

A Collaborative and Reflective Approach to Teaching for Metacognition

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The Teaching for Metacognition project, a hybrid model of PD, integrates the “training model of PD” with sustained support for teachers to integrate knowledge gained from the PD into their classroom practice. This paper is based on the work of the teachers in the project in two-tier communities of practice. It examines the perceptions of the project teachers about working collaboratively and reflecting on their practice when integrating the knowledge they acquired during the knowledge-building workshops of the project. From the reflective journals of the teachers it is evident that working collaboratively provided them with the encouragement and support that is needed to begin to experiment with new approaches to teaching and reflecting on their teaching in school-based groups provided them with much needed insights as to how they may improve on what they did.

Introduction - Professional Development of Mathematics Teachers

Research has shown that professional development (PD) of teachers that is carefully designed and implemented can have significant impact on teacher knowledge and skills which in turn results in improved student achievement (Darling-Hammond, Wei, Andree, Richardson & Orphanos, 2009). Furthermore, high quality and effective professional development programs have been found to have a purpose as teachers are involved in shaping the foci of the program so that it is related to their school work (Clarke 1994; Hawley & Valli 1999; Elmore 2002). These PD programs are part of coherent programs of teacher learning and development that support their instructional activities at school, such as adoption of new standards (Stiff 2002; Desimone 2009) and focus on how to teach and what to teach – the substance and the subject matter- is key (Stiff 2002; Desimone 2009; DeMonte, 2013; Doerr, Goldsmith & Lewis, 2010). Lipowsky and Rzejak cited in Maaß and Artigue (2013) noted that teachers viewed professional development initiatives as effective if they had clear relevance to their day-to-day teaching and the programs had a clear focus on specific aspects of teaching or facilitation of student learning. Ball and Cohen (1999) have argued that “teachers’ everyday work could become a source of constructive PD” (p. 6) through the development of a curriculum for professional learning that is grounded in the tasks, questions, and problems of practice.

Such programs include training, practice and feedback, and follow-up activities (Abdal-Haqq 1995). Ball (1996) claimed that the “most effective professional development model is thought to involve follow-up activities, usually in the form of long-term support, coaching in teachers’ classrooms, or on-going interactions with colleagues” (pp. 501–502). Effective PD programs are sustained (Clarke 1994; Abdal-Haqq 1995; Hawley & Valli 1999; Elmore 2002; Stiff 2002; Borasi & Fonzi 2002; Desimone 2009) and embedded in teacher work (Clarke 1994; Abdal-Haqq 1995; Hawley & Valli 1999; Carpenter, Fennema, Franke, Levi & Empson, 1999; Elmore 2002). Lipowsky and Rzejak noted that effective programs are also intensive, combining learning-off-job in courses with learning-on-job in school. Teachers learn best when observing, being observed, planning for classroom implementation, reviewing student work, and presenting, leading, and writing (Stiff 2002). Therefore, opportunities for teachers to engage in active learning are certainly related to effectiveness

of PD (Wilson & Berne 1999; Desimone 2009). They also value the exchange of experiences with colleagues (Lipowsky & Rezak). In addition, collective participation by teachers from the same school, grade or department allow for a powerful form of teacher learning through prolonged interaction and discourse (Wilson & Berne 1999; Desimone 2009; Stiff 2002). PD programs that foster collaboration have been found to be effective (Clarke 1994; Abdal-Haqq 1995; Hawley & Valli 1999; Elmore 2002; Borasi & Fonzi 2002).

Matos, Powell and Sztajn (2009) noted that in teacher PD, learning should not be defined as the acquisition of knowledge of a propositional nature, but rather be conceptualized as being situated in forms of co-participation in the practices of teachers. Teachers participating in such learning may be said to belong to a community of practice (CoP) (Lave and Wenger 1991). Such a community does not exist when a group of teachers from several schools are interacting in a given setting such as attending a series of seminars or workshops, nor with groups of teachers in the same school who are teaching the same subject or year level but do not have mutual relationship and shared goals.

According to Wenger (1998), a CoP is a group of persons sharing the same practice. It has three key features: the members of a community of practice have a mutual enterprise; a shared commitment; and a common repertoire. This repertoire can contain material objects and stories that are shared by members of the community. When teachers have shared goals their professional conversations can provide them with the encouragement and support that is needed to begin to experiment with new approaches to teaching (Britt, Irwin & Ritchie, 2001) and support their sense of competence as they engage in the work of changing practice (Arbaugh, 2003; Edwards & Hensien, 1999; Jaworski, 1998; Smylie, 1988).

Teaching for Metacognition Project

Teaching for Metacognition project, is a hybrid model of PD (Kaur, 2011) that integrates the “training model of PD” (Matos et al., 2009) with sustained support for teachers to integrate knowledge gained from the PD into their classroom practice. It exemplifies a critical development in the professional development of teachers in many parts of the world. This development reflects a gradual shift in the centre of gravity away from the University-based, “supply-side”, “off-line” forms of knowledge production conducted by university researchers for teachers towards an emergent school-based, demand-side, on-line, in situ forms of knowledge production by teachers with support from university scholars. It is funded by the Academies Fund of the Ministry of Education and led by professors from the National Institute of Education, curriculum specialists from the Curriculum Planning and Development Division (Mathematics) of the Ministry of Education, a master teacher from the Academy of Singapore Teachers and a lead teacher from a secondary school. The aims of the project are threefold. The first is to provide teachers with knowledge and know-how of crafting performative tasks and how teachers may engage their students in metacognition during the learning of mathematics, i.e., metacognitive strategies. The second is to facilitate teaching for metacognition in the classrooms of teachers in the project. The third is to enthuse and support teachers to contribute towards the development of fellow mathematics teachers in Singapore and elsewhere.

Design of the project

The project has five significant features. The features are as follows.

Content focus. The project is focused on what to teach and how to teach. It is specific to the pedagogy of mathematics and teachers in the project are working with mathematical content that is appropriate for the grade levels of their students.

Coherence. The project is coherent with the needs of the teachers. It focusses on teaching for metacognition which is one of the five components of the school mathematics framework that nurtures mathematical problem solvers. In addition, it also addresses a gap in instruction identified by Hogan et al. (2013), i.e. the dis-proportionate use of knowledge-building tasks by teachers to engage learners in higher order thinking during mathematics lessons. The project supports the instructional activities of teachers at school, such as the adoption of initiatives.

Duration. The duration of the project is two years and comprises three phases. Teachers attended training workshops for a semester, followed by a semester of school-based work guided and monitored by the university scholars (PD providers), followed by another year (2 semesters) of self-directed school-based work. The duration of the project is significantly longer than most in-service courses that mathematics teachers usually attend.

Active learning. The project engages teachers in active learning. It includes training, practice and feedback, and follow-up activities as teachers learn best when observing, planning for classroom implementation, reviewing student work, and presenting, leading, and writing.

Collective participation. In the project there is collective participation at two levels – school and project. At the school level, at least four teachers, with pairs of teachers teaching the same grade year and mathematics program are participating. These teachers work together during the training workshops and also at school when implementing their learning in their classrooms. At the project level, teachers also work together building their knowledge by participating in sessions during which they critique their peers' work, and share their experiences and difficulties encountered during the implementation of their newly gained knowledge. Teachers in the project are participating in two-tier communities of practice, the school community of practice and the project community of practice.

Participants

Forty in-service secondary mathematics teachers from seven secondary schools in Singapore are participating in the project. The project is facilitated by a professor from the NIE, a research associate and a lead teacher from a secondary school.

Implementation of the project

The project has three phases spread over two school years. A school year comprises two semesters, each of 20-week duration. Details of the phases are as follows.

Phase I. Duration of this phase is the first semester of the first year of the project (i.e. from January till May). The phase started with the participants completing the Pre-Intervention Teacher Survey. The survey sought from teachers their understanding about performative tasks, knowledge-building tasks, metacognition and teaching for metacognition. The findings of data from the survey were used to plan the knowledge-building workshops for the participants. Seven three-hour knowledge-building workshops were organized for the teachers.

Phase II. The second phase of the project was the second semester of the first year of the project. It was from July till November of the year. During this phase the school groups of the project worked collaboratively and implemented their planned lesson. They wrote a

detailed lesson plan for the lesson they were carrying out. One teacher from the group taught the lesson to his / her students and the lesson was video-recorded. The school group met and viewed the lesson and prepared their presentation for the project group sharing meetings. Two project group meetings were held in October. During the project group meetings, the school group that presented solicited feedback from the project group. All participants in the project group except the teachers from the presenting school, participated in the feedback session. They used the four lens noticing feedback framework to give their feedback. The research team collected the feedback and the feedback was collated before it was sent back to the school group that presented.

Following the sharing sessions, the research team organized a meeting with every school group. Each meeting lasted between 2 to 3 hours. A total of seven meetings were held. During the meetings the feedback from the project group was discussed and addressed. The feedback was very helpful as it provided the views of many more pairs of eyes reviewing the lesson. In addition, during the meetings the research team inducted the school group into a four-step approach to facilitate working and learning collaboratively when integrating their new knowledge into classroom practice. The four steps were as follows:

Plan and write a detailed plan of the lesson.

Enact and video-record the lesson.

Watch the recorded lesson, compare it with the lesson plan and write the lesson narrative detailing the short comings and what the team would do differently the next time. A set of prompts were provided by the research team to guide the writing of the lesson narrative.

Write a reflection about the learning journey of the teacher's learning. Every member should do this individually, subsequently meet as a group and share with each other the reflections. The journal prompt was "Describe in detail your learning journey during the planning, enacting and reviewing of your team's lesson that was carried out with the goal of teaching for metacognition".

Phase III. This phase is a year-long and in the second year. Participants of the project continue to work in their school groups and integrate their new knowledge into classroom practice. They attend periodic project meetings during which the school groups showcase their lessons and invite critique and suggestions from the project group. In addition, the school groups engage in activities through which they contribute towards the development of fellow teachers both nationally and internationally.

The Study

The study reported in this paper is on a part of the data of the Teaching for Metacognition project. It examines the perceptions of the teachers in the project as they are engaged in collaborative and reflective practice. The research question that guides the exploration is: What were the perceptions of the project teachers about working collaboratively and reflecting on their practice when teaching for metacognition (i.e. integrating their new knowledge into classroom practice)?

Data and Analysis

The data comprises narratives about learning journeys of teachers in the project. The prompt used for the narrative was:

"Describe in detail your learning journey during the planning, enacting and reviewing of your team's lesson that was carried out with the goal of teaching for metacognition".

In the first cycle of show and tell, i.e., project level presentations, eight lessons were presented by the schools in the project. In this paper we report the analysis of 8 narratives, one for each of the lessons presented. The qualitative data from the narratives was subjected to content analysis (Weber, 1990). We adopted a deductive approach. For the narrative data arising from the prompt or interviews, as is often the case (Chapman, 2008), we identified themes and searched for characteristics that related to specific research questions.

Findings

The findings arising from the content analysis of the data were as follows.

Working and learning collaboratively during school-based work

Content analysis of the reflective journals show that the task of integrating knowledge the teachers acquired during the knowledge-building workshops was not easy for the teachers. It was ‘daunting’, ‘never easy’ and ‘not an easy feat’. Nevertheless, they overcame their apprehensions working together and supporting each other. It is also apparent that they were learning collaboratively while planning to teach for metacognition. Figure 1 shows examples of excerpts from the journals about teamwork.

TA: Conducting a lesson based on knowledge building tasks seemed rather daunting initially. To be honest there was quite a bit of inertia but I am thankful that the team worked together weekly to brainstorm on the lesson to teach for metacognition...

TPH: The journey to planning a lesson was never easy. Initially, we were lost as we were not sure about the expectations of how a lesson should be and whether we have applied the Metacognitive skills correctly in our lesson or not. The topic needed to be picked with care as it has to be suitable one to be conducted in Term 3. We also had to find time amidst our tight schedules to meet up and plan the lessons together. I’m thankful for great teammates who are willing to go the extra mile and also to take initiative in writing the lesson.

TCK: Creating/Crafting out the lesson plan/play and worksheet was not an easy feat. Everything has to start from scratch. However, with teamwork, we manage to overcome the challenge. The [knowledge building] workshops on Metacognition conducted by [university scholar] were also helpful in our team’s planning stage.

Figure 1. Excerpts from reflective journals about getting started

Reflecting on practice during school-based meetings

Figure 2 shows examples of excerpts from the journals about reflecting on their practice. From the content analysis of the journals it was apparent that when the teachers viewed the recorded lesson and reflected on it with their project mates in school, they deepened their understanding about teaching for metacognition. They also reviewed the feedback given by their peers in the project, project teachers from the other six schools, and considered suggested improvements to their enacted lesson.

TWW: We [group of teachers who planned and enacted the lesson] reviewed the lesson by watching the recorded video. It was an insightful experience, as this was one of the very few occasions where we had the opportunity to watch almost the whole lesson to observe what were done well and what could have been done better. When we became observers of our teaching selves, we became more critical and spotted some short-comings such as not

giving students enough wait-time, having a tendency to answer our own questions, and also not asking enough higher-order-thinking questions (as opposed to yes-no questions).

TG: After viewing our recorded lesson, [that I taught], using the four lens together with my school teachers and also reviewing the feedback from the project teachers [collected during the show and tell], we identified several areas for improvement and decided to modify our lesson to ask more why questions.... My biggest takeaway is to consciously remind myself to not attempt to control the students' thinking but to allow them to develop and construct their own knowledge. Also I should not be afraid to allow the students to lead the discussion and to make mistakes.

TS: We learnt a lot when we reviewed the recorded lesson, and went through the feedback given by the project teachers during the show and tell. For example, we realised that more opportunities can be given to students to play different roles, like giving feedback about the solutions presented by their peers. The task could also include building their own 3 D models and posing problems related to the model. Most importantly, we [teachers] must talk less and ask thought provoking questions.

Figure 2. Excerpts from reflective journals about review of lessons

Discussion and Conclusion

It is apparent that in the Teaching for Metacognition project teachers were active learners and worked in communities of practice. Working collaboratively in their school-based communities supported them in taking the leap to plan lessons that teach for metacognition and draw on their learning during the knowledge building workshops and make sense of it. Furthermore following the enactment of the lessons, the four step approach they adopted facilitated their reflection of the lesson they planned and enacted. This reflective aspect of the learning process deepened their understanding of the what, and how of teaching for metacognition. The findings of this study concur with firstly the characteristics of effective PD programmes which are that participants must be active learners (Wilson & Berne, 1999; Desimone, 2009) and that they should be collective participation as this allows for prolonged interaction and discourse (Wilson & Berne, 1999; Desimone, 2009; Stiff, 2002). In addition, the Teaching for Metacognition project fostered collaboration amongst the teachers in the project which is yet another attribute of effective PD programmes.

The findings of this study show that professional development that moves beyond providing teachers with knowledge into integration of the knowledge in their classroom practice must be supported. It is also apparent in this study that when teachers have shared goals their professional conversations, in this case that took place during their meetings in school when they met to plan, enact and reflect on their lesson, can provide them with the encouragement and support that is needed to begin to experiment with new approaches to teaching (Britt, Irwin & Ritchie, 2001). In addition, when the lesson was enacted, the shared ownership of it provided them with a progress towards changing their classroom (Arbaugh, 2003; Edwards & Hensien, 1999; Jaworski, 1998; Smylie, 1988).

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