Pre-Service Teachers' and Tutors' Perceptions about the Value of Talk Moves

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Talk moves simulations were used in tutorials for a mathematics education unit. Pre-service teachers (PSTs) and tutors were surveyed about their perceptions of the purposes, benefits, and drawbacks of the simulations. There was strong support from both groups for the benefits of talk moves in developing PSTs' ability to manage discussions, ask good questions, and understand students' thinking. Tutors were more inclined than PSTs to note improvements to PSTs' mathematical knowledge. Challenges to implementation were authentic engagement in the simulations, PSTs' lack of experience with children, the cognitive load associated with managing discussions, and limited mathematical knowledge.

Providers of Initial Teacher Education (ITE) in Australia are under continuous scrutiny (Louden, 2008), exemplified by recent public demands that the institutions prepare "classroom ready" graduates (Teacher Education Ministerial Advisory Group, 2014). This challenge is particularly difficult in primary mathematics education, as a significant proportion of students enter courses with modest levels of achievement, which in turn impacts their attitudes and beliefs about mathematics and their personal confidence for teaching the discipline (Hine, 2015; White, Way, Perry, & Southwell, 2006). It is also recognised that subject knowledge alone is insufficient for classroom readiness. The pedagogical content knowledge required for teaching mathematics is complex and connected (Beswick & Goos, 2012; Depaepe, Verschaffel, & Kelchtermans, 2013; Hurrell, 2013). Furthermore, graduate teachers of mathematics face a plethora of demands including participation in communities of practice (Alvalos, 2011), demonstration of adaptive expertise (Anthony, Hunter, & Hunter, 2015), and iterative inquiry into their own praxis (Kazemi & Hubbard, 2008). Therefore, educators in ITE need to provide learning opportunities for their students (i.e., PSTs) that meet these multiple demands. In this paper, I report on PSTs' and tutors' perceptions about the value of talk moves simulations within tutorials of an ITE mathematics education unit.

Background Literature

In his recent meta-analysis of research into discourse in mathematics education, Ryve (2011) stated that discourse is underpinned by three principles: (a) Language constitutes and builds ideas, (b) Discourses construct versions of reality reflective of social objectives, and (c) Meaning is co-constructed with others though talk. Consistent with these principles, participation in discussions that promote mathematical understanding involves students both explaining their ideas and actively engaging with the ideas of others. Explanation and justification of their own ideas helps students to reflect on, monitor, and refine their ideas while analysis of others' ideas prompts students to broaden their ideas and develop their identities as participants in a mathematical community (Hiebert & Grouws, 2007). Productive talk is essential to providing effective opportunities to learn mathematics (Walshaw & Anthony, 2008).

The management of classroom discourse creates pedagogical tensions, mostly between the achievement of social outcomes and mathematical outcomes (Sherin, 2002). Two

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approaches used by researchers to support teachers are to establish rules for participation and to provide tools for orchestrating discussion (Franke et al., 2015). Talk moves (Chapin, O'Connor, & Anderson, 2009; Michaels & O'Connor, 2013) are a set of actions that a teacher may use in managing discussion, though the authors also address norms for participation in their later work. The "moves" have both function and form, in that they are observable actions with goals for creating "academically productive talk". In Table 1, I summarise the five original talk moves (Chapin et al., 2009) that were used in this study and the corresponding goal for using each move.

Table 1
Five Original Talk Moves (Chapin et al., 2009)

Talk Move	Example	Goal
Revoicing	"You said you did/thought X. Is that right?"	A student clarifies her/his own thinking
Repeating	"Can you repeat what M said?"	A student expresses her/his interpretation of another student's thinking
Eliciting	"Do you agree or disagree with what M said? Why?"	A student analyses the validity of another student's thinking
Adding One	"Would you like to add on to what M said?"	A student expands on the thinking of another student
Wait Time	Teachers waits for an extended period before expecting a response from students	Students get space to reflect on their own thinking and that of other students

Anthony et al. (2015) used talk moves successfully to develop the adaptive expertise of PSTs in New Zealand, while Michaels and O'Connor (2013) used their framework in the professional development of teachers in mathematics and science. In this small-scale study based in Australia, PSTs' and tutors' perspectives about the value of talk moves simulations within tutorials were examined.

Methodology

The opportunity to use talk moves arose within an undergraduate mathematics education unit taught to third-year primary Bachelor of Education PSTs. The 195 PSTs who enrolled in the unit attended a large city campus in Melbourne, Australia. Prior to the unit, the PSTs studied three units in mathematics education, two designed to develop their personal knowledge of mathematics, and the other aimed at developing their capacity and confidence for teaching mathematics. Hence, the PSTs in this research were studying their final unit in a suite of four units. This unit focused on the learning and teaching of challenging concepts such as rational number, decimals, proportional reasoning, probability, and algebraic thinking at the primary school level. While in their second semester of their third year, these PSTs had limited experience on placement in schools, having spent 10 days as "observer/helpers" as first-year students, and only 15 days on placement in their second year.

Talk moves formed an integral part of nine concept-based tutorials, out of 12 tutorials for the whole unit. For approximately 45 minutes, the PSTs attempted two different simulations in each tutorial. One PST acted as the teacher while four other PSTs role-played the part of primary-aged children. In the first three simulations, a fifth student monitored the teacher PST's frequency of using different talk moves using a checklist. An indicative example of a simulation task based on proportional reasoning is given in Figure 1. In a simulation, the teacher PST set up any materials s/he needed while the student PSTs read and rehearsed their strategies. A role-play then occurred in which the teacher PST used talk moves to manage the discourse, eliciting and responding to the strategies of the students. The role of the student PSTs was to stay true to the way of thinking of a student who used the strategy that each participant had received on an allocated card. Tutors used variable ways to support the simulations such as modelling themselves "fish bowling", an interesting scenario within one group, and inviting PSTs to record their reflections of the activity.

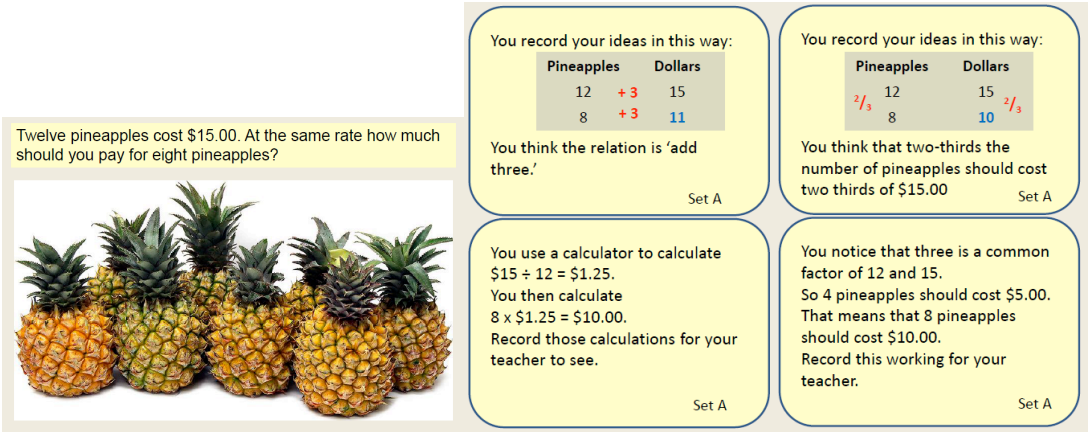

Figure 1. Example of talk moves simulation task.

The research question for this study was "What are PSTs' and tutors' perceptions about the purposes, benefits, and negatives of using talk moves as a tutorial activity?" At the end of the final lecture, all PSTs in attendance were invited to complete a survey. Participation was voluntary and anonymous. The survey consisted of four statements with five-point Likert-scale response options (strongly agree, agree, uncertain, disagree, and strongly disagree). The four statements were:

1. Talk moves helped me to engage students in productive mathematical discussion.
2. Talk moves made me aware of the mathematical thinking that primary-aged students might use.
3. Talk moves improved my questioning skills.
4. Talk moves improved my own mathematical understanding.

In addition, PSTs were provided an open prompt to which to respond: "Use this space to make any comment you want about the value of talk moves to your development as a teacher of mathematics."

Six tutors, five of whom were sessional academics, taught in the unit. Three of these tutors were in their first year of university teaching, two of them had three or four years of experience while the Lecturer in Charge was a very experienced academic. Tutors were

asked to complete a survey at the end of semester consisting of open responses to four questions.

1. What is the purpose of using talk moves as an instructional tool with PSTs?
2. What do you consider to be the main benefits and negatives of using talk moves?
3. How do you anticipate that PSTs will evaluate the usefulness of talk moves?
4. If you were to modify talk moves, as it was used this semester, what would you change and why?

The rationale for Question 3 was to investigate if the tutors' expectations of the PSTs' perceptions of talk moves were consistent with what PSTs actually reported.

Results

Seventy-five of the 195 (38%) PSTs who completed the unit provided survey responses. High proportions of respondents agreed or strongly agreed that the use of talk moves in tutorials had helped them engage their students in discussion (92%), made them more aware of students' thinking (88%), improved their questioning skills (87%), and improved their own mathematical understanding (72%). Though the proportions in the complementary categories were small (8%, 12%, 13%, and 28%, respectively for the four statements), a lower proportion of the participants agreed that talk moves had improved their personal mathematical knowledge.

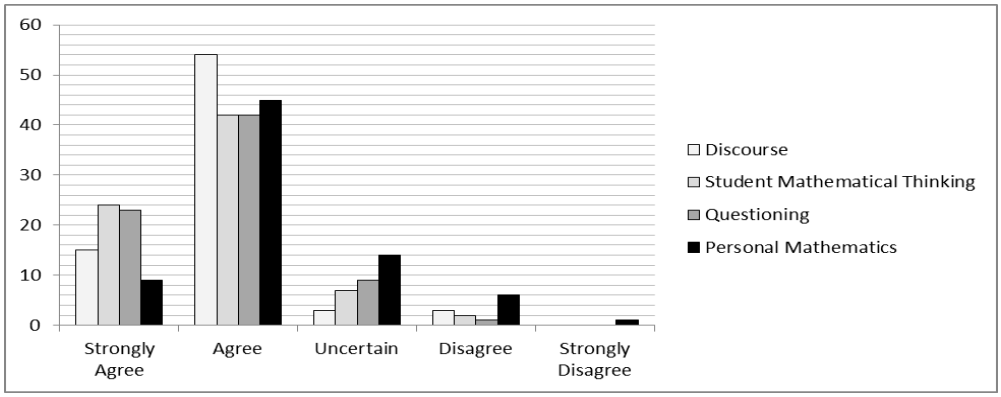

Figure 2. PSTs' responses to Likert-scale questions.

Fifty-one of the 75 respondents (68%) provided a comment in the open section of the survey. The comments aligned with two categories: references to the development of personal abilities and advice about talk moves as an activity within tutorials. Table 1 contains the frequency of comment types by these categories. The tenor of responses to the Likert-scale questions was also reflected in open comments about the development of personal abilities. Understanding children's thinking, developing questioning and other scaffolding strategies, orchestrating discussion, working with small groups, and modelling for students were reported, as highlighted by the below sample responses.

> Talk moves gave me great insights into students' possible thinking and how to work at possible misconceptions and getting children to help each other.

> Talk moves allowed me to use effective questioning to gain insight into student thinking.

> Helpful in making mathematics lessons more of a social experience, and creating authentic conversation that helps build and develop ideas.

Few PSTs reported development of their personal knowledge of mathematics, or of their ability to support their students with the mathematical processes (proficiencies).

The "advice" category highlighted some of the issues related to enacting talk moves in the artificial setting of a university tutorial. PSTs commented that the value of a simulation was dependent on the authentic engagement of their peers, particularly in acting out the roles of primary-aged children, and that this role-playing was difficult, given their lack of experience with children on school placements. These ideas are discussed in the responses provided by the PSTs:

> Wonderful to be able to practise in tutorials each week. Of course it is dependent on students engaging with the activities appropriately – In my case it went really well!
>
> It is hard to practice [*sic*] talk moves when there is [*sic*] no students, rather peers.
>
> The talk moves activities only worked well when peers took the tasks seriously. Often there were times when others couldn't be bothered and so rather than actually practising the talk moves they would just get each student to read out what their 'student' did.

Some PSTs felt the need for tutor modelling on enacting talk moves early in the first tutorials, and they provided suggestions regarding some simulation tasks and spending less time overall on the activity.

Table 2
PSTs' Open Comments

Personal Abilities	Frequency	Advice	Frequency
Children's thinking	13	Challenging at first	3
Questioning/Scaffolding	12	Dependent on positive engagement by peers	3
Importance for classroom readiness	8	Difficult without "real" students	3
Discussion	4	Some simulations better than others	3
Personal learning of mathematics	3	Too much time/Too many tutorials	2
Modelling	4	Need for tutor modelling first	3
Small group	3	Needs to be applied in practice	1
Mathematical processes	1		
Total	40	Total	18

All six tutors who taught the unit agreed to complete the survey. Tutors' beliefs about the purpose of using talk moves generally matched the improvements to personal abilities reported by the students. Purposes discussed by the tutors were the development of understanding of children's thinking (n = 6), and classroom discourse (n = 5), and PSTs' mathematical knowledge (n = 2). A sample of responses is provided next.

> It gives them a framework to explore concepts and develops their own understanding.

> The scenarios given to PSTs, with pre-empted misconceptions and achievements, are highly beneficial as PSTs at this stage of their degree often lack the classroom experience to consider the wide variances that might occur.

Purposes discussed by only one of the tutors each were questioning, improving achievement, facilitating co-operative learning, representation of concepts, and making learning "visible". Tutors were also asked about the positives and negatives of using talk moves in tutorials (see Table 3). The development of PSTs' personal mathematical knowledge was given as a strong positive by four tutors, although only two had listed it as a purpose. The positive impact on students' ability to understand students' thinking, to question, and to effectively orchestrate classroom discourse was aligned with the benefits also reported by the PSTs. Tutors' beliefs about the negative aspects of the simulation did support those of a few students about the need for authentic and equitable participation by PSTs in role-playing within the simulation. One tutor reported occasions when the tasks failed:

> Really only with PSTs who did not embrace it fully. Maybe were embarrassed? But some PSTs found it difficult to engage in the student's method/thinking. May not have been used as effectively as it could have.

However, tutors noted other issues related to implementation such as the challenge talk moves presented to PSTs' cognitive load, understanding of given strategies, and time to explore the simulations adequately. One tutor questioned her own preparedness to model talk moves and another suggested other possible frameworks for classroom interaction.

Table 3
Tutors' Beliefs about the Positives and Negatives of Using Talk Moves

Positives	Frequency	Negatives	Frequency
PSTs' mathematical knowledge	4	Difficulties assuming roles (authenticity)	4
Understanding students' ways of thinking	3	Cognitive load of teaching situation	2
Developing questioning	2	PSTs not understanding strategies	1
Developing discourse	2	Equitable opportunities to play different roles	1
Encouraging active participation in tutorials	2	Inadequate time	1
Illustrating specific mathematical concept	2	Not all possible student responses covered	1
Simulating real classroom	1	Ineffective tutor introduction	1
		Other discourse frameworks exist	1
Total	16	Total	12

Tutors were asked to anticipate PSTs' evaluation of the talk moves simulations. The tutors' comments aligned well with the focus on discourse, questioning, and thinking given by the PSTs. However, four tutors expected that PSTs would acknowledge that the real benefits of talk moves would be most visible in the next school placement. Three tutors

anticipated acknowledgement of how the simulations built up PSTs' ability for informal assessment of specific mathematical concepts. Neither expectation was evident in PSTs' open comments.

Asked how they would change talk moves-based tutorials in the following year, tutors provided a range of practical suggestions, including tutor modelling of teacher-student interaction in the early tutorials (n = 2), flexible balancing of PST groups (n = 2), linking to WALTs (outcomes; n = 1), showcasing skills as well as strategies (n = 1), providing talk moves charts (n = 1), setting norms for participation (n = 1), and providing videos of real primary-aged students (n = 1). One tutor felt that the talk moves simulations should be left "as is". In general, the tutors' suggestions amounted to fine-tuning the talk moves simulations.

Discussion

There was strong agreement between the perceptions of PSTs and tutors about the positive contribution of the talk moves simulations to PSTs' abilities to manage classroom discourse and to engage with students' thinking. The main differences in perception were that PSTs put more emphasis on their improvements of questioning skills while tutors noted the observed effects on PSTs' personal mathematical knowledge. Gains in conceptual knowledge are not discussed in the literature about talk moves but emerged as a significant benefit.

Both PSTs and tutors provided useful suggestions regarding implementation. Both groups mentioned the importance of authentic engagement from the PSTs involved, and tutors suggested that they would manipulate groupings of PSTs to improve group dynamics in future. The challenges of talk moves simulations were attributed differently by the two groups. PSTs viewed their ability to assume the roles of children as their major challenge, presumably due to a lack of classroom experience. In contrast, tutors attributed the challenge to the cognitive load associated with the PSTs "teachers" managing interactions among their "students" and to gaps in mathematical knowledge prohibiting PSTs making sense of strategies. Both groups promoted the need for tutors to model talk moves in early tutorials, and one tutor commented on her personal lack of confidence to do so. Tutors expected PSTs to comment that the benefits of the simulations would be more visible on placement but such comments were not provided. PSTs did not share their tutors' perception of the value of talk moves in terms of preparing them for informal assessment.

Talk moves simulations were generally perceived as beneficial, though the artificial setting of university tutorials, coupled with the lack of classroom experience of PSTs, raised some barriers to implementation. The lack of placement experience provided to PSTs in this pre-service program appeared to work directly against attempts by tutors to make the tutorial offerings relevant to their students' needs and to prepare "classroom ready" graduates. Talk moves simulations may result in more benefits to practicing teachers who have the experience to take up role-playing with greater authenticity.

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