Coaching Pre-service Teachers for Teaching Mathematics: The Views of Students

Robin Averill
Victoria University of Wellington
<robin.averill@vuw.ac.nz>

Michael Drake
Victoria University of Wellington
<michael.drake@vuw.ac.nz>

Roger Harvey
Victoria University of Wellington
<roger.harvey@vuw.ac.nz>

Using rehearsals and in-the-moment coaching is being explored in mathematics teacher education courses at two New Zealand universities. This paper describes the perceptions of students, gathered using questionnaires, from two classes at our institution using different approaches for incorporating rehearsals and coaching. Students believed rehearsals and coaching enabled their development as teachers and mathematical understanding by providing relevant practice, discussions, and feedback. Implications include that realistic teaching opportunities with empowering coaching interruptions are useful components of teacher education.

As in-the-moment coaching within our mathematics teacher education courses was new to us, we explored literature on coaching and mentoring to inform our practice. Themes such as emphasis on reciprocity, relationships, reflection-on-reality, and questioning are frequently discussed as important components of effective coaching (e.g., Bearwald, 2011; Knight, 2011; Robertson, 2008). We found the concepts of 'cognitive coaching' and 'cognitive apprenticeship' (Rowley, 2006) particularly pertinent to this project work. They require trust and rapport between coaches and those being coached; cognitive coaching promoting self-reflection and self-directed growth, and cognitive apprenticeship being designed to reveal and develop the "covert, cognitive aspects of practice" (p. 120).

Our implementation of Instructional Activities (IAs) and in-class coaching was informed by the work of Kazemi, Franke, and Lampert (2009) and Lampert, Beasley, Ghousseini, Kazemi, and Franke (2010) conducted with elementary student teachers in American Universities. We focussed on developing teaching practices suitable for eliciting mathematical thinking and managing mathematical discussions (Stein, Engle, Smith, & Hughes, 2008). In adapting the work to our New Zealand setting, we had to balance the requirements of introducing new approaches into full courses taught in tight timeframes.

Incorporating rehearsals and in-the-moment coaching in our teacher education courses has been a collaborative process using informal and formal trialling, personal and group reflection, and discussion within our team and with our Massey University colleagues. To further inform our use of rehearsals and in-the-moment coaching, we wanted also to collect students' feedback on their experiences of rehearsals, in-the-moment coaching, and reflective discussions. This paper presents a study used in our institution to do so.

The Study

Our approaches were consistent with three methods of self-study: teacher educators "researching their own practices and regularly coming together to share" (Nicol, Novakowski, Ghaleb, and Beairsto, (2010, p. 238); "coming together to understand a particular event, concept or idea, moving into [our] respective classrooms to explore that idea and then returning to the group to share" (p. 238); and "working together in the same classroom, collaborating on teaching and/or researching practice" (p. 238).

In V. Steinle, L. Ball & C. Bardini (Eds.), Mathematics education: Yesterday, today and tomorrow (Proceedings of the 36th annual conference of the Mathematics Education Research Group of Australasia). Melbourne, VIC: MERGA.

Method

The study participants included two initial teacher education classes and their lecturers and one further lecturer involved in the wider research project. Rehearsals and coaching were used differently with the two classes. As this study was part of a continuing developmental process within the larger project, both approaches involved all lecturers at our institution in some way and reflective discussion on Approach One and discussions with our colleagues at the partner institution regarding rehearsal and coaching practices used by them informed Approach Two. In-the-moment coaching was managed in both approaches by one lecturer pausing the student teacher's delivery a number of times through the rehearsal to question, discuss, and at times, to make suggestions regarding delivery in relation to eliciting mathematical thinking and managing mathematical discussions. Contributions to the paused interlude discussions were made by the lecturer, the presenting student teacher, and their peers. Questionnaires comprising Likert scales to determine the strength of student views (10 = extremely valuable, 0 = not at all valuable), one 'Yes/No' question regarding whether rehearsals and coaching should be retained in our courses, and open questions to collect detail and variation across respondents were used to collect student perceptions of rehearsals and coaching. As this was a pilot study to inform further use of rehearsals and coaching in our courses and the wider project, no forms of triangulation were used. Data from each approach were analysed separately. Themes across the courses were then discussed by the three researchers at our institution.

Approach One: Class One included 27 students, 20 female and seven male. The mathematics education course was their third within a programme that results in graduates being qualified to teach in primary and secondary schools. All of the students were learning to teach primary school level mathematics and two were also learning to teach secondary school level mathematics. IAs and in-the-moment coaching were modelled by the lecturer and another researcher. Groups of four students then took turns to collaboratively design and plan to use a similar IA within a course teaching session. To gain feedback on the mathematical focus of the activity and their planning, each group met with the lecturer for 30 to 45 minutes. The lecturer then also suggested how they could use a teacher move (Kazemi, et al., 2009) such as roving and listening in on student conversations towards facilitating whole class mathematical discussion (Stein et al., 2008). Rehearsals tended to last 30 to 40 minutes, each person being responsible for delivering one section. Initially coordinated by the lecturer and later with greater class ownership, debriefs involving reflection and oral feedback followed. The debriefs focused on discussing issues requiring substantial discussion, the clarity of the key mathematical idea for learners, and the effectiveness of the teacher moves used. Class One completed their questionnaire during the last session of the course.

Approach Two: Class Two comprised 17 secondary school mathematics student teachers, eight female and nine male. Students were introduced to IAs and coaching by the lecturer modelling a choral count. Students were encouraged to use the choral count and quick images IAs on their next practicum. The class were then given online access to five IAs, the Stein et al. (2008) article, and a range of support material. Students were asked to read the material and each to prepare a rehearsal that they would run individually using one of the IAs provided or one of their own choosing or design. No planning meetings were held prior to these students' rehearsals, each of which took roughly 15 minutes. The questionnaire for Approach Two and its use varied slightly from that used with Approach One students due to the differences between the groups in the way the rehearsals and coaching were used. Class Two completed their questionnaires after each group of three or

four back-to-back rehearsal and coaching sessions. Informal feedback from both classes indicated that they had no prior experience of in-the-moment coaching in their teacher education.

Results

In this section we address themes prevalent across the data from both student groups and the differences found between them. We discuss the quantitative results first to indicate the strength of students' views about incorporation of rehearsals and coaching in their classes. Student teachers' perceptions of their learning within the rehearsal and coaching sessions are presented in relation to their development as a teacher and their teaching skills, pedagogical content knowledge, and knowledge of mathematics. Finally, we share the results relating to students' perceptions of how the rehearsals and coaching enabled their learning and their feedback for future use of rehearsals.

Students were unanimously in favour of rehearsals and coaching being retained in future teacher education courses. The Likert scale questions were used to examine students' perceptions regarding the value of the rehearsals and coaching, subsequent reflective discussion, planning for the rehearsal, and the in-the-moment coaching for their development as a teacher. Wording of the Likert scale questions varied slightly between the two questionnaires. However, mean values of 7 or above were obtained for every question across all students in each class, indicating that all aspects of the rehearsal and coaching process were valued by students for their contributions to their development as teachers.

Student teachers reported the rehearsals and coaching facilitated their development as a teacher and their teaching skills (e.g., learning about "keeping people engaged and on task", and that "clarity" and "order of instructions" are "important"). Pedagogical content knowledge students reported developing included "questioning strategies", "revoicing", "writing and saying what you want students to take in", "making learning explicit", "seeing different ways of using the same activity", how the teacher can take "a less dominant role", and "understanding the importance of discussion amongst learners and how to encourage this". They stated the rehearsals and reflective discussions enhanced their confidence in their teaching, "knowing I am on the right track". Student teachers reported the rehearsals and coaching increased their mathematical knowledge; examples included "the probability of two people in the room having the same birthday" and "mathematical correlation".

Some differences were apparent in the feedback gained from the two groups. Approach One student comments indicated they valued the iterative nature of the process and the collaborative planning with other students and the lecturer. Perhaps not surprising given that the Approach Two students had undertaken higher levels of personal mathematical study than those in Approach One, Approach One student comments focussed more on the usefulness of the rehearsals for their mathematical content development than those of Approach Two students. They stated that the rehearsals enabled them to think through the detail of the mathematical ideas to be presented and the progression of how they would teach these. Approach Two student comments had a stronger focus than their Approach One counterparts on the pedagogy of effective mathematics teaching and the teacher moves needed. In general Approach One students (who had experienced fewer longer rehearsals than those in Approach Two) wanted less time devoted in class to rehearsals and Approach Two students (who had participated in more shorter rehearsals) wanted more.

A range of reasons were given to support students' strong support for the continued use of rehearsals and coaching. These related to their enabling of relevant and realistic practice of teaching, immediate feedback, and discussions about specifics of teaching. Students appreciated being able to try suggestions straightaway enabled by the in-the-moment coaching: [The most useful thing about the coaching was] "having the interruptions—[because I] can see what the impact of making the change is", "being able to try the advice straightaway". Reported as most useful for their learning was "seeing it done and doing it after reading about it", gaining "ideas for my own teaching" from watching others, "getting more teaching experience in", and that it was "active and stimulating", "valuable", and "fun". Recommendations for future use included optimising the time used for the rehearsals, "picking specific things to focus on", and "making rehearsal the session starter.

Discussion, Conclusions, and Implications

That students were uniformly in favour of continued use of rehearsals and coaching is a remarkable finding, as seldom have we experienced such unanimity of views in informal or formal feedback within our teacher education experience. The findings affirm our choice of coaching styles and provide insights to assist in developing our practice. Students strongly believed that rehearsals and in-the-moment coaching were useful for their learning and could identify specific learning that had occurred for them within three broad areas: teacher development/skills, pedagogical content knowledge, and mathematics knowledge. Students were also able to explain aspects of the rehearsals and coaching process that they believed enabled this learning: relevant and realistic teaching practice, feedback on their teaching which they could try immediately, and the discussions that arose about their teaching with their peers and lecturer. As a result of this study we believe that the use of rehearsals and in-the moment coaching has considerable potential for making mathematics education coursework authentic and engaging for student teachers. We are continuing to refine the Instructional Activities and our practices to make the most of this approach in our work in pre-service primary and secondary teacher education.

References

Bearwald, R. R. (2011). It's about the questions. *Educational Leadership, 69*(2), 74-77.

Kazemi, E., Franke, M., & Lampert, M. (2009). Developing pedagogies in teacher education to support novice teachers' ability to enact ambitious instruction. In R. Hunter, B. Bicknell, & T. Burgess (Eds.), *Crossing divides: Proceedings of the 32nd annual conference of the Mathematics Education Research Group of Australasia (Vol. 1)* pp. 11-29. Adelaide, SA: MERGA.

Knight, J. (2011). What good coaches do. *Educational Leadership, 69*(2), 18-22.

Lampert, M., Beasley, H., Ghousseini, H., Kazemi, E., & Franke, M. (2010). Using designed instructional activities to enable novices to manage ambitious mathematics teaching. In M. K. Stein & L. Kucan (Eds.), *Instructional explanations in the disciplines* (pp. 129-141). New York: Springer.

Nicol, C., Novakowski, J., Ghaleb, F., & Beairsto, S. (2010). Interweaving pedagogies of care and Inquiry: Tensions, dilemmas and possibilities. *Studying Teacher Education, 6*(3), 235-244.

Robertson, J. (2008). *Coaching educational leadership: Building leadership capacity through partnership*. London: Sage.

Rowley, J. B. (2006). *Becoming a high performance mentor: A guide to reflection and action.* Thousand Oaks, CA: Corwin Press.

Stein, M. K., Engle, R. A., Smith, M. S., & Hughes, E. K. (2008). Orchestrating productive mathematical discussions: Five practices for helping teachers move beyond show and tell. *Mathematical Thinking and learning, 10*(4), 313-340.