Feedback About Professional Growth for Teachers of Mathematics: A Developmental Perspective

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This paper provides some insights into teacher professional growth as part of the ten-day Australian Government Summer School for Teachers of Mathematics Programme (the Program). These insights are revealed in three surveys completed during the Program. Preliminary analysis has provided information about participants' expectations related to classroom practice and the professional growth that took place during the program. This growth represents a shift in focus from the acquisition of new knowledge to thinking more deeply about its applications.

Introduction

An important characteristic of a successful professional development program has been articulated as working with, rather than doing to, teachers (Loughran & Gunstone, 1997). This approach is recognised as providing an appropriate mix of influences that contribute to professional growth. Affirming teachers as central agents is also recognised by Clarke & Clarke (2005) in ten key principles that increase the likelihood of long-term and effective professional development. These principles can be used to identify the processes that teachers engage in during professional development programs. For example, addressing "issues of concern and interest, largely (but not exclusively) identified by the teachers themselves and involve a degree of choice for participants" (principle number 1, Clarke & Clarke, 2005). Failure to place teachers at the centre of any plans for reforming practice or to implement innovations, can only lead to disappointment in the achievement of positive outcomes particularly if those plans do not incorporate sustained activity (Gore & Ladwig, 2006; Supovitz & Turner, 2000; Van Driel, Beijaard, & Verloop, 2001).

There is no shortage of guidelines for effective professional development. A typical example in the context of improving assessment practices is that of Black and Wiliam (1998). They have identified a four-point scheme for development, some important features of which include:

- Teachers being supported to work together;
- Teachers incorporating ideas into classroom practice;
- Teachers balancing the requirements of curriculum imperatives and meaningful learning; and
- Teachers gaining feedback from peer/external review of their practice.

Such a scheme provides a working model for professional development that is based on establishing communities of learners who can reflect on their practice. In addition, teachers are provided with clear statements of what it means to be an excellent teacher at various stages of their careers, e.g., The National Professional Teaching Standards for Advanced Teaching and School Leadership (Teaching Australia, 2007), and the AAMT Standards for Excellence in Teaching Mathematics in Australian Schools (AAMT, 2006).

Elsewhere, Loucks-Horsley, Love, Stiles, Mundry, and Hewson (1998) have attempted to simplify the enormously complex process of crafting professional development. In their Design Framework for Professional Development in Science and Mathematics, four key components of Knowledge and Beliefs, Context, Critical Issues, and Strategies interact with a sequence of implementation phases for professional development programs. This framework sets out a developmental sequence that can act as a useful guide, not only for the developers of programs, but also for the way participants interact productively with the 'diet' of materials which make up any program.

Some essential features of effective professional development would therefore need to include teachers playing an active role, and an environment that is conducive to the sharing of knowledge about teaching and learning in the classroom. In addition, the content and structure of a program would need to facilitate planning for the improvement of teaching and learning outcomes, and critical reflection by teachers about their roles.

Background

The Australian Government Summer School for Teachers Programme (the Program) was announced as part of the Australian Government's 2007-08 Budget Package: Realising Our Potential. Funding of $101.7 million over four years was committed to this initiative. A key feature of the Programme is the recognition of up to 4,000 of Australia's high performing teachers, over four years, by providing them with opportunities to further enhance their knowledge and skills in one of five priority areas: Literacy and Numeracy; English; Mathematics; Science; and Australian History. Indirectly, through follow-up professional development activities and funding through the Australian Government Quality Teaching Programme (AGQTP), many more teachers will benefit from the Summer School experience. The University of New England (UNE) and Flinders University were selected to develop and deliver ten-day Summer School courses for 2008 to approximately 400 teachers in mathematics and science.

Five two-day modules were developed to deliver the Summer School materials with opportunities for teachers to have some choice within the modules to focus on particular aspects that might be more relevant to their needs and interests. The course content showcased current thinking in pedagogical practices, subject knowledge (including pure research and industrial applications), educational leadership, and curriculum issues. In brief the modules were:

- *Frame Works* explored 'big picture' neurocognitive frameworks and how they help teachers understand, practice and assess learning, teaching and problem solving in mathematics.
- *Potential Difference* examined the advantages and challenges associated with student diversity in mathematics classrooms, and how to cater for such diversity.
- *Cutting Edges* explored what it means to be a mathematician in the 21st century by providing participants with opportunities to hear from people who work with and apply mathematics in their daily work.
- *Next Praxis* focused on teaching and learning strategies that integrate information communication technologies within mathematics curricula.
- *World Class* provided an opportunity to share exemplary practices in mathematics education.

During the 10-day Summer School, participants completed three surveys – one at the beginning (Day 1), one mid-way through (Day 5), and one towards the end (Day 9). A fourth survey is scheduled for three months after completion of the Program. The remainder of this paper provides a preliminary analysis of the responses of the participants over the Summer School with the view of identifying the nature of teacher growth.

Participant Feedback

The tender accepted by the Australian Government for the Summer School incorporated two evaluation components. The first of these was a Government initiated evaluation of all Summer School Programs, and the second was a commitment by the Program providers to conduct an internal evaluation. The issues to be addressed by this second evaluation were prescribed by the Department of Education Employment and Workplace Relations (DEEWR) and were drawn from the evaluation criteria of the Australian Government Quality Teaching Programme (AGQTP) Reporting Framework (2007). From these criteria, a schema was constructed setting out the questions to be addressed throughout the Summer School.

The comments obtained from surveys were the most important feedback as they represent, first-hand, the expressions of participants' concerns and interests. This feedback provided mainly qualitative data consisting of responses to questions in each of the surveys. Two questions in the final survey seeking to measure participants' satisfaction with the Summer School required teachers to respond using Likert scales. All free response feedback from the survey forms was transcribed and forwarded to an independent evaluator for analysis to identify emerging themes. The first of the surveys was designed to elicit participants' expectations

and motivations in relation to attendance at the Summer School. It provided a convenient reference point for subsequent feedback. Subsequent surveys provided important information concerning the efficacy of the materials making up the Program and the extent to which they supported teachers' expectations, engagement, and further professional learning.

Participant Expectations (Survey 1)

There were two free-response questions in the initial survey of the Summer School that asked participants about their motivations and expectations. An additional question, "Any other comments?" was provided for participants to raise any other issues they saw as relevant. There was significant cross-over in responses with some participants referring to learning about particular aspects of their teaching as a motivation and others as an expectation or area they hoped to address. Consequently, no attempt has been made to report motivation separately from expectations in this preliminary analysis. What emerged from their comments were five broad themes which relate to classroom and professional practice:

- *Theme 1*: To improve teaching and pedagogy.
- *Theme 2*: To update the currency of knowledge in specific areas, e.g., integration of ICT within the curriculum, catering for student diversity.
- *Theme 3*: Opportunities for professional interaction and networking for the purposes of personal learning or sharing learning with colleagues.
- *Theme 4*: The enhancement of student learning and student engagement.
- *Theme 5*: Learning about curriculum and assessment.

The five main themes listed above are in broad agreement with the results that were identified in the recent SiMERR National Survey (Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006). This survey set out to obtain a deeper understanding of the particular professional development needs of rural teachers, the learning needs of their students and the expectations of their communities.

Participant Feedback Related to Expectations (Surveys 2 and 3)

This section provides an overview of participant responses from the second and third surveys administered during the Summer School. These comments have been selected as indicators of professional growth for each of the five themes that represent participant expectations of the Program. Each of the themes is discussed separately drawing on feedback covering the two separate time periods. The relevant open-ended questions that made up the second survey, and which were repeated as the first of four questions in the third survey, were:

1. Has participation in the Summer School sessions thus far increased the currency of your knowledge of issues in mathematics education? (Please comment)

2. Were the issues presented in the Summer School sessions thus far relevant to the teaching of your students? (Please comment)

3. To what extent have the sessions thus far challenged you to think about new directions and strategies for the teaching of mathematics in your classrooms/school? Please comment on the aspects of the sessions that have been most helpful to you.

4. Any other comment?

Theme 1: To improve teaching and pedagogy. In the second survey, there were many sessions that participants drew attention to as being particularly useful, for example, those related to low-achieving students, indigenous students, engaging students in the middle years of schooling, the SOLO assessment framework (Pegg, 2003), and the *QuickSmart* Program (Pegg & Graham, 2007). Some commented on being taken out of their teaching comfort zones and several voiced their intention to make changes in their practice, or felt just "revitalised". Underpinning the majority of comments in Survey 2 was a focus on being motivated, the acquiring resources and identifying useful strategies that could be applied in the classroom. Some representative examples of comments (from Survey 2) included:

I am challenged to rethink strategies in dealing with low-achieving students and indigenous students. I have new resources for engagement of students.

> The low achieving/diversity choice has given me ideas I'd like to try in my classroom.

> They have challenged me by stepping out of my comfort zone of teaching to better my students. The aboriginal/middle school sessions gave me many strategies to help with my student's education.

In the third survey on Day 9 of the Program, responses took on a more personal professional relevance with many participants indicating that they felt empowered by sessions. Typical responses referred to what participants intended to do, for example, restructuring lessons, planning significant changes in teaching, re-thinking classroom practice, and restructuring approaches. Some talked about "bad habits" that they had fallen into over the years. They talked about "new ways to re-engage and structure my teaching", "new teaching techniques to bring to the classroom", or being helped to "develop a stronger teaching framework". Some participants began describing plans for implementing changes in their schools indicating that the sessions were "invaluable in supporting my arguments as an agent for change in the mathematics teaching and curriculum development". Another stated "I am looking forward to taking time to meet with my head of department and principal to discuss possible avenues from here". It is clear from these comments that participants' thinking became oriented towards how to improve their own practice – and that of others, as the Summer School progressed. Some representative comments (from Survey 3) included:

> I thought that before I came that I was an experienced and capable teacher. I now realize just how much I have to learn.

> It has made me realize that I need to look through the eyes of the students more often and allocate more time to the reflection of my lessons … I can see that technology in the classroom will open up so many more opportunities for teaching and more importantly learning. I have also got to inspire my staff to think of themselves as learners.

> I'll have to try and convince some of my colleagues that their teaching and learning programmes and ideas may need a little 'adjustment'. I'll have to change my ways a bit too! We are meant to be 'change agents' and I'll have to be fearless in my pursuit to set up the Best Possible situation for the students in my classes!

Theme 2: To update the currency of knowledge in specific areas, e.g., integration of ICT within the curriculum, catering for student diversity. In the second survey, participants commented positively about specific areas of interest, for example, the *QuickSmart* Program for low-achieving students (Pegg & Graham, 2007), the SOLO assessment model (Pegg, 2003), models of brain functioning (Geake, 2004), and the importance of focusing on mental computation and open-ended tasks. Some comments were more general, mentioning that the Program had "sown many seeds", helped improve the "conceptual knowledge", or helped to "rethink the validity of some of the fundamentals on which my practice is based". The underlying benefit for participants at this stage in the programme related to the ideas and strategies that could be applied. Some representative comments (from Survey 2) included:

> The *QuickSmart* program have/will have an impact on my thinking and structure of classroom programs. Some sessions have given me extra ideas for adding more 'creativity' in my classroom programs.

> I now have better contextual knowledge, some clever ideas, more ideas about mathematical careers… The focus on neuroscience has been interesting for me: a new area.

> One particular session has opened my eyes to the importance of focusing on mental computation and open-ended tasks.

In the third survey of the Program, there were still many positive responses about being able to update knowledge in specific areas. Some comments were more general indicating that sessions "challenged our teaching philosophy as well as our school priorities", "allowed me to challenge my current thinking about teaching within a classroom", and provided "a better understanding of what works". Some comments indicated appreciation for the "evidence-base for thinking on current knowledge" and the encouragement to be "a leader". As participants experienced more of the Summer School Program, they were able to 'dig deeper' into their knowledge about teaching to consider underlying frameworks. Some representative comments (From Survey 3) included:

> The feedback session was a real challenge. The need to find out what students know and don't know is essential to providing lessons that have meaning for the students.

They have been hugely challenging. While some sessions gave small ideas to use, others have turned my thinking 180 degrees. How can I arrange for my school's teachers to watch others teaching? How can I arrange my department to analyse teaching strategies? How can I ensure that feedback to students is regular and real?

I have been challenged every step of the way, but my biggest challenge (and unsolvable, I think) will be finding the time to create and implement some changes. I know I should take small steps, but even that seems to be a large hurdle (oops! Mixing metaphors). Finding the time in an incredibly filled school schedule will mean either I go mad or have a marriage breakdown! The Summer School has filled a need that I have felt for a long time; we teachers need to have our trees shaken every so often: the apple may hit you on the head but it's still good to eat!

Theme 3: Opportunities for professional interaction and networking for the purposes of personal learning or sharing learning with colleagues. Responses at Day 5 of the Program (Survey 2) relating to opportunities for professional interaction and networking invariably referred to workshops, tutorials and informal discussions. As one respondent put it, they "allowed me to share and refine ideas raised in lectures/keynote presentations". Another referred to a "great culture of sharing and professional debate". Some participants were able to obtain resources from other participants, especially interstate participants. Some representative comments (from Survey 2) included:

The workshops and tutorial discussions have resulted in terrific ideas and a great culture of sharing and professional debate.

The sessions have been good to introduce new ideas but the most helpful part has been the chance to talk about it in workshops and tutorials to get other people's interpretation of the issues.

The workshops, tutorials and informal discussions have been invaluable. I've gained great information from these, together with terrific contacts who are also life long learners. Having the opportunity to hear new ideas and research findings from the presenters and discuss current classroom practices and experiences with other teachers, will certainly impact on my teaching and thus the learning of my students.

Comments at the end of the Summer School (Survey 3) were again very positive and reinforced how participants appreciated "the collegial nature of the conference", being able "to make contact with other professionals Australia wide", of being able "to network with others and discuss with others". Once again, the workshops, tutorials and informal discussions were venues where sharing of ideas took place. As before, with comments from the third survey there is a sense that participants are thinking more deeply about issues. In this context, this represents going beyond the sharing of resources during discussions to making judgements about current teaching styles and practices. Some representative comments (from Survey 3) included:

While it will take some time to synthesise all that I have been exposed I hope I do not teach in the same manner during this year as if I had not attended the SS. The network and sharing of ideas are invaluable.

The workshops have shown me models of great teaching practices. I have experienced sitting as a student in the classroom and been able to make judgements on what I have taken away what worked for me. The tutorials where I have been able to network with others and discuss what others have learnt.

The material presented, backed up by valid data and research, has provided me with additional knowledge and affirmed my practices in the classroom. Since I want my students to always do better I need to continue to incorporate new ideas into my teaching. This summer school has allowed me to make contacts with other professionals Australia wide to think about and take on other practices and to challenge my existing practices.

Theme 4: The enhancement of student learning and student engagement. In the second survey, participants commented positively on how particular sessions had equipped them with specific strategies or insights that would support student learning. These sessions included those related to assessment and the way they "make one think about student levels of understanding", or those about "engaging and challenging students in the middle years". Many comments appreciated that they would have "more tools to engage … students", that "the sessions were very relevant to the teaching of students", or that they provided "a direct connection with the instruction and implementation of mathematical ideas and concepts". Some voiced their intention to "aim to improve outcomes for all students" in their own practice or through in-servicing other teachers in their schools. Some examples (from Survey 2):

> The engaging students in the middle years of schooling presentation and workshops were not only brilliant and relevant but enabled me to take a plethora of exciting, challenging and fun ideas back to my classroom and my school.

> The initial sessions were useful in how I approach assessment of my students and hence the planning I would use in developing units. The later sessions have given plenty of practical suggestions for problem-solving/ rich tasks that I can use to supplement my current practices.

> I will try to fit in the newfound strategy/ies especially on the students with learning difficulties. I am referring to *QuickSmart* program. I now have a full understanding of the brain anatomy and need to be MORE understanding and receptive to these students.

Comments at the end of the Summer School (Survey 3) once again tended to be more focused on changes that could be brought about as a result of personal reflection and of taking particular strategies and thinking deeply about how to use them to best effect. In many cases participants referred appreciatively to "the idea of seeing the lessons through the children's eyes" and "learning through the eyes of the students". Compared to their responses in the survey half-way through the Summer School, there is a greater sense of a more focused desire to implement changes in their own classrooms in a way that benefits the students. Some representative comments (from Survey 3) included:

> The concept of student learning became a focus. It was good to consider how we as teachers can self-reflect in order to improve.

> The idea of seeing the lessons through the children's eyes had particular impact on me. I am sure I need to give more valuable feedback to my students.

> Probably the most challenging aspect of teaching for me is the significance of feedback on learning, both for the student, and for me as a teacher. I think I need to find some ways to improve in this area hopefully in some "measurable" way. I would also like to find some ways to get the students to reflect more on their own learning process.

Theme 5: Learning about curriculum and assessment. Once again, participants commented positively in the second survey about specific areas of interest, for example, the messages contained in results from PISA and TIMSS, and the SOLO assessment model. The underlying benefit for participants at this stage in the program related to the insights and ideas that could be further developed. Some representative comments (from Survey 2) included:

> … the update of [the SOLO assessment] framework has been excellent in that I can now see much more clearly how it can be useful to me in formative assessment of my students.

> PISA and TIMSS added so much to my knowledge.

> PISA and assessment … I will be able to identify their (students') level of thinking and target scaffolding from there.

In the third survey on Day 9 of the Program, there were still many positive responses about being able to update knowledge about assessment. Some comments were more general indicating that sessions provided "better understandings", and "a real challenge. As highlighted above for other themes, as participants experienced more of the Summer School Program, they were able to 'dig deeper' into their knowledge about teaching and to consider how they might change practice. Some representative comments (from Survey 3) follow:

> … having a better understanding of what works, how effective strategies are, etc, based on research etc gives us ideas and makes us hopefully, constantly evaluating our classroom practices, reasons for using an activity, fine-tuning on assessment or evaluating the way we give feedback information to our students.

> I have learnt that I must concentrate on the teaching practices that actually improve student achievement, not just the ones that just make me feel I have done a good job.

> The assessment parts; trying to move away from quantitative tests will be a challenge for the school where I teach but gave me great insights into why we should.

Conclusion

In working with, rather than doing to, teachers, the Summer School Program provided a productive context in which to obtain commentary about their issues of concern and interest. The feedback from the participants presented above represents a 'snapshot' of their engagement with the Program materials. An important component of that engagement was the commentary about how relevant information might inform improvements in student learning outcomes. The preliminary analysis has identified five areas of professional relevance for participants and for each of these areas there was an observable shift in how they reflected on the sessions. This shift was from a recognition of the many ideas, strategies and insights that presenters delivered to a deeper thinking about the issues in terms of where to next – both personally and professionally, and the processes associated with improving student learning. This shift is summed up in one comment from the end of programme survey:

> I always thought I was a "good" maths teacher. However, looking back there are things that I need to improve or address in order to meet the learning needs of my students more effectively. I now feel that I have a more theoretical base for my beliefs that I can extend into developing worthwhile mathematical (and also other KLA's) activities.

This identified shift to a more reflective professional focus highlights two aspects of the Program. The first is the professionally supportive structure that was provided by the sequence of modules. Whilst evidence-based research was common to all modules, sessions that focused on the incorporation of ideas and strategies into the classroom, and the planning of future activities in schools were a feature of the last days of the Program. The second was the opportunity for discussion that facilitated the transition from "new knowledge" to its "practical application". The associated workshops, tutorials and informal networking times encouraged the sharing of information about approaches to teaching and learning, and about what contributes to enhanced learning outcomes for students.

The professional development provided by the 10-day Summer School Program was intensive and indications are that the collegial interactions were highly productive for providing insights into teaching and learning. The preliminary analysis of participant evaluations echoes some of the findings in the literature concerning components of effective professional development (e.g., Black & Wiliam, 1998), the need for sustained professional development to bring about change (e.g., Supovitz & Turner, 2000), and the importance of providing research-based knowledge to support improvements in student learning outcomes (e.g., Ingvarson, Meiers, & Beavis, 2005).

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