The Nature of Feedback Given to Elementary Student Teachers from University Supervisors after Observations of Mathematics Lessons

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This research explores the frequency and nature of mathematics-specific feedback given to elementary student teachers by university supervisors across a collection of post-lesson observation forms. Approximately one-third of the forms (n=250) analysed from five large universities had no comments related to mathematics. Forms that did have mathematics-specific feedback varied in terms of the number of summary, strength, and suggestion (i.e., type) comments and in the pedagogical focus (e.g., tasks, discourse) of those comments. Chi-square tests of independence indicated the frequency of forms with mathematics-specific feedback differed significantly by university. Results of additional Chi-square tests showed significant interactions between the type of comments and university and between the pedagogical foci of the comments and comment type. Contributing factors and implications, including connectedness of the university supervisors to the programs, professional development provided to university supervisors, and the organisation of the forms, are discussed.

Keywords · lesson feedback · preservice elementary teachers · mathematics · field experience · university supervisor

Learning to teach is an arduous undertaking. Although elementary school preservice teachers have been learning content and pedagogy in various disciplines for many years as students themselves, actually teaching that same content provides challenges for the novice teacher (Ball, Sleep, Boerst, & Bass, 2009). It requires individuals to negotiate new discourses about the learning and teaching of mathematics and to link those discourses to their existing vision of high-quality mathematics teaching (Munter, 2014). Reliance on other more experienced individuals within the field of elementary education to articulate and model high-quality teaching practices becomes paramount (Darling-Hammond & MacDonald, 2000). Feedback from these individuals on preservice teachers' practice during field experiences is a crucial part of this process (Feiman-Nemser & Buchmann, 1987; Shantz & Ward, 2000). However, feedback is often about general classroom practices such as management and organisation (Moore, 2003). The purpose of this study is to examine the nature of feedback given to elementary preservice teachers by university supervisors after enacted mathematics lessons.

Problem Statement

Preservice teachers (PSTs) refine their visions of high-quality mathematics instruction as they gain knowledge and experiences in the multiple contexts in which they find themselves across their teacher preparation programs. We work during methods courses at our universities to promote a research-based vision for high-quality mathematics instruction (Munter, 2014) which includes students' engagement in: cognitively demanding tasks focused on conceptual understanding (Stein, Smith, Henningsen, & Silver, 2009); the use of multiple representations for mathematical concepts (Lesh, Cramer, Doerr, Post, & Zawojewski, 2003); and mathematical discourse including explanation and justification (Hufferd-Ackles, Fuson, & Sherin, 2004). To this end, we work with elementary preservice teachers to increase their mathematical knowledge for teaching (Ball, Thames, & Phelps, 2008), hoping they leave our methods courses with deeper content knowledge and an expanded vision of effective mathematics instruction. However, as PSTs move to their next learning context, student teaching, they interact with other teacher educators who may have different levels of mathematical knowledge for teaching and different visions of mathematics instruction. This results in PSTs trying to make sense of the various discourses about mathematics teaching as they try to enact what they have learned.

Recently, methods courses that are embedded in K-5 classrooms or that include practice of pedagogies through enactment-investigation cycles (Kazemi et al., 2016; Lampert et al., 2013) have mitigated competing discourses because methods instructors are directly engaged in providing feedback to PSTs. Yet, the student teaching experiences at our universities (their full-time, culminating clinical experience in an elementary classroom), arguably the most influential part of teacher education (Levine, 2006), are largely supervised by generalists. Specific feedback given by content experts is more effective (Evans, Jones, & Dawson, 2015), but do university supervisors in elementary programs who are generalists or who have content expertise in only one domain give mathematics-specific feedback?

Our interest in this topic started with anecdotal episodes of PSTs telling us they were unable to try what they had learned in our program. Some university supervisors were giving feedback on mathematics lessons contrary to the visions of effective mathematics instruction they developed during methods courses. As researchers, we wanted to move past anecdotal evidence to understand how much of the feedback given to elementary student teachers during mathematics lessons was content-specific and descriptively, what the feedback addressed. Since we wondered about the scope of the issue, we chose to begin with a broad survey of written feedback on observation forms. Considering only the written feedback on observation forms afforded us the opportunity to look at the breadth of feedback given on a large scale and has provided direction for future research.

We report the results of our study's findings in terms of the frequency and nature of mathematics-specific feedback on written observation forms associated with elementary student teaching lessons from five universities. We then suggest possible factors in the different universities' programs and forms that might explain differences, and we present areas for further research.

Theoretical Perspectives

Our study draws on two theoretical perspectives: educative mentoring and standards-based mathematics teaching practices. Educative mentoring rests upon Dewey's (1938) notion of educative experiences, those experiences that promote future growth and lead to more substantial learning. Feiman-Nemser (2001) states that educative mentoring is dependent upon "an explicit vision of good teaching and an understanding of teacher learning" (p.18). In the case of preservice teachers (PSTs), teacher preparation programs want to have a shared vision about what constitutes high-quality mathematics instruction with their PSTs' mentors in field placements (i.e., cooperating teachers, university supervisors). When there is a shared vision, it is much more likely that the feedback provided to student teachers is educative and centred on content-related understandings of effective teaching and learning during mathematics (Burbank, Bates, and Gupta, 2016).

Feedback during the preparation program is a significant component of PSTs' development; their learning is optimised "when they receive systematic instruction, have multiple opportunities to practice, and receive feedback that is immediate, positive, corrective, and specific" (Scheeler, Ruhl, & McAfee, 2004; p. 405). That is, practicing the act of teaching and receiving educative feedback is important for PSTs to leave their program with the knowledge and skills necessary to be effective teachers. One type of feedback is the written feedback on post-lesson observation forms received by PSTs when they are student teaching. As mathematics teacher educators preparing elementary-school teachers, we were interested in understanding the nature of post-mathematics-lesson written feedback, that is, whether it is specific to the discipline of mathematics.

In addition to the nature of the feedback, it is also important to understand the focus of the feedback that student teachers receive on their mathematics lessons. Mathematics teacher educators tend to have a shared vision of effective mathematics instruction and agree on components of standards-based mathematics teaching practices (Walkowiak, Berry, Rimm-Kaufman, Meyer, & Ottmar, 2014; Australian Association of Mathematics Teachers, 2006; Eurydice, 2011; National Council of Teachers of Mathematics [NCTM], 1989, 2000), the second component of our theoretical framework. In the United States, NCTM (1989, 2000) outlined a vision for K-12 mathematics teaching and learning that includes processes such as problem solving, communication, and connections. This vision has been further articulated in recent documents such as NCTM's *Principles to Actions* (2014) and the Common Core State Standards for Mathematics (CCSS-M) (National Governors Association Center for Best Practices & Council of Chief State School Officers [NGA CBP & CCSSO], 2010). These documents place instructional emphases on opportunities for K-12 students to engage in processes like modelling with mathematics, using and connecting representations, constructing viable arguments, and critiquing the reasoning of others.

Relevant Literature

The Student Teaching Experience

Models for preparing preservice elementary teachers typically include a series of content-specific methods courses taken within a university setting followed by or in conjunction with some type of external school-embedded field experience. Based on early studies, Hammerness et al. (2005) stated that:

> During both the preservice period and initial years in the field, new teachers need support in interpreting their experiences and expanding their repertoire, so that they can continue to learn how to become effective rather than infer the wrong lessons from their early attempts at teaching. (p. 375)

Typically, the culmination of pedagogy and content come to fruition at the conclusion of a preservice teacher's formal education in their capstone experience of student teaching (Davenport & Smetana, 2004; Scheeler, McAfee, Ruhl, & Lee, 2006). Frequently, student teaching is a full-time field experience for the preservice teacher during which he or she works in a cooperating teacher's classroom for an extended duration (12 to 15 weeks) with additional support from a university supervisor.

Preservice teachers often state that the student teaching experience is one of the most influential experiences in learning how to teach (Richardson-Koehler, 1988; Wilson, Floden, & Ferrini-Mundy, 2002). However, Borko and Putnam (1996) found that to create instances of substantial change in content and pedagogy during student teaching, a preservice teacher must first employ instructional strategies as presented in their methods classes and then receive constructive feedback on each lesson that is taught. Reflecting on instructional practices provides opportunity for individual growth and helps preservice teachers to distinguish what is and is not valued in the classroom (Pena & Almaguer, 2007). Yet, in elementary programs, university supervisors may not have discipline-specific expertise in the subject matter of the lessons they are observing, and thus may be unable to make connections to what is presented in methods courses or may even make suggestions that are counter to teaching practices espoused in methods courses.

The student teaching experience is a collaboration of three individuals; the preservice teacher, the cooperating teacher, and the university supervisor work as a team to achieve the most effective, meaningful experience. As part of the triad, the cooperating teacher holds the responsibility of day-to-day guidance of the preservice teacher during the imperceptible changes that occur during the student teaching experience. Borko and Mayfield (1995) show that preservice teachers reported that cooperating teachers influenced their teaching more than the university supervisor. Unfortunately, preservice teachers often fail to improve instructional decisions due to the fact that "well-meaning praises from cooperating teachers, coupled with a focus on management, fixed the attention of student teachers in the wrong direction" (Feiman-Nemser & Buchmann, 1985, p. 255). Additionally, preservice teachers may be placed in classrooms where factors such as inadequate preparation for the role and unclear delineation of responsibilities limit the cooperating teacher's ability to promote high-quality teaching practices (Lawley, Moore, & Smajic, 2014; Clarke, Triggs, & Nielsen, 2014). In these cases, the university supervisor can play a pivotal role by promoting a deliberate focus on pedagogy *and* the disciplinary content.

The Role of the University Supervisor

Studies reveal that university supervisors maintain an important role in the clinical experiences of student teachers; university supervisors help to promote positive interactions between the student teacher and the cooperating teacher (Griffin et al., 1983; Shantz & Ward, 2000), and university supervisors enhance the student teaching experience, even though their role, at times, may appear undefined or changing (Burns, Jacobs, & Yendol-Hoppey, 2016). Researchers have indicated there is a dearth of literature on the role and work of university supervisors (Steadman & Brown, 2011) pointing out the lack of attention to student teaching supervision in the third edition of the *Handbook of Research on Teacher Education* (Cochran-Smith, Feiman-Nemser, McIntyre, & Demers, 2008).

To wholly understand the influence of the student teaching experience, it is necessary to identify and acknowledge the nature of observational feedback received from university supervisors that addresses content and content-specific pedagogical knowledge (Chalies, Ria, Bertone, Trohel, & Durand, 2004). Ideally, feedback from university supervisors would include both discipline-specific and general feedback, and the feedback would reinforce the pedagogical strategies taught in methods courses. Koster, Brekelmans, Korthagen, & Wubbels (2005) identified content competence as a very important indicator of a quality teacher educator. However, many elementary student teaching supervisors are generalists or are specialists in other disciplines, and therefore lack the expertise in mathematics teaching needed to give rich feedback. Anecdotally, our sense is that in many instances (but not all), university supervisors are either not giving mathematics-specific feedback, or if they do, are not actively promoting standards-based mathematics teaching practices (ACARA, 2012; NCTM, 2007, 2014). In fact, our experience is that sometimes feedback given is in direct opposition to what is learned in methods courses. This study attempts to explore our hunches more formally by examining the nature of feedback given to elementary preservice teachers after observed mathematics lessons during the student teaching experience.

Feedback from University Supervisors

When looking at the types of feedback that preservice teachers receive from university supervisors regarding enacted teaching practices, comments presented to the preservice teacher frame the educative experiences of the novice teacher. Giving educative feedback becomes the foundation for change and the scaffolding that preservice teachers require as they progress from captive learner to facilitator of knowledge. Fletcher (2000) posits that the role of the mentor, defined as the university supervisor for the purpose of this study, is to acknowledge the nuances of the teaching observation and clearly articulate strengths and weaknesses of the teaching performance. Accordingly, observational feedback should require self-reflection of personal teaching skills. Knowing that student teaching is one of the most influential pieces of a preservice elementary teacher's experience, it is essential that the nature of feedback received from university supervisors be productive in promoting positive change in teaching practice.

Research has shown that, in an attempt to avoid conflict, university supervisors moderate the power of their comments and choose to adhere to more general types of comments or questions that lack the educative prompting that is essential for personal growth (Chalies, et al., 2004; McNally, Cope, & Inglis, 1997). Oftentimes, their comments depict a sense of leniency toward the preservice teacher in an effort to support the PST emotionally in the stressful situation of student teaching (Burns, Jacobs, & Yendel-Hoppey, 2016). Borko and Mayfield (1995) posit that university supervisors "place a high priority on being positive in their interactions with student teachers, in order to build their confidence" (p. 516). In contrast, when conducting research with preservice teachers in Finland, Jyrhama (2001) noted that when university supervisors posed 'why' types of questions, preservice teachers were forced to reflect upon what produced effective teaching practices, helping to move them forward. When constructive critiques on teaching pedagogy as well as content fail to be implemented, the role held by the university supervisor becomes more of a formality than the necessary role of educative mentor.

Van Houten (1980) organised feedback into three domains: the nature of feedback; the temporal dimensions (i.e., timing, frequency); and who delivers the feedback. In our case, university supervisors are the individuals who gave handwritten feedback to preservice teachers on university observation forms. While certainly an important domain, we did not consider temporal dimensions of feedback in this study because our analyses were limited to archived records of written observation forms. We were specifically interested in the <u>nature</u> of this handwritten feedback, which can be organised into five nonexclusive dimensions: corrective, noncorrective, general, positive, and specific (Van Houten, 1980; Scheeler, Ruhl, & McAfee, 2004).

First, corrective feedback is defined as feedback that points out the "error" and provides specific ways to correct it. In the context of classroom teaching, the "error" is defined broadly. It could be an existing behaviour to eliminate or to improve upon, or it could be a needed behaviour that is currently missing in the implementation of instruction. In contrast to corrective feedback, the second type, noncorrective feedback, corresponds to pointing out an "error" without offering strategies or ideas for correcting it. Third, general feedback is vague or not specific. In feedback on classroom teaching, general feedback tends to be in the form of summary comments about the lesson. Fourth, positive feedback can be defined as praise or compliments to identify strengths in instruction. Finally, specific feedback provides precise and clearly defined information about observed teaching behaviours. It is important to note the non-exclusive feature of the dimensions, when considering the level of specificity of any type of feedback. For example, a suggestion for correcting a behaviour (i.e., corrective feedback) can be clearly identified and precise (i.e., specific feedback).

Mathematics-specific feedback. When looking more specifically at mathematics content and mathematics pedagogy, the depth and breadth of university supervisors' comments remain limited. In a study conducted by Borko and Mayfield (1995), results show that mathematical content remained trivial during exchanges between preservice teachers and university supervisors. Mathematics and mathematics-specific pedagogy were seldom addressed. The researchers conjectured that this is "probably related to the lack of attention to content and content-specific pedagogy on the Student Teacher Observation Form" and the university supervisors' lack of knowledge in mathematics content and mathematics-specific pedagogy (Borko & Mayfield, 1995).

Mathematics-specific feedback may be focused on one of several domains of mathematics instruction (Walkowiak et. al., 2014) that have been deemed important in standards (e.g., Common-Core State Standards for Mathematics [CCSS-M]) and recommendation documents (Australian Association of Mathematics Teachers, 2006; ACARA, 2012; NCTM, 2000, 2014; NGA Center for Best Practices & Council of Chief State School Officers, 2010). First, a university supervisor may offer feedback on how a student teacher facilitates mathematical *discourse*, perhaps through the types of questions posed, the opportunities for children to talk with peers about mathematical ideas, and the degree to which explanation and justification of strategies is required (Hufferd-Ackles, Fuson, & Sherin, 2004). Second, feedback can be provided on the *tasks* the student teacher plans and implements with the elementary students. Tasks are central to the lesson's goals and require varying levels of cognitive demand (Stein, Smith, Henningsen, & Silver, 2009). Third, the university supervisor can give feedback on the mathematical *representations* utilised in the lesson since experiences with multiple representations can help build conceptual understanding (Lesh, Cramer, Doerr, Post, & Zawojewski, 2003). Fourth, feedback may be provided on how the student teacher uses *assessment* to inform instruction, even in-the-moment decisions based upon students' responses to the mathematics (Popham, 2008). Finally, the university supervisor may provide feedback on the mathematical *coherence*; specifically, the supervisor may comment on whether the lesson components are organised, flow logically, and are mathematically connected (Hiebert et. al., 2005). In the context of this study, we were interested in knowing not only whether a written comment from the university supervisor was a summary, suggestion, or strength, but we also investigated the pedagogical focus of each comment within these mathematics instructional domains.

Research Questions

Focusing our attention on the development of mathematics content and content-specific pedagogy in student teachers, we collected and coded data from student teaching observation forms (n=250) from five university teacher preparation programs to address the following research questions:

1. What is the frequency of mathematics-specific feedback across a collection of observation forms completed by university supervisors for elementary preservice teachers' mathematics lessons?
    a. How do the number of forms with mathematics-specific feedback vary by university?
2. What is the nature of the mathematics-specific feedback given on observation forms?
    a. How do the types of comments (i.e., summary, strength, suggestion) vary by university?
    b. How do the pedagogical foci (i.e., discourse, tasks, representations, assessment, coherence) vary by the types of comments?

Methods

Context

The data in this study is from five large universities within a state university system in the U.S. Universities were selected because they responded to an invitation to participate given at a state-wide meeting of mathematics education faculty. While all five universities are large, the number of students in their education programs varies in size with the number of graduates ranging from 60 to 260 per year. In addition to differences in program size, universities differed in who the supervisors are and the professional development they receive. These differences are summarised in Table 1.

Design and Sampling

This study utilised a content analysis design (Krippendorff, 2012) and included feedback forms given to elementary student teachers from university supervisors who observed the student teachers' mathematics lessons. Fifty observation forms from a five-year period were randomly selected from each of five large state universities. This set of 250 forms became our sampling unit (Krippendorff, 2012); the coding of the forms took place in multiple iterations and is described in the analysis section below.

Procedure

After identifying information was removed, the forms from all universities were compiled and sent to researchers for independent coding. Researchers subsequently met weekly to share coding, discuss discrepancies, and revise codes accordingly. The first level of coding addressed the first research question about whether or not the forms had mathematics-specific feedback. The forms which were deemed to have mathematics-specific feedback were then re-coded iteratively for the nature of the feedback to address research question two.

Table 1
Profiles of Universities

University	Average # of Elementary Education Graduates per Year	Approximate # of Supervisors per Year	Roles of Supervisors	Professional Development/ Collaboration
1	87	27	One Tenured faculty; Remaining Adjuncts (former administrators and teachers)	Two meetings per year at mid-term and end of the semester to help with grading assignments
2	260	38	Tenured or Tenure-track faculty, Fixed-Term faculty, and Adjuncts (former administrators and teachers)	Half-day orientation session to become familiar with the expectations for supervising interns (roles and responsibilities; paperwork and deadlines; and working with a marginal intern).
3	60	5	Full-time supervisors and/or Part-time instructors in program	Three 2-hour meetings per semester with other supervisors (and as needed); Co-observe lessons with program faculty; Teach courses in program; Regularly attend program meetings with faculty
4	130	23	Retired elementary school teachers, clinical faculty, doctoral students	Shadowing of experienced supervisors, professional development in monthly elementary education meetings conducted by regular faculty
5	180	15	75% supervised by full-time supervisors (former teachers), considered fixed-term clinical faculty 15% former administrators 10% clinical or tenure-track faculty in elementary ed	One 2-hour orientation each semester Three 1-hour meetings during semester

Analysis

Question 1. The collected observation forms were first coded using the form as the unit of analysis (Krippendorff, 2012). They were divided into two groups: forms that had mathematics-specific feedback and those that did not. We operationally defined mathematics-specific feedback as those comments on the forms that could not apply to other subject disciplines. For example, the following comments apply to the teaching of mathematics, but they also apply to teaching other subjects. They were therefore coded as non-mathematics-specific feedback.

> Cited many relevant examples and gave all students the opportunity to participate in provided activities. (University 2, Form 26)

> Use appropriate vocab. and use the same vocab. throughout the lesson. (University 5, Form 1)

Conversely, the following comments relate specifically to the doing and teaching of mathematics and were thus coded as mathematics-specific feedback.

> You are trying to incorporate more math talk into your lessons by asking the students to articulate their work and solutions repeatedly. (University 3, Form 11)

After the sorting was completed, a chi-square test of independence was run to see if there was interaction between the number of mathematics-specific forms and the different universities. Adjusted standardised residuals were found to indicate sources of interaction within the data.

Question 2. Forms that did contain mathematics-specific feedback ($n = 170$) were subsequently coded to determine the nature of the feedback given. The unit of analysis used was individual comments rather than forms. A comment was defined as a statement or group of statements about a distinct topic or event.

Figure 1 shows how we used Van Houten's (1980) organisation of feedback to inform our coding. First, we determined if each comment was *specific* to the discipline of mathematics. Then, we classified each mathematics-specific comment as a summary (i.e., *noncorrective, general*), suggestion (i.e., *corrective*), or strength (i.e., *positive*). Lastly, we examined the *specific* pedagogical focus of the comment (e.g., tasks, discourse, representations).

In labelling each mathematics-specific comment as a summary, suggestion, or strength, we followed a protocol. If the comment simply stated what was happening in the classroom without additional indication of judgment, it was categorised as a summary comment. If the comment indicated a positive view, it was listed as a strength (for example, "Good job..." or "I like how you..."). Comments in which the observer indicated something that should be changed or offered an idea were categorised as suggestions.

One issue raised in research group discussions was how to handle comments that felt like a summary, that is, simply a recording of what happened, but were located on the form under the heading of "Strengths." This happened at Universities 3, 4, and 5, but most notably at University 4. In this instance, the group decided to categorise all comments under such headings as strengths. While this possibly inflated the number of comments recorded as strengths, we felt that this decision decreased our level of assumption in trying to determine whether or not a comment was simply a summary or was recognising a positive component of the lesson.

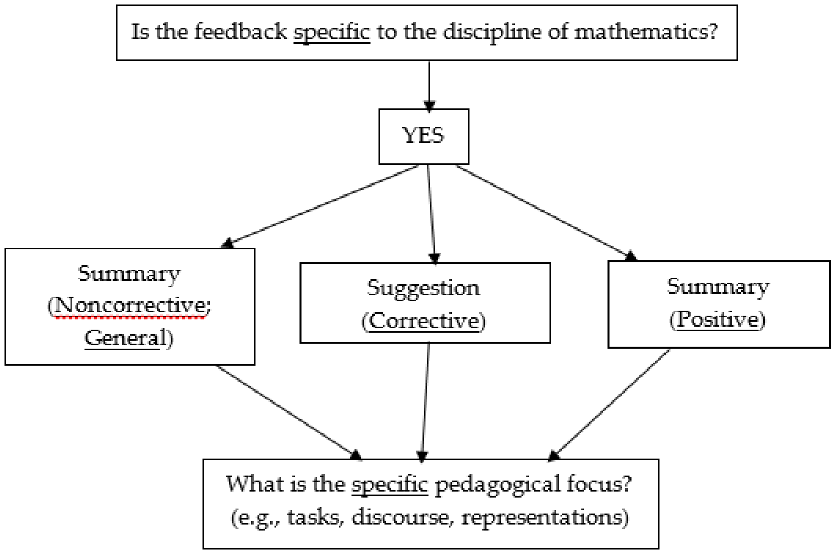

Figure 1. Coding framework informed by Van Houten (1980).

After comments were categorised as summary, strength, or suggestion, open coding (Miles & Huberman, 1994) was used to determine the pedagogical focus of each comment. Codes were continually revised throughout the process (See Appendix 1 for final coding taxonomy). All forms were re-coded with the final taxonomy by at least two team members to ensure reliability. When the two team members disagreed, the comment was brought back before the entire group to discuss until consensus was reached. Descriptive statistics were examined to summarise the type and pedagogical foci of the comments. Additionally, chi-square tests of independence and post hoc analyses were conducted to see if interactions existed by university and comment type and by pedagogical code and comment type.

Results

Findings from this study address: 1) the frequency of mathematics-specific feedback across a collection of observation forms by university, and 2) the nature of the mathematics-specific feedback given on the observation forms in terms of the types of comments (i.e., summary, strength, suggestion) and the pedagogical foci of the comments (e.g., tasks, discourse).

Frequency of Mathematics-Specific Feedback

Overall, approximately 68% of observation forms (n= 170) from elementary student teaching lessons had mathematics-specific feedback (see Table 2). A chi-square test of independence indicated that the frequency of forms with mathematics-specific feedback differed significantly by university, χ^2 (4, N = 250) = 17.83, $p < .001$. In post-hoc analyses, adjusted standardised residuals with an absolute value greater than 2 were identified to better understand the source of the significant results (Sharpe, 2015). In this case, University 3 had significantly more forms with mathematics-specific feedback than the other universities with an adjusted standardised residual of 4.1.

The number of mathematics-specific comments on the forms varied as well (see Figure 2). There were 477 total comments specific to mathematics across all forms. While 27% of the mathematics-specific forms came from University 3, they accounted for 44% of the total number of mathematics-specific comments.

Nature of Mathematics-Specific Feedback

Comments complimenting the student teacher or noting a strength accounted for 51% of the 477 total comments, while summary comments and suggestions accounted for 26% and 23%, respectively. Again, these numbers differed by university. Chi-square tests of independence showed a significant relationship existed between the universities and the type of comment, χ^2 (8, N = 477) = 89.51, $p < .001$. Specifically, adjusted residuals indicate significantly higher numbers of summary comments and lower numbers of strength comments than expected at Universities 1 and 2 (See Table 3). Conversely, Universities 4 and 5 have fewer summary comments and more strength comments (University 4) and suggestion comments (University 5) than expected.

Table 2
Number of Forms with Mathematics-Specific Feedback per University

University	Non-Mathematics Specific	Mathematics-Specific
1	21	29
	(1.7)	(-1.7)
2	16	34
	(0.0)	(0.0)
3	4	46
	(-4.1)	(4.1)
4	19	31
	(1.0)	(-1.0)
5	20	30
	(1.4)	(-1.4)

Note. χ^2 = 17.83, df = 4, $p < .001$. Adjusted standardised residuals appear in parentheses below group frequencies.

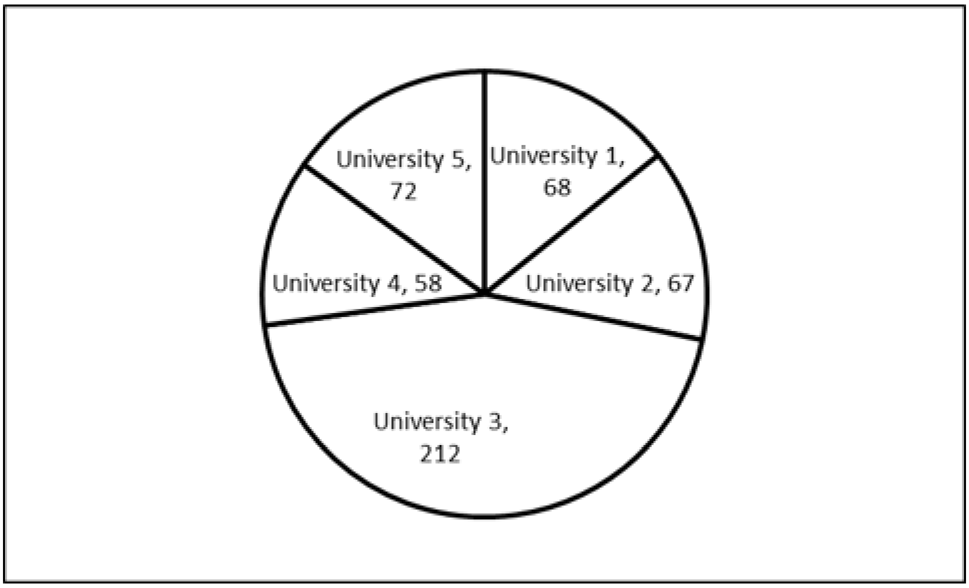

Figure 2. Number of Mathematics-Specific Comments per University

An obvious question for the research team has been the impact of the design of the form itself at each university. At Universities 1 and 2, the forms list competencies as a checklist with a space in each section labelled "Comments." The forms at Universities 4 and 5 have no checklists. Instead, there are two headings labelled "Strengths" and "Suggestions for Improvement," with space under each heading for comments. University 3 contains both a list of practices and, at the end, a page with two columns labelled "Strengths" and "Areas on which to focus."

Since approximately half of all the comments were strengths (see Table 3), the question of the value of pointing out a student teacher's strengths became a prominent discussion in our analysis of results. Are positive comments about a teacher's lesson helpful in moving a teacher forward? As indicated earlier, positive comments may serve to build confidence. In some sense, they also shape teaching practices by pointing out positive aspects of a lesson to reiterate particular actions or practices as important, consequently encouraging continued use of those practices in the future. For example, consider the following detailed comment about a strength of a student teacher's mathematics lesson.

> I'm going to draw another rectangle under his, even though he did it right, because sometimes I think it can be harder to see when they are divided differently." The preceding example showed that you are able to provide feedback to promote growth for not only one student but for the entire class. (University 3, Form 46)

In this case, the student teacher is provided with a specific statement made during the lesson and an explanation of why that statement was a productive one.

Two issues mitigated the effectiveness of some of the comments labelled as "strengths." First, some of the comments were general:

> Good use of technology and math manipulatives. (University 2, Form 11)

> Good use of manipulatives. (University 1, Form 48)

Effective feedback needs to be specific to the situation and detailed to impact student learning (Black & Wiliam, 1998; Scheeler, Ruhl, & McAfee, 2004), or in this case teacher learning. Therefore, the general comments noting strengths were not particularly helpful in moving the student teacher forward in teaching practice beyond validating the choice to use manipulatives or technology. Acknowledging "good use of manipulatives" in a lesson does not provide information about why their use was a lesson strength. Without a more detailed comment, the student teacher at best is left without a specific idea of the way his or her use of manipulatives supported students, and at worst, with the impression that any use of them will suffice, even rote use.

A second issue in the discussion of the value of "strength" comments was the effect of summary comments. Some summary comments were coded as strengths because they were in the section of the form under "strengths." Even summary comments that were not in the strengths section seemed like implied strengths because they were not followed by a suggestion. By default, then, the activity being described was accepted as "appropriate" or "good" teaching. Thus, while some comments did provide detailed and specific feedback, the general nature of many comments and the abundance of summary comments call into question the value of the strength comments in terms of their helpfulness in supporting growth in mathematics teaching practice.

Table 3
Number of Summary, Strength, and Suggestion Comments by University

University	Summary	Strength	Suggestion	TOTAL
1	28 (3.1)	26 (-2.3)	14 (-0.5)	68
2	38 (6.2)	19 (-4.0)	10 (-1.7)	67
3	51 (-0.8)	115 (1.2)	46 (-0.6)	212
4	0 (-4.8)	48 (5.1)	10 (-1.1)	58
5	6 (-3.7)	36 (-0.2)	30 (4.1)	72
TOTAL	123	244	110	477

Note. $\chi^2 = 89.51$, df = 8, $p < .001$. Adjusted standardised residuals appear in parentheses below group frequencies.

Digging deeper - what are the comments about? At the next level of analysis, comments were coded based on pedagogical focus (e.g., questioning, mathematical language/definitions). To better organise our long list of codes (see Appendix 1), we examined the content of the comments relative to an existing framework for standards-based mathematics teaching (Berry et al., 2013; Walkowiak et al., 2014). We grouped our codes into five larger pedagogical domains: tasks, discourse, representations, assessment, and coherence. Table 4 shows the number of comments by type and pedagogical domain. This revealed that of the 477 comments on the forms, 145 comments related to the tasks given to students and 156 comments related to the representations utilised in the lesson by the preservice teacher and his/her students. These two domains accounted for 63% of the comments. Only 10% of the comments were related to the domain of discourse.

A chi-square test of independence showed a significant interaction among the pedagogical domain codes by comment type (summary, strength and suggestion), χ^2 (8, N = 477) = 19.65, $p < .01$. This significance is due to a larger number of tasks comments and a fewer number of coherence comments labelled as summary (adjusted standardised residuals 3.7 and -3.2, respectively).

When analysing the data based on pedagogical domain, an issue of the quality of each comment arose. Judging the quality of comments is beyond the scope of this paper since our goal was to examine breadth; however, we want to raise some examples from our data that cannot be ignored as we begin to think about improving feedback to elementary student teachers about their mathematics lessons and about foci for future studies. As described earlier, some comments are more general and others quite detailed. We found particular comments that we felt clearly represented excellent feedback in terms of promoting students' mathematical thinking and sense-making.

Table 4
Number of Codes by Comment Type

Codes	Summary	Strength	Suggestion
Tasks	54 (3.7)	63 (-2.3)	29 (-1.1)
Discourse	13 (0.2)	23 (-0.5)	12 (-0.3)
Representations	35 (-1.2)	87 (1.4)	34 (-0.5)
Assessment	10 (0.0)	20 (0.0)	9 (0.0)
Coherence	11 (-3.2)	51 (1.4)	26 (1.6)

Note. χ^2 = 19.65, df = 8, $p < .01$. Adjusted standardised residuals appear in parentheses below group frequencies.

> When working with one group you asked them if 12 was a reasonable answer for .3 x40--this would be a great question to ask the class, too! Have them think about the reasonableness of their answers. Maybe students could pair-share what 3.4 x 10, 100, and 1000 equals just to get them engaged to start the lesson--you could also allow students to discuss and come to the conclusion about multiplying by .1, .01, and .001—this would be a great place to add in some challenge questions such as "what would happen if..." (University 3, Form 12)

> Have a variety of students offer ways to solve problems- ask "Did anyone solve it a different way" and have them share so other students are exposed to different ways of thinking and all students are valued for the way they think. (University 5, Form 20)

In other instances, the comments seemed to be the antithesis of the reform-based teaching we espouse in our methods classes, comments we informally dubbed as "cringe-worthy." Consider the following comments in which the emphasis is on hard and fast rules rather than sense-making.

> Great job emphasising key math vocab (altogether, in all means add). (University 3, Form 41)

> Good work reiterating that the entry into the calculator of numbers is top to bottom. (University 1, Form 17)

Between the excellent and cringe-worthy remarks are a whole host of comments that are not able to be clearly classified without substantial thought given to what counts as "good" or "helpful" feedback in our discipline in general and with respect to the development of beginning teachers. We hope to take on these issues in future work.

Discussion

Since student teaching is typically perceived by preservice teachers as the most influential component of their preparation program (Levine, 2006), feedback on observation forms from university supervisors is critically important. Of the 250 forms analysed in this study, 32% did not contain mathematics-specific feedback, and 17% contained only summary math-specific comments. Perhaps summary comments are intended and perceived as strength comments if no suggestions are made about that particular practice or characteristic. However, indicating strengths explicitly in comments would be most effective in guaranteeing that the student teacher continues that practice. For example, instead of saying "used virtual manipulatives to demonstrate fraction addition," the university supervisor could indicate that the use of virtual manipulatives was effective and why it was effective, resulting in *positive* and *specific* feedback (Van Houten, 1980) such that the candidate knows which behaviour to continue.

Approximately 62% of the forms had only summary and/or strength comments, but no suggestions. As in past research (Borko & Mayfield, 1995), it seems that the supervisors may focus on building preservice teachers' confidence, as the percentage of strength comments (51%) was more than double the portion of suggestion comments (23%). While this is certainly understandable, an abundance of praise may give preservice teachers an inflated perception of their current level of skills. Further, it seems that suggestions (that are both *specific* and *corrective*) like the aforementioned comment at University 3 about multiplication patterns (i.e., "*you could also allow students to discuss and come to the conclusion about multiplying by .1, .01, and .001 – this would be a great place to add in some challenge questions such as "what would happen if..."*") would be the most helpful for promoting change, yet these types of comments were the least acknowledged on the observation forms.

In addition to the variation in the types of comments (i.e., summary, strength, suggestion), there was also variation in the pedagogical foci of the comments. There were many comments (63% of all comments) about the tasks given to students and the types of representations and modelling used during the lesson; this is predictable since what the students are doing (tasks) and how the mathematics is represented or modelled (representations) are key components of a mathematics lesson. Surprisingly, discourse accounted for only 10% of the total comments, although this is deemed an essential part of standards-based mathematics instruction as outlined by NCTM (2000; 2014) and the Common Core State Standards for Mathematics (NGA Center &

CCSSO, 2010). Perhaps, facilitating classroom discourse becomes less of a focus for the university supervisor due to the novice skill set of the preservice teacher.

Regardless of the pedagogical focus of the comments, the level of *specificity* of the comments varied. More *specific* comments would be most helpful in moving the student teacher along in his or her development (Scheeler, Ruhl, & McAfee, 2004; Van Houten, 1980), if those comments are aligned with standards-based mathematics teaching practices. Despite strategic efforts at all universities to prepare teachers in methods courses for standards-based pedagogy, there were still comments from university supervisors that are in opposition to these efforts (e.g., praising the use of key words as an approach to solve story problems).

The discrepancies among the five universities in the number and types of comments given are worth noting. University 3 had significantly more forms with mathematics-specific feedback than the other universities and more comments on those forms. Universities 1 and 2 were more likely to have summary comments while Universities 4 and 5 had fewer summary and more strength or suggestion comments. We discuss three factors which possibly explain this variation across universities and the implications for practice and further study.

First, the connectedness of the supervisors to the university programs could explain some of the variation in comments. For example, at University 3, the elementary teacher preparation program is relatively small (approximately 60 graduates per year). The university supervisors regularly attend program meetings and consult with methods instructors. They have even co-conducted observations of mathematics lessons with methods instructors. This could explain the higher number of mathematics-specific comments and the higher percentage of forms with suggestions. In contrast, Universities 1 and 2 are both much larger programs with university supervisors who typically do not teach mathematics methods courses and in many cases are part-time employees who only supervise student teachers.

Secondly, and tightly related to the first factor, the professional development and guidance offered to university supervisors varies across the universities. For example, at Universities 1, 2, and 5, supervisors attend a half-day training which is mainly focused on procedures and how to fill out paperwork. At University 3, supervisors do not attend a formal training, but they meet regularly (two or three times per semester) in groups, and as mentioned previously, they attend program meetings with methods instructors during which discussions take place about student teachers' field experiences. At University 4, numerous part-time supervisors are hired each semester to supervise elementary school teachers. A two-hour meeting is held prior to the semester to cover student teaching logistics. Those supervisors seeking more support may meet individually with the full-time supervisors who are elementary education generalists.

Putting practices in place to foster connectedness among university supervisors and methods instructors could be a powerful first step in coming to common understandings of what constitutes a good mathematics lesson. Future studies should examine the nature and extent of professional development for university supervisors (who may not be mathematics educators) and explore possible options to support supervisors' knowledge of mathematics pedagogies.

Thirdly, the observation forms vary across the universities and likely influence the nature of feedback given. For example, the form at University 1 was recently revised in light of state mandates that preservice teachers exhibit particular types of evidence of proficiency. When the form was altered to be more structured, there was less mathematics-specific feedback. University 2 recently made similar changes. This evidence points to the need to carefully consider the structure, prompts, and content of observation forms used to provide feedback to student teachers. It seems further investigation is needed to examine the form and its relationship to the types of comments provided. Hertzog and O'Rode (2011) demonstrated success in focusing university supervisors' observation notes and feedback more on mathematics teaching with the use of a mathematics field experience reflection guide. Yet many forms serve purposes beyond providing formative assessment to the student teacher, such as documenting teacher evidences of proficiency for program summative assessments (Cheng & Tang, 2008); therefore, it is unclear how the use of a discipline-specific form would fit into these purposes.

Based upon our findings, the type, pedagogical focus, and level of specificity of feedback are variable on observation forms provided to student teachers from university supervisors. In this study, it seems the most helpful feedback was the most *specific* feedback (usually in the form of strengths or suggestions) that encouraged or provided ideas for pedagogy associated with standards-based mathematics instruction. However, we suggest that more discussion is needed about the nature of "good" or "helpful" feedback for both student teachers. Simply clarifying the expectations for the types and pedagogical focus of domain-specific comments beyond the requirements of "completing the paperwork" could be a powerful tool in increasing the quality of feedback given. It seems it would be helpful to include explicit attention to a feedback framework (e.g., Van Houten, 1980) during training of university supervisors in order to provide clarity in expectations and in the power of the nature of feedback in preservice teacher development and change (Scheeler, Ruhl, & McAfee, 2004)

In this study, 68% of the forms had mathematics-specific feedback; therefore, almost a full third of the observed lessons did not include mathematics-specific feedback from the university supervisor. We do not believe this is intentional on the part of the university supervisor. Rather, many elementary student teaching supervisors are generalists. Regardless, due to the critical role of the university supervisor in the development of the preservice teacher (Fletcher, 2000; Jyrhama, 2001), we need to give careful attention to the role of professional development, the observation form, and university program-supervisor relationship in the types of feedback provided not only in mathematics, but in all subject matter disciplines. This study provides a broad foundation for future work to examine the impact of varying types of feedback on subsequent teaching practices of both preservice and beginning teachers.

Limitations

While there is precedent for doing this work based on written feedback (Burbank, Bates, & Gupta, 2016, e.g.), we would be remiss not to acknowledge two limitations: (1) looking at a single piece of data like the written observation form without considering the contextual factors and communications surrounding each one; and (2) examining forms at universities within the same state of one country.

To better understand the frequency and nature of mathematics-specific feedback by university supervisors to elementary student teachers, we gathered mathematics lesson observation feedback forms from five large universities. Certainly much of the feedback given to preservice teachers occurs informally or orally during observation post-conferences, but we chose to examine the actual written observation forms for two reasons. First, forms create the focus for guiding post-lesson conferences and are often a major source for determining student teaching grades (Borko & Mayfield, 1995). In short, what is written is what is ultimately privileged in terms of assessment of performance. Most studies about university supervisors' communications during student teaching are case studies (e.g., Borko & Mayfield, 1995; Feiman-Nemser & Buchmann, 1987; Fernandez & Erbilgin, 2009). Secondly, using only observation forms provided a means to understand the breadth of the problem; that is, our results show what is being promoted as "good mathematics teaching" on a larger scale. Therefore, we believe the results contribute to the conversation about feedback and are informative to the community as mathematics educators consider the factors affecting feedback to student teachers at their own universities.

We limited our analysis to five universities who responded to an invitation to participate. All universities were located in the same state in the United States. We recognise the limitation of our sample; however, the diversity and breadth of our data, even within a region of the U.S., provides results that are worthwhile for mathematics teacher educators around the world in light of their own teacher preparation programs and the feedback given to their preservice teachers.

Summary

We examined the written feedback from university supervisors on 250 observation forms from elementary student teachers' mathematics lessons. Approximately 68% of the forms had mathematics-specific feedback; therefore, almost a full third of the observed lessons did not include mathematics-specific feedback from the university supervisor. Of the mathematics-specific comments, many were general or were not in line with visions of effective mathematics instruction promoted in methods courses. We do not believe this is intentional on the part of the university supervisor. Rather, many elementary student teaching supervisors are generalists. Regardless, due to the critical role of the university supervisor in the development of the preservice teacher (Fletcher, 2000; Jyrhama, 2001), we need to give careful attention to the quality of feedback they provide to student teachers in their mathematics lessons. We identified factors for further study that contributed to differences in feedback from the different universities including the role of professional development, the observation form, and university program-supervisor relationship. These factors have implications not only in mathematics, but in all subject matter disciplines. This study provides a broad foundation for future work to examine the impact of varying types of feedback on subsequent teaching practices of both preservice and beginning teachers.

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Appendix

Final Coding Taxonomy

Tasks:

Code	Example
Connections–interdisciplinary	Incorporates writing with math concepts and terms being taught
Connections–prior knowledge	Good job reviewing what "decimal place" means.
Connections-real world	Great job with opening the lesson and having the students give real-life examples of where they see angles.
Level of challenge	A last question was open-ended, “Show me all of the ways to make fifty cents.” [Teacher] tells students that there are SO many ways that she doesn’t think she can think of them all. This is a great way to observe students going above and beyond.
Task–structure and implementation	Limit amount of animal suggestions so the voting isn't so spread and really show the majority's vote.
Task-descriptive	Each child is given a dry erase board to practice drawing parallel and perpendicular lines. Students use whiteboard and geo boards to show parallel and perpendicular lines.
Value/reasons for doing mathematics	It would be helpful to make the value of knowing about different types of shapes more explicit so that students are imprinted with a stronger takeaway message for why the lesson's key concepts are valuable.

Discourse:

Code	Example
Discourse	Continue to give students opportunities to explain math process to show understanding.
Listening to student ideas	Enthusiastic as she responds to students sharing strategies to solve math problems with missing addends.
Questioning	Good questioning skills for student understanding – “How do you know?”

Representations:

Code	Example
Representations	Cubes used when working out problems, so students understand the process of how to solve these problems but also to give them a visual of what they are actually doing.
Teacher Modelling	She did a fraction demonstration using jelly beans to practice getting the numerator and denominator of fractions and relating that to the whole set.

Assessment:

Code	Example
Feedback to individual students	She was very affirming with the students when they provided correct answers and patiently guided their thinking when an erroneous response was offered (e.g., "Let's look at that again. Is 120 closer to 100 or…")
Assessment	Students were successful in classifying by numbers as evidenced on the worksheets

Coherence:

Code	Example
Content knowledge	The intern demonstrated good knowledge of patterns using geometric shapes.
Structure of lesson	Math centres are so well received by the kids, even in 4th grade, because they get a chance to explore a concept in different ways.
Engagement	Used math game to keep students' attention
Mathematical language/definitions	When verbalising larger numbers, use the word "and" to indicate a decimal point.