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Teachers' learning in an innovative school

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The successful establishment of a purpose-built innovative school designed to support new ways of teaching and learning in the senior secondary years, particularly in the area of science and mathematics, required a comprehensive and research-based professional development policy and program. Planning professional learning opportunities for the teachers located within the Australian Science and Mathematics School (ASMS) emerged from reviewing the literature on effective professional development and collaboration between the ASMS leadership team and staff from Flinders University. In keeping with honouring the individual teachers and their specific learning needs a professional learning program that provided a range of options was developed. This article reports on the reasoning behind the design of the professional development policy and two specific strategies used to support teachers' learning and practice in this innovative environment.

Professional development, teachers' learning, professional partnerships

INTRODUCTION

Who dares to teach must never cease learning.
John Cotton Dana (cited in Guskey, 2000, p.146)

Teachers' learning is a critical aspect in schools attempting to work in innovative ways. Researchers, including Darling-Hammond (1999), Fullan (2001), Loughran (2002), and Sparks (2002), note the importance of teachers' learning in promoting change at the school level. But as Elmore and Burney (1999, p.267) also note "teachers do not respond to simple exhortations to change their practice", they must have access to professional learning opportunities that link with their perceived and current developmental needs. Such opportunities should have a strong focus on the acts of teaching and learning, as Darling-Hammond (1999, p.8) suggests, "…teachers who know a lot about teaching and learning and who work in environments that allow them to know students well are the critical elements of successful learning." King and Newman (2002) also provide advice when considering how to plan for effective teachers' learning.

> Since student outcomes and how teachers teach are profoundly influenced by the school in which the students and teachers work, the design of professional development itself should be grounded not only in a conception of how individual teachers learn, but also in a conception of how schools as organisations affect teachers' learning, teachers' practice, and student achievement. (King and Newman, 2002, p.577)

The school at the centre of this paper, the *Australian Science and Mathematics School* (ASMS) is innovative in many ways including: a) being architecturally designed to promote new ways of

teaching and learning; b) being situated on a university campus (Flinders University) to promote collaboration between staff in both organisations; c) catering specifically for senior secondary students who have a strong interest in mathematics and science; d) designing and implementing an interdisciplinary curriculum; and e) providing a major role in the professional development of teachers in and beyond the school. The infrastructure for innovation is in place for promoting educational reform. However, whether true educational reform occurs or whether the status quo of education in the senior years is maintained in this school, may be significantly influenced by the quality of the opportunities for teachers' learning and the subsequent outcomes of this learning.

The school's vision, as stated below, suggest that the way teachers and students work and learn in this school may look very different from more traditional senior secondary schools.

> The Australian Science and Mathematics School will be recognised as a quality school that provides leadership of innovation and reform of the teaching and learning of science and mathematics. (ASMS Vision Statement, 2004)

Achieving such a vision requires significant consideration about how to support teachers to work in new ways. The school links one of its mission statements to this very notion in stating that:

> The ASMS will be one of the most advanced learning centres of its kind, it will provide Australian educators, and South Australians in particular, with state of the art professional development. (ASMS Mission Statement, 2003)

This mission clearly indicates that the opportunities for teacher learning are not confined to those working in the school but to the wider professional field. However, this paper focuses specifically on two of the initial strategies that have used to support teachers' learning within the school.

Research on professional development presents a dichotomous view on optimal approaches to professional development, noting that many traditional models of professional development are considered fragmented and poorly coordinated (Guskey, 2000, Cohen and Spillane, 1992 cited in Sykes, 1999). Often little thought has been given to the strategic application of knowledge and skills presented in professional development programs. Many professional development programs are presented as so-called 'one hit wonders' with a focus on the latest 'trend' (Hawley and Valli, 1999). Increasingly, it is recognised that there is no one perfect approach to successful professional development because the content, process and contextual variables differ across programs, styles of delivery and learning, and situation. However, Hawley and Valli (1999, p.137) have described eight characteristics of effective professional development. Some of these characteristics included:

- teachers clearly identifying their learning needs,
- processes that involve collaborative problems solving,
- organisation based on the continuous and ongoing involvement of a cohesive group,
- opportunities to develop theoretical understanding of new knowledge and skills
- integration of professional development within a comprehensive change process including the facilitation of student learning, and
- incorporating evaluation of multiple sources of outcomes for teachers, students and organisations.

All of these characteristics are featured in the professional development policy at the ASMS. The policy is aimed at promoting effective teacher learning that ultimately supports rich learning

outcomes for students at the school. As Guskey (1994, p.43) points out, "the teaching and learning process is a complex endeavour that is embedded in contexts that are highly diverse". Given this premise it is important to consider that even within this school there are diverse contexts for teaching and learning and therefore a diverse approach to supporting professional development is required. The fundamental aspect that is addressed consistently in the school's professional development policy is the situating of learning opportunities on real problems and practices. Loughran cites Dewey (2002, p.10) who recognised that:

> educational practices themselves must be the source of the ultimate problems to be investigated if we are to build a science of education, so a focus on teacher research is paramount as it is teachers who work in the crucible of educational practice from which the 'problems' are derived.

Some of the real problems faced by teachers at the ASMS are the development and implementation of an interdisciplinary curriculum, the use of new pedadagogies, reframing the role of the teacher, designing authentic and transparent assessment, the de-privatisation of practice and the provision of learning opportunities that stretched teachers and students alike but meet the criteria for the South Australian Secondary Schools Assessment Board. While teachers at the school all faced these issues they did so to varying degrees depending on their specific leadership role. This diversity of teachers' learning needs required much flexibility within the professional learning opportunities that the school provided. Shulman's (1999) comment guided the shaping of learning opportunities that varied from traditional so-called 'sit, listen and discuss' seminars.

> Acquiring sophisticated knowledge and developing a practice that is different to what teachers themselves experienced as students, requires learning opportunities for teachers that are more powerful then simply reading and talking about new pedagogical ideas (Ball and Cohen, 1996). Teachers learn best by studying, doing and reflecting, by collaborating with other teachers, by looking closely at students and their work, and by sharing what they see. (Shulman, 1999, p.11)

The following section of this paper provides details about two professional learning opportunities that are in action at the ASMS. The first centres on a partnership between the school and Flinders University to engage teachers in sustained professional learning around an issue of significance to them; and the second, a learning-in-action opportunity where teachers and additional expert personnel, either from the university or industry, work together to support students in individually designed inquiry based projects.

PROFESSIONAL LEARNING PARTNERSHIPS

The situating of the ASMS on a university campus provides many opportunities for interaction between staff in both settings. Staff from the Faculty of Science engage with staff from the ASMS in developing new and innovative curriculum offerings (see the *ASMS Curriculum Handbook 2004* for specific details). Flinders University School of Education staff and staff from the ASMS work as a team in developing opportunities for teachers' learning that can be formally recognised. The stress placed on collaborative processes was generated from considering the key elements associated with building professional learning communities. Sparks, (2002, p.66) suggested that "successful learning communities have at their base high quality relationships, collegiality, reflection, risk taking and collaborative problem solving". Developing professional partnerships whereby staff from both organisations viewed themselves as colleagues of equal status was critical to building a sense of shared responsibility for learning outcomes at the ASMS.

From the collaboration between the School of Education staff and the ASMS leadership team a formal graduate level certificate program was developed. The Graduate Certificate in Education (Professional Learning) was designed to promote professional learning groups that involved staff

from both organisations. Teachers at the ASMS were invited to participate in this program with the understanding that they would be required to attend formal sessions and submit some form of evidence about their professional learning at the completion of the program (approximately 8 months in length). It was hoped that the outcomes from successful involvement in the program would include significant professional learning and subsequent contribution to the policies and practices within the school in addition to a formal tertiary qualification.

Although the program provided an opportunity for teachers to reflect in detail on issues of interest and concern that had emerged from their role in the school initial sessions had an explicit focus on 'the self as a learner'. It was viewed as paramount to consider effective learning from a personal perspective as teachers often found themselves responsible for enhancing the learning of others rather than engaging in learning themselves. Bransford et al. (1999, p.183), noted that, "…teachers are generally accustomed to feeling efficacious – to knowing that they can affect students' learning – and they are accustomed to being in control". Teachers often viewed themselves as being responsible for the learning of others but struggled with the notion of being learners themselves. By engaging the teachers at the ASMS in the learning process the notion of who was in control of what could be experienced first-hand. The teachers in the program were all strongly encouraged to document their learning processes and outcomes and to reflect on what made a difference for them. The aim of this activity was to assist teachers to generate a deeper understanding of the processes of learning and to examine whether this was transferred to their planning and support for student's learning. As Perry (2004, p.36) suggested,

> Revitalising one's creativity and intelligence can come from being a true student again. Educators need time to be students in several different ways…Being a student again creates greater empathy for students in our own classrooms while deepening our understanding[s] of subject matter and [self].

Moon's (1999) Map of Learning was used as a model to track the teacher's learning in this program. Moon drew on constructivist views of learning, notions of cognitive structure, content, stages in learning, and deep and surface approaches to learning in building her model. Key stages in the map along with links to surface and deep learning as suggested by both Entwistle (1988, cited in Biggs, 1999) and Biggs (1999) are detailed below.

- Noticing
- Making sense

} Surface Learning

- Making meaning
- Working with meaning

} Deep Learning

- Transformative learning

In using Moon's model teachers at the ASMS were able to track their own learning commencing with what they noticed most about their current work in the school. How they made sense about what they noticed was supported through professional discussion within the group. As Schon (1983, p.243) suggested "Awareness of one's own intuitive thinking usually grows out of practice in articulating it to others". The role of others in supporting 'making sense and meaning' of teachers' issues was also recognised by York-Barr, Sommers, Ghere and Montie (2001, p.59) who noted that "Because we filter our experiences through our own view of the world, reflecting alone can result in self-validation and justification". The very nature of being involved in the professional learning group ensured that even when a sound idea was proposed close scrutiny of the belief or practice was generated between members.

The program provided much time for initial making sense and meaning of the teachers' issues as they revolved around real and complex notions including: student engagement, individual learning plans, transparency in assessment practices and pedagogies that supported student learning. Teachers commenced working with meaning when they felt prepared to, and this varied for the individuals within the group. The so-called 'working with meaning' stage of the program resulted in less formal meetings and more individual consultation between the university and ASMS staff. For example, when a small group of teachers felt the need to develop skills in analysing qualitative data a session on this was provided. Other ASMS staff sought meetings to discuss the data gathered from students that reflected Feather's (1982) theory of 'expectancy x value'. This reference was provided for these teachers who then changed their practice (transformative learning) to support student engagement.

The teachers in the program presented their work to others in the group and also to the wider community within and beyond the school. Different ways of providing evidence about their own learning journeys reflected the way in which the individuals preferred to work and this was noted as something that should be available to their own students as well. The evidence that has been generated from the group has provided impetus for continued focusing on several areas as well as a range of valuable documents that could be used in a number of ways, particularly as evidence of the history behind the practices and beliefs emerging in this school.

In seeking feedback from the teachers involved in the program all participants responded that the program was "highly integrated" with their work at the ASMS. Comments about the most significant outcomes from engaging in the program included the following:

> The most significant outcome for me has been about planning for supporting change in the learning environment. My action research had focused on priorities for change and action to support those priorities. I have also reflected on myself as a learner and my capabilities and characteristics and how they have helped or hindered my progress. I did manage to keep journals as a practice to monitor and understanding my own learning and this is certainly an improvement for me which I am glad I persisted with. I need to further develop explicit learning in regard to learning theories.

In reflecting on the structure and organisation of the topic the following comments were made.

> A good start and end but I fell down a little in the middle however, this wasn't exactly the fault of the topic it was probably due to me putting priority on other things, more regular contact may have reduced this.
>
> Seemed to open and lacking in direction in the beginning but this has to do more with my lack of experience and on reflection that time allowed for exploration of the research question. I changed my focus many times as I tried to make sense of where I wanted to focus my energies.
>
> I think I needed more scaffolding and support, like some of my students, we need help but don't bother to ask for it.

These comments provide valuable feedback to the designers of the program and they also provide evidence of the teachers reflecting on their own style of learning. Understanding self as a learner was a key aim of this program. Transferring this knowledge of self as learner to thinking about learning for students is evident in the last comment. The teachers as learners in this program all take some responsibility for their learning. They appear to recognise that to gain the most from learning situations learners have a significant responsibility too, and this concept is something that can be continually and explicitly shared with all learners at the ASMS.

LEARNING-IN-ACTION

This second aspect of professional learning opportunities provided by the ASMS has emerged from innovation around the topics that were available to Year 12 students at the school. In seeking to provide innovative practices and learning opportunities for both teachers and students in this school the concept of 'extension studies' – a model where students in their final year of secondary schooling could engage in a self directed study was developed. Extension Studies would replace one of the five more traditional subjects that on successful completion would result in the South Australian Certificate of Education, a pre-requisite for university entry, being awarded. Some of the more traditional topics available for students in their final year of schooling included Pure Mathematics, Physics, Chemistry, Biology, English Studies and Geography. As the ASMS was committed to transforming the way student learning and achievement were defined and measured it has been a key innovator in the development of Extension Studies.

In line with the teaching and learning principles of the ASMS, Extension Studies used an inquiry approach to learning. Students nominated an area of interest suitable for a research investigation that enabled them to be engaged in learning experiences that were complex and creative and more specifically linked to the real world. The projects should build their processes and skills in research in addition to developing key content knowledge. This was achieved by providing opportunities for students to conduct concentrated research in a specialised field. Students drew on many information sources and traditional subject disciplines and on the way they learnt to manage and allocate resources such as time and materials.

The Extension Studies investigation topics designed by current students at the ASMS, stated below, gives some indication of the interdisciplinary nature of the inquiries and the depth of knowledge and skills needed to address the student's investigation.

- How can the laws of electricity, magnetism and mechanics be made consistent?
- How is artificial intelligence technology poised to enrich the life of an individual with a disability?
- Design and build a device that sends digital data over UHF radio.
- What skills does a scientist need to act in an entrepreneurial way?

Inevitably student's Extension Studies investigations were across traditional subject disciplines. In fact many of the new sciences were derived from emerging technological developments and sat between disciplines. This creates new demands on teachers who were supporting the students through their Extension Study. Teachers were no longer in a position where they could turn to a pre-determined curriculum or traditional ways of teaching.

Support for students engaging in such inquiry-based projects required the teachers to contribute to curriculum development and reassess their notion of evidence of learning. Previous work at the Year 12 level was constrained by statewide assessment procedures, with any alternative approaches to the traditional exam orientated model, often considered as lacking in academic rigour particularly in the science and mathematics domains. Any initiative in the area of reforming learning and assessment at the senior years levels would be closely scrutinised by such organisations as the Senior Secondary Assessment Board of South Australia (SSABSA). Therefore working closely with professionals from these organisations was critical to developing a shared understanding about the broader outcomes of such an initiative.

Professional learning opportunities were provided for the staff in a number of ways but foremost through connecting a staff member with significant others, including the content expert, assistant principal of the school and also with personnel from the SSABSA. This provided the credibility

demanded by many at this level of schooling and facilitated working partnerships between educators and practising scientists and technologists. These working relationships provided opportunities for all to consider aspects beyond the individual student's progress in an Extension Study. Opportunities to review pedagogies that supported deep learning, considered alternative assessment practices for the senior years and introduced the new sciences to the curriculum offered at the ASMS could emerge through such collaboration. As a student's Extension Study was nine months in length it also provided for ongoing interaction between all the people involved but in particular for the teachers at the ASMS and the expert mentor. The teacher was provided with a sustained opportunity to learn new content knowledge from the mentor and to consider carefully the most effective way to develop students' understanding of this content. The staff member in working and learning along side of the student modelled for the student the responsibilities of the learner as discussed in the previous section. Such responsibilities might include careful planning to get maximum benefit from meeting with the mentor, the need to ask questions if unclear about specific aspects and the active theorising about possibilities.

Although this project has been in its infancy, other outcomes to date have included:

- teachers developing insights into the latest scientific research;
- development of teacher skills in supporting learning styles and inquiry based learning;
- recognition of constraints on students learning afforded by the current senior secondary school assessment structures; and
- support for teachers in developing deep knowledge and understanding of their subject.

CONCLUDING COMMENTS

This article describes only two aspects of the learning opportunities presented for teachers at the ASMS. There are many other aspects including teachers accompanying university colleagues to conferences on the new sciences; jointly planned and run statewide professional development workshops in areas such as nanotechnology; and ongoing workshops and professional discussion about working with the new technology in the school. In planning for teachers' learning at ASMS it is paramount to draw on our understanding of learning and how we learn in different ways. As Biggs (1998) noted there were times when we learnt at a surface level and times when learning was for strategic purposes but it was deep learning that was required before significant change could occur. While the teachers in this school are working in an environment of significant change they are still in control of how and what they teach. As Fullan (1991, p.117) noted, "Educational change depends on what teachers do and think. It's as simple and complex as that". Without appropriate support to learn and reflect on whether their beliefs and practices were creating rich learning experiences for the students desired outcomes would not be achieved. Providing for teachers' learning remains a significant priority at the ASMS.

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