

Expert mathematical pedagogical assistance to pre-service teachers using a website

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Abstract

Preliminary research indicated that UWS practicum students in both primary and secondary areas experienced difficulty in obtaining expert and quick mathematical pedagogical advice while completing in-school experience. Mathematics specialist lecturers were unable to supervise all their secondary students, while primary students required advice from many specialists. This occurred in a context of shrinking university budgets, where in some cases specialist lecturers were replaced by much cheaper non-specialist part-time staff. A website was constructed as a means of providing access to speedy expert advice on the teaching of mathematics. The site contained a number of features such as collections of classroom teaching ideas and lesson plans, links to other helpful websites, a threaded discussion site, frequently asked questions, and an entry port for submitting material. This paper discusses the data compiled on the usage and the mathematics teaching and learning issues associated with the site.

In July of 2000, I attended an annual conference in Perth of the Mathematics Education Research Group of Australasia (MERGA). I was particularly inspired by a paper presented on the use of the web to support pre-service teachers when they were completing their in school professional experience (Herrington, Herrington, & Omari, 2000). I left the conference with the strong message that:

The use of a range of technologies in the preservice teachers' learning environment has meant that they have become adept at accessing appropriate technology, and are able to use electronic resources and the internet effectively as an information source. However, the tendency has been to neglect these powerful resources to support preservice teachers once they leave the confines of the university and move to schools for professional practice (Herrington, Herrington, & Omari, 2000, p. 316).

When I returned to my university and began the new semester I decided to conduct a survey among my final year secondary methods and primary methods students. The survey consisted of three open questions and was completed in the second week of semester (August, 2000). There were two versions catering thus for primary and secondary final year students.

The three questions used with the secondary group (21 students) survey were: what is your greatest frustration when on practicum?; what topics are the most difficult to teach?; and how could I help you during practicum? The results were surprising to me. There were two strong common responses to the first question. The students reported their greatest frustration was having a tertiary professional experience supervisor who did not have a mathematics teaching background. In my university because

of various constraints I am assigned to a couple of schools and supervise all the students in that school. Thus I have students from all the key learning method subjects such as English, Science and so on. Perhaps I get to supervise two or at most three mathematics methods students during a professional experience period usually of four weeks duration. Lately, because of financial pressure upon universities in Australia, casuals are replacing lecturers as a cheaper option. These casuals are usually retired teachers from across all key learning areas. Thus a student is fortunate to have a supervisor with a mathematics background.

Their second most reported frustration of the students was the difficulty in getting assistance when a situation became difficult. In follow-up conversations, while students were appreciative of the help given by the other teachers in the school, because of the busy nature of the job this help was not always available. The student teachers were also reluctant sometimes in raising certain issues through fear of '*losing face*' in front of the other teachers. Students stated that they were trying to impress the other teachers in the hope of being offered casual or full-time employment when they completed their course. In the eyes of the students there was a lot at stake by appearing to be in control and not being a burden on the school staff.

The question concerning the difficult topics ranged across a number of areas and levels and I tried to include the important ones in the remaining course lectures. However, there was a need expressed by students for access to 'best practice' advice across a wide range of topics. The two most difficult senior topics to teach listed by the students were inverse functions and limits. The two most difficult junior topics to teach listed by the students were directed numbers and algebraic operations.

In the third question, there was unanimous support for me being available to the students to consult or to visit. When I discussed this with the group as a whole, they agreed that with such a large group, visits would be impossible and that contact via phone or email would have to suffice.

The three questions used with the primary methods students (97 students) were: what is the most difficult key learning area you have to teach while on practicum?; what is the key learning area you are least confident to teach while on practicum?; and how could I help you during practicum? In the first question the subjects Science followed by Mathematics were regarded by the majority of students as being the most difficult to teach. The order was reversed in the responses to confidence in teaching, with the students indicating they were least confident in teaching mathematics. This presents a real challenge to the mathematics lecturer to address this lack of confidence. The answer to the third question mirrored the responses of the secondary group. Students wanted access to advice when needed that was independent from the school.

In response to this data, I successfully applied for a teaching grant during 2000 and began constructing the site using the Blackboard platform on the University's server. This year I have had to change to using the WebCT (Goldberg, 1997) platform and at the moment have the site running on both platforms. Blackboard has been retained until the end of this year as a service to students who completed their degree last year and who requested access during their first year of teaching. As offering this service was not a financial difficulty the request was granted.

The site contains a number of features. The first feature provides access to 'best practice' material such as collections of classroom teaching ideas and lesson plans across all year levels and topics of the mathematics syllabus. Some of the grant money was spent hiring 'recognised expert teachers' to write material for this feature of the website. The New South Wales State Education system has a number of syllabus documents that cover Kindergarten to Year 12. Currently the syllabus documents for years K-10 are under review but at the time of writing this paper the following are the mandatory documents for NSW teachers. The primary syllabus covers K-6 (NSW DOSE, 1989) and consists of three main strands: Number; Measurement; and Space. While it contains many useful teaching strategies, there are areas that lack depth of treatment. The early secondary syllabus covering years 7 and 8 (NSW BOS, 1988) contain the strands of: Problem Solving; Geometry; Measurement; Statistics; Number; and Algebra. There are three syllabus documents in years 9 and 10 for the three courses of Standard, Intermediate and Advanced Mathematics (NSW BOS, 1996 a, b, c). In years 11 and 12 there are four courses: General Mathematics (NSW BOS, 1999); Mathematics (formerly called 2 Unit); Mathematics Extension One (formerly called 3 Unit) (NSW BOS, 1997 a); and Mathematics Extension Two (formerly called 4 Unit) (NSW BOS, 1997 b). Obviously providing material for all these courses is a mammoth task and is still in progress, yet what is available is very popular according to the number of hits each week on the website and the unsolicited comments and emails from students. Classroom teachers have also requested access to the site for the purpose of obtaining ideas and resources for their planning and teaching.

Another feature of the site (called MAPS for Mathematics Assistance to Practicum Students) was the provision of an annotated guide of links to other helpful websites. Students are encouraged to submit reviews of websites which are then cross checked by other students. If there is agreement then the new site and the corresponding description is added to the list. This is an area that is too large for the lecturer to monitor and allowing students to control this feature of the website has proved very successful to date.

The second most used feature after the resource collections is the threaded discussion facility. It is here that students can post a request, provide comments and responses from the lecturer are also posted. Other students may contribute advice or comments. This facility is monitored and controlled by the lecturer who can remove unwanted or insensitive remarks before they are displayed. The site has a protocol for online discussion that was adapted by others that are available. It contains the usual advice such as:

Start with a friendly greeting and use a friendly and relatively informal tone. You would never go up to a stranger and blurt out a question!

Ask yourself 'Would I say this to their face?' before you send the message. Re-read your message before sending/submitting. It can be embarrassing and often impossible to recover careless messages or those with glaring spelling mistakes. Humour, if brief, can be a great asset in getting messages read.

And it contains the usual don'ts such as:

Don't use all upper case letters (IT MAKES IT LOOK AS THOUGH YOU ARE SHOUTING!!!!).

Don't use discriminatory language (eg sexist or racist).

During the practicum periods, the lecturer monitors this facility regularly and responds either via the threaded discussion facility, a personal email or a by phone if necessary. For example one student from the secondary program wrote:

I had my first lessons and they were so terrible! It was 2 x 50 min lessons for yr9 adv math class. Kids were OK when they were with my supervising teacher, but in my lesson they just didn't listen and I had serious problems in attracting students concentration on the tasks and controlling the whole class. So my supervising teacher gave me 1/14 - total failure!

After discussion with my supervising teacher, I found I had problem with

** Long teacher talk.*

** Disorganised lesson (My lesson went astray very quickly!)*

** Need to be more assertive.*

** Lack of teacher-students interaction and the list goes on...*

I agree with everything my supervisor commented, but I felt so down after my first shot. I feel so bad. Can you give me some tips that can improve my lessons? Also I would like to know how long teacher's talk should be. (ie. what's the kid's concentration span?)

This student had recently migrated to Australia from an Asian country, which is a common for the secondary course at UWS. There is a shortage of secondary mathematics teachers in New South Wales and the Department of Education and Training is running advertising campaigns to attract new teachers, both locally and from abroad. The Department is also funding retraining and accelerated university courses in Mathematics and Science teaching.

In this case a telephone call was made to the student and time was spent allowing the student to ventilate his feelings before gently moving him to consider his part in the situation. I will not include the advice and strategies suggested but they were in harmony with the maxim that "*if you manage learning well, you don't have to worry about managing learners*" (Guskey, 2000, p. 59). The important message arising from this example is in the importance of speed in providing feedback. The student was able to return the next day with confidence and with a plan of what to do. He managed to pass his professional experience after a very poor start.

Another example, listed below resulted in a number of students providing suggestions and sharing their experiences as well as input from the lecturer. Students report that they receive a great deal of comfort and support from sharing their experiences, both good and bad. This opposes claims by others that the internet is an isolating technology that reduces participation in communities (Nie & Erbring, 2000). It is more in harmony with those who claim that the internet can support more collaborative forms of teaching and learning (Jefferies & Hussain, 1998). The student wrote:

I have a Year 10 - Intermediate class with very low abilities -

a) Unable to Simplify equations.

b) Unable to identify changes in sign, and

c) Unable to simplify fractions.

I am teaching them PROBABILITY. The co-operating teachers are very friendly and useful. However, I am unable to infuse success into this class. Are you able to suggest some strategies for this class. I think this is a 10 with year 7 abilities or less.

Again, after the student's frustration and emotions are acknowledged and ventilated, the direction of the advice turned to lesson structure and planning.

To complete the tour of the website, there are two other features such as the frequently asked questions, and an entry port for submitting material. The frequently asked questions mainly dealt with the administration of professional experience. However, some of the threaded discussions were summarised and then added to the list of questions and answers. The entry port allowed students to submit material that was vetted by the lecturer. This also contributes to the gradual accumulation of resources and ideas.

Another interesting feature of the Blackboard and WebCT software is the ability to monitor the number of hits on any part of the website. Both platforms maintain detailed information regarding accesses made by each student to the any feature of the site. This becomes a data source that will be analysed and reported in a later paper.

Conclusion

This paper has presented the reaction to some preliminary research which indicated that University of Western Sydney professional experience students in both final year primary and secondary method courses experienced difficulty in obtaining expert and quick mathematical pedagogical advice while completing their in-school experience. Mathematics specialist lecturers were unable to supervise all their secondary students, while primary students required advice from many specialists. This occurred in a context of shrinking university budgets, where in some cases specialist lecturers were replaced by much cheaper non-specialist part-time staff. This paper also discussed the issues involved in the construction of a website as a means of addressing the needs and concerns of these students. The paper also highlighted a number of features and discussed some of the associated issues.

The success of the initiative has been overwhelmingly positive from the feedback received from the students. While there is still considerable development work to be completed, students regard it as a valuable resource. The following is a common student response:

I have just spent numerous hours downloading resources from the Practicum site on Blackboard to use next semester when I go out casual teaching for the Catholic system. I am, as you can probably understand, very nervous about teaching Mathematics and these resources will come in very handy in easing these nerves of mine.

A recent Senate Inquiry into Higher Education in Australia highlighted a number of problems including:

A dramatic fall over the last decade in the number of secondary students studying the more advanced mathematics subjects and a lack of appropriately qualified staff (Carey, Guttman, & Thomas, 2001, p. 55).

With greater demands placed upon lecturers together with their dwindling numbers, technological solutions such as this website may become one of the options available to universities in meeting the needs of pre-service teachers and the demands of society. Already some groups are predicting that in the near future:

... there will be an emerging realization by parents and the students themselves for the necessity of mathematical competence, and that this is related to quality teaching. They will demand the right to learn mathematics and will demand properly qualified teachers (Carey, Guttman, & Thomas, 2001, p. 58).

A web resource of this nature is both dynamic and adaptable and there is the possibility of universities cooperating and combining expertise for the benefit of all their students. A really creative solution by the universities in my state of New South Wales who offer teacher education in mathematics would be to pool and share their mathematics education expertise. The use of a website available to all mathematics method pre-service students from any university would be a resource that would enhance the programs of all participating universities. The interesting point is that this is possible in all key learning areas and not just mathematics.

This paper has presented an insight into a creative way of teaching and supporting pre-service mathematics methods students while they undertake their professional experience in schools. It is hoped that the paper has presented a challenge to teacher educators of all key learning areas to consider implementing similar initiatives. A good idea is capable of producing many manifestations, which ultimately result in cross fertilisation and strengthen all.

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