	General Feedback	10	11	12	2	3	3
	No Response or Feedback Aligned with Sub-theme		1	1			
Sub-theme 2: subject specificity	Mathematics Specific Feedback						
	Mathematics Specific and General Feedback	**6**	**3**		**1**		
	General Feedback	7	7	4	2	3	
	No Response or Feedback Aligned with Sub-theme		3	9			3
Sub-theme 3: feedback is actionable	Mathematics Specific Feedback	**1**					
	Mathematics Specific and General Feedback	**1**			**1**		
	General Feedback	11	13	9	2	3	
	No Response or Feedback Aligned with Sub-theme			4			3
Sub-theme 4: feedback enhanced knowledge	Mathematics Specific Feedback	**1**	**1**				
	Mathematics Specific and General Feedback	**1**					
	General Feedback	3	1		1		
	No Response or Feedback Aligned with Sub-theme	8	11	13	2	3	3
Sub-theme 5: feedback improved skills	Mathematics Specific Feedback	**1**	**1**				
	Mathematics Specific and General Feedback						
	General Feedback	11	11	8	3	3	3
	No Response or Feedback Aligned with Sub-theme	1	1	5			

Professional Knowledge

In this domain, only a single written report contained specific feedback related to mathematics. Feedback within this report addressed sub-themes 1, 3, 4 and 5. In the mid-point report, sub-theme 2, focusing on subject specificity, was discussed generally. However, in the end-point report, the discussion was specifically on mathematics, "designed and implemented learning sequences for Stage 3 ... implemented open-ended, low-floor, high-ceiling tasks to allow for quality differentiation" [PST Primary Report 1]. The mentor also noted the PST's growth from mid to end point in mathematics. The feedback specifically addressed mathematics content, resource development, and assessment implementation. The mentor acknowledged the success in the PST's teaching based on student results.

Most feedback was of a general nature, with some instances where the mentor did not provide a response to that particular sub-theme. To illustrate, one report captured feedback that appears to be across multiple subjects, urging the PST to "continue to develop rich extension opportunities" and to "continue to consider assessment opportunities" [PST Primary Report 6]. Similarly, the feedback provided in another report was broad, suggesting that the PST "should explore and implement teaching strategies, e.g., pair/share" [PST Secondary Report 14]. These examples highlight a tendency for general feedback and instances where mentors did not provide subject specific comments.

Professional Practice

Examination revealed only one primary PST received specific feedback related to mathematics. No written reports from the secondary PSTs made reference to mathematics. This explicit reference to mathematics is likely to have been omitted as a subject area of the placement is identified as mathematics on the coversheet of the report. A comment by a secondary mentor "demonstrated a strong understanding of the content and effectively conveyed this knowledge to the students. … Lesson plans were well structured using a variety of techniques" [Report Secondary 16] has the reader assume the context is mathematics and was categorised as General Feedback. One primary PST received mathematics specific feedback within this domain. The mentor highlighted the PST's creation of a mathematics assessment task. In the same report, the mentor mentions the content area of patterns and algebra in connection to the PST's professional practice [PST Primary Report 1].

Professional Engagement

This domain had no instances of mathematics (or a subject area) specific feedback. The comments were either general in nature or focussed on school based professional learning opportunities. For example, "[PST] is encouraged to engage in professional learning and use this time as an opportunity to learn from his colleagues" [PST Primary Report 2].

Discussion

Addressing the research question, "What type of mathematics-specific written feedback is found in reports to PSTs?" reveals a scarcity of such feedback, raising concerns about potential oversights in addressing specific needs. The researchers agree that this study has limitations, for example, that it relies solely on written reports, potentially overlooking nuanced interactions or feedback that may occur during verbal communication between mentors and PSTs and that the study is restricted to a specific university, which may limit the generalisability of the findings to broader ITE programs.

The results prompt crucial discussions on the effectiveness of general feedback in fostering PST growth in mathematics, underscoring the need for clarity in the PEXC Report and specificity in mentoring practices. The finding that there is only one instance of a prompt to write feedback related to subject specificity suggests that the mentor may not have thought to include such feedback and greater signposting of the requirement is needed in the documentation. Instances of alignment with AITSL standards suggest the potential influence of professional standards in guiding mentor feedback, akin to findings by Schwartz et al. (2018) and Brett and Parks (2022). These emphasise the importance of examining PST preparation programs for subject-specific feedback and raising questions about mentors' qualifications and experience, particularly when mentoring outside their subject specialisation. The results obtained in this study will contribute to the broader research project, specifically addressing templates for written feedback, mentor professional learning, and subject-specific feedback strategies to enhance PST growth.

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