# Online Support for Preservice Mathematics Teachers in Schools

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This paper describes the development of a web-based resource designed to support preservice mathematics teachers on school practice. The development of the site resulted in part from a needs analysis conducted with a focus group of students. The purpose of the focus group discussion was to gain from the students their ideas about the type of support that would be most helpful to them as they prepare to teach mathematics lessons, and how the university might be able to assist in these sometimes prolonged periods in school where they are without their traditional support structures. As a result of these discussions, the website was developed and refined to provide a comprehensive resource to suit their needs while on professional practice. Elements of the site, together with potential further developments and research, are described.

Despite Strommen and Lincoln's (1992) claim that: "The technological changes that have swept through society at large have left the educational system largely unchanged" (para no. 3), almost a decade on, technology has made significant, and one might argue, sustained inroads into higher education. The use of multimedia and the internet have provided educators with powerful tools to create effective and immersive learning environments (Jonassen, 1995; Jonassen & Reeves, 1996; Wilson, 1996). Such technology-based learning environments (e.g., Herrington, Sparrow, Herrington, & Oliver, 1997; Mousley, Sullivan, & Mousley, 1996) have been particularly productive in providing preservice teachers with authentic and realistic contexts within which to explore problems and issues that face teachers today, *before* they move to real classrooms.

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 university and move to schools for professional practice.

## The Web as a Support Tool for Preservice Teachers on Practicum

The purpose of this paper is to describe the development of a web-based resource designed to support preservice mathematics teachers on school practice. The idea to develop such a resource arose from a number of concerns of mathematics teacher educators at Edith Cowan University. As with many teacher education programs, cost reductions have led to a cut back in university staff preventing many preservice teachers from direct involvement with university supervisors on their school practicum. Students are receiving less specialist supervision than in the past to the extent that on block practices, more than one third

have a university supervisor outside their chosen specialism. In many cases, school visits have been replaced with phone calls, with the handing over of responsibilities to school staff. Other problems with the professional practice system have been identified in the literature, such as: the disparity between the theory students learn at university and the practical realities of the classroom (Goodlad, 1991); the removal of students' "web of support" while on practice (Roddy, 1999); supervising teachers' inability to relate practical teaching episodes to general pedagogical principles (Kennedy, 1991); the concern that students exposure to a small number of supervising teachers limits the value of the experience (Richardson-Koehler, 1988); and the practical focus on how to teach at the expense of having to make decisions about why and what to teach (Zeichner, 1981). Many students also find themselves in schools with limited resources for lesson planning, particularly the type that reflect the teaching approaches developed in methods courses, such as concept development through problem solving, and investigations.

Educators are acutely aware that the internet has provided a powerful force which has the potential to impact significantly on the way education is delivered at all levels of schooling. Together with multimedia, the internet can be used to deliver effective and immersive learning environments (Jonassen & Reeves, 1996; Wilson, 1996), and can also provide efficient and collaborative means of communication for students with their teachers, and with each other (Jonassen, 1995). It is well placed to provide opportunities for cooperation and communication that never existed with previous technologies.

Teacher educators are also aware that classroom teachers will need to be able to use internet technologies, and incorporate them into their classroom activities. It is important that preservice teachers are given the opportunity to engage in web-based learning environments. For example, Lowther, Jones and Plants (2000) contend that learning to use technology as a tool is far more important than learning about technology. Harmon and Jones (1999) have distinguished five levels of use of the web common in schools, universities and corporations: *informational web use*, where students access the web as a source of information; *supplemental web use*, where web use is more integrated and some curriculum materials are available; *essential web use*, where students cannot be productive members of a class without web access to the materials; *communal web use*, where course content is available online, students may or may not be physically present and use is made of bulletin boards and discussion boards; and finally *immersive web use*, where no face-to-face classes exist and all course content and interactions occur online using web technologies and constructivist pedagogies extensively (pp. 424-425). With the possible exception of the first level, all these levels of web-use involve learning *with* technology, rather than learning *from* it. Lowther, Jones and Plants (2000) suggest that teacher education programs need to include a range of instructional approaches in order to ensure that preservice teachers can acquire competencies related to web-based education. For example, they suggest that methods such as a simulated K-12 classroom (where teachers take on the role of a child learning with technology), modelling, observing and participating in technology settings, and reflective practices, all have the potential to engage preservice teachers in using the internet in a meaningful way in their own classrooms.

Clearly, preservice teachers need to learn not only the technical aspects of using the internet in their classrooms, but also how to use it as a tool to improve their

students' learning, to refine their own development as teachers, and as a means to maintain contact with their traditional supports.

With these concerns in mind, and a recognition that the internet could be employed productively for such a purpose (Casey, 1994; Hutchinson & Gardner, 1997), a Committee for University Teaching and Staff Development Grant (CUTSD) was applied for and awarded to develop a web site that would provide:

- open communications channels, to discuss problems, with peers and lecturing staff;
- a database of prepared lesson plans accessible through a simple search engine;
- links to other web-based resource materials for use in lessons;
- video clips of teaching strategies with teacher and student commentary; and
- answers to frequently asked questions by students on school practice.

## Assessing the Need

To establish the effectiveness of the resource, focus group interviews were conducted with eight students, studying undergraduate mathematics education, to determine their perceived needs on school practice and their views on how a web resource could assist. These students were required to attend 18 weeks of school practice during their teacher training, varying from continuous blocks of time in a school to distributed practice, where students attended a school for one day a week over an extended period.

Focus group techniques were used to elicit opinion from the students. The interaction between the students proved to provide data on issues and problems, which were of greater richness and depth than might have been collected by individual interviews. As Morgan (1988) notes one of the strengths of focus group methodology is the intentional and explicit use of the group interaction: "to produce data and insights that would be less accessible without the interaction found in a group" (p. 12).

The purpose of the focus group discussion was to gain from the students their ideas about the type of support that would be most helpful to them as they prepare to teach mathematics lessons, and involve themselves in school life generally. In particular, we wanted to know the types of problems they have, and how the university might be able to assist in these sometimes prolonged periods in school where the students are without their traditional support structures. In the focus-group discussion, students were asked questions related to two principal areas:

1. What are some of the difficulties you face on professional practice? (*Prompt questions*: Can you tell us about some of your professional practice experiences? Have you had any difficulties relating to lesson planning? Teaching the students? Dealing with supervising teachers? Resources? Did you have difficulty contacting lecturers? Have you found educational theory useful to your practice?)
2. Do you have any suggestions on how the university might be able to assist you to overcome these difficulties? (Prompt questions: What kind of

resources could the university produce that would help you, e.g., booklets, videos etc? How useful would a web-site devoted to teachers on professional practice in mathematics be? If you were to use such a web-site in your professional practice in school, what would you want it to provide? Content? Communication? Resources?)

The focus group discussion was audio taped and transcribed for analysis. Transcripts were analysed using techniques of qualitative analysis recommended by Miles and Huberman (1994): data reduction, data display, and conclusion drawing and verification. Student comments were grouped to reflect common themes.

From these themes and comments, specific recommendations were formulated by the researchers on the type of web-based resource that would best meet the needs of students on professional practice. Table 1 provides a summary of responses for the first area of investigation, together with the researchers' suggested solutions and their possible manifestation within an online resource.

The student teachers gave several ideas on the type of support the university might provide to make their practice more enriching and productive. These are listed in Table 2, together with the researchers' view of solutions and manifestation in a web-based resource.

Generally, the student teachers were enthusiastic about having a variety of lesson planning ideas readily accessible, but they made it clear that they required much more substantial support. While just-in-time support was clearly important, particularly when students had little notice that they were required to give a lesson, more resources on learning mathematics and mathematical pedagogy, that could be accessed in a reflective way, were also required.

Table 1
*Summary of Difficulties Encountered on Professional Practice with Possible Solutions*

| Problem | Example student explanation of problem | Possible solution | Possible manifest-ation in online resource |
|---|---|---|---|
| Problems with mathematical understanding | "Getting across to the kids, how to do things basically, fractions and things like that. Actually explaining to them…. the things I don't understand myself, it's hard to get across". | Web-based resources that develop mathematical understanding | Links to appropriate websites |
| Disparity between the way students are encouraged to teach mathematics and the way they learnt mathematics | "I find the hardest thing is that, we were taught a certain way at school, and now we are being taught not to teach how we learnt it". | Exposure to different teaching approaches | Video clips of teachers using a variety of approaches |
| Disparity between the way students are encouraged to teach mathematics and the way mathematics is taught in school | "Like not doing multiplication—tables wise—or not doing carrying and that sort of thing. I find it hard because they are still doing it that way in schools, but we are told we should steer away from that. It's really hard to know where to go". | Exposure to different teaching approaches | Video clips of teachers using a variety of approaches |
| Lack of resources | "We have to plan the night before. Sometimes they give it to you a couple of nights before, and you have to find resources. You don't have enough time to run about here and there to find these resources". | Provide resources for mathematics teaching | Lesson plans URLs of appropriate sites |
| Lack of ideas for lesson plans | "Trying to create some ideas to relate it to what you are trying to teach the children to do, and how to do it. We are told one example, like how to do a shop but not how to set it up and how to make it work". | Provide students with a range of lesson plans related to strands and year levels | Lesson plans classified according to content, process and year level |
| Lack of practical strategies for dealing with large classes | "We are told ideas but not really how to go about them, like in a class of 30, you know it's such a huge class". | Access to broader educational issues such as class management | Links to other general educational websites |

Table 2

*Summary of Suggestions on How the University Might Assist in Overcoming Difficulties*

| Suggestions for university | Example student explanation | Possible solution | Possible manifest-ation in online resource |
|---|---|---|---|
| Practical exemplars | "I would like to be able to see a lot more in practice, like videos in schools, seeing demonstrations of these things, because it's easy enough to read in a book, but to actually see it puts a whole different perspective on things". | Practical demonstrations of teaching strategies suitable for a variety of class levels | Video clips of teachers in real classrooms using teaching strategies |
| Resources for lesson ideas | "Have a Resource Centre, may be on the internet to give you some ideas" | Ready access to resources | Lesson plans with downloadable lessons resources Links to lesson plan websites |
| Support via telephone | "It would be nice to be able to speak to someone instead of an answering machine." | Ready access to lecturer and other students for mutual support | Email access to lecturer Discussion board with other students |
| Australian web-based resources | "It would be good to have something Australian … not dimes and nickels". | Web-site with variety of cultures represented | Links to sites reflecting cultural and ethnic diversity |
| Easily accessible lesson support | "When you're on prac, you're just so busy you don't have time to go searching". | Centrally located resources for just-in-time support | Fully searchable site covering a variety of resources |

The feedback received from the students enabled the basic website to be developed with a more specific focus which would directly address the concerns and suggestions of the target group. The design of the *Mathematics Education On the Web* (MEOW) site is described in more detail below.

# Design of the MEOW Website

The interface of the site resembles a typical (if well-equipped) teacher preparation workspace. It features a desk and other items that act as metaphors for the resources that can be accessed from the site. Figure 1 shows the central interface which acts as a main menu, and it is here that the students choose the type of resource or support they require.

*Figure 1.* The main MEOW interface.

The design of the MEOW website utilises databases to simplify management and provide a flexible, yet efficient means of displaying and representing the content. The database driven approach has been used for a range of reasons:

- management and display of media is separated and hence more easily controlled;
- simplifying the design process by requiring fewer HTML source files;
- simplifying the maintenance and extension of the website by not requiring any editing of display information, only content;
- cross referencing of lesson plan and teaching/assessment content for flexible navigation and discovery of information; and
- future extensibility by the addition of frequently asked questions (FAQs) about issues related to teaching mathematics.
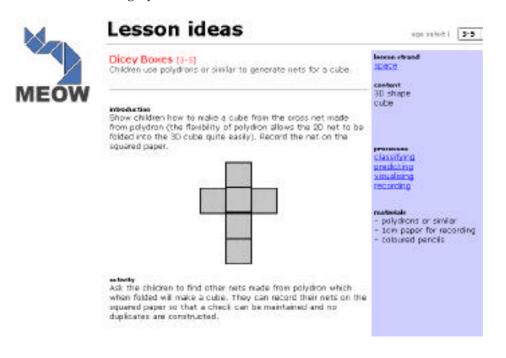
A student on professional practice can access the following elements:
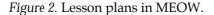
## Lesson plans: "We have to plan the night before"

A student on professional practice, when faced with little notice to prepare a lesson can access a variety of mathematical lesson plans from the drawers of the desk on the interface.

The lesson plans database enables students to choose according to a number of different parameters, giving them lesson plans which precisely meet their needs. Lesson plans are categorised according to a number of keys: the *year level* (K-2, 3-5, 6-8 and 9-12), *content* categories (e.g., space, number, measurement) and the *processes* being used (e.g., classifying, visualising). These keys are not only used so that

teachers can find plans relevant to their specific requirements, but are used to provide cross references between common content and processes. For example, in the Dicey boxes lesson (see Figure 2) the content area is *space* and the processes are *classifying, predicting, visualising* and *recording*. A teacher interested in finding other exercises in *classifying* can select from a menu of processes and find other plans that also relate to that category.



*Figure 2.* Lesson plans in MEOW.

## Message board: "I find it hard sometimes going into prac"

Clicking on the message board gives students access to a threaded discussion board, where messages and all related postings are grouped so that students can follow discussions in logical sequence. If students have problems, they can post messages to the discussion board, where other students and the lecturer can make suggestions and provide support. In such a way, contact with traditional support groups can be re-established. Useful discussion board items (and suggestions posted in response) will form the basis of the Frequently Asked Questions (FAQs) site which is accessible from the file on the desk in the main MEOW interface.

## URL posting: "You're just so busy you don't have time to go searching"

When students click on the computer on the desk, they have access to a range of relevant websites beyond the MEOW site (Figure 3). Students can access any of these sites by simply clicking on the link. They can also add any interesting sites

themselves, together with a short annotation describing its value to other preservice teachers.



*Figure 3.* The useful websites.


*Teaching strategies: "I would like to be able to see a lot more in practice"*

Students wishing to access examples of classroom strategies can presently observe video clips of teachers in real classrooms demonstrating teaching and assessment strategies appropriate to mathematics classrooms. These strategies use a database to record a text description of each strategy, its type (assessment or teaching), and details about the video sequences available (Figure 4). Each screen is created dynamically from the teaching strategies database. Students can observe teachers demonstrating a particular strategy, check teachers' and students' perspectives on that strategy and read descriptions, enabling them to explore different classroom strategies reflectively.

*Figure 4.* Teaching strategies in MEOW: Text description, and videos of the use of manipulatives, and the teachers' and students' comments.

## *Contacts: "It would be nice to be able to speak to someone"*

Regardless of where the students complete their professional practice, students can have email access to their lecturer via the phone metaphor on the desk on the interface. Clicking on this image gives students access to the lecturer's phone number (with available times), together with a direct email link (Figure 5).

**Contacts**

Dr Joanne Smith
Phone: +61 8 9123 4567
Fax: +01 8 9123 6789
Email: j.smith@cowan.edu.au

Generally available for a quick response:
Monday 9.00-11.00 am
Tuesday 1.00-5.00 pm
Thursday 2.00-4.30 pm
Friday 9.00-11.00 am

*Figure 5.* The contact information.

The use of databases means that the content can be extended by simply adding records in the appropriate database—the display of menus and the cross-referencing of content is then automatically updated without the need to update the underlying display (HTML) code. In this way, the resource grows as a vigorous, searchable, comprehensive, and current resource.

## Conclusion

A web resource of this nature is both dynamic and adaptable. Student teachers will be encouraged to add lesson plans and links to other web resources. A rich collection of advice should grow in response to students' periodic and prevailing concerns. The potential is there to extend the functions of the web site and its boundary of support. As a resource developed with Commonwealth funding it is available for use by any University and any mathematics education community that wishes to use it. However, in building a community of learners, the boundaries need not be national ones. The project team is now working with a team of mathematics educators at the *Institut für Didaktik der Mathematik* at the *Westfälische Wilhelms-Universität Münster* in Germany to extend the capabilities of the site for German student teachers.

While budget cuts will continue to be part of the higher education landscape, the internet can be a useful tool for reducing the isolation and providing preservice teachers on school practice support in both their pedagogical and communication needs. Further research is under way to investigate how students use the resource, and to determine their opinions on ease of use, functionality and development of the site. Research is also investigating how the resource can be used to support beginning teachers, particularly in isolated and remote areas.

Despite recent claims that the internet could be "the ultimate isolating technology that further reduces our participation in communities" (Nie & Erbring, 2000, p. 19), the project described here attempts precisely the opposite. When fully operational, it will provide many of the benefits of collaboration, communication and human contact, without the physical constraints imposed by the lonely isolation of teaching practice. In so doing, it will maintain and enhance students' roles as valued members of a community of scholars, able to learn, plan, create, and consult as they practice mathematics pedagogy in a fully supported environment.

# References

Casey, J. M. (1994). TeacherNet: Student teachers travel the information superhighway. *Journal of Computing in Teacher Education, 11*(1), 8-11.

Goodlad, J. (1991). Why we need a complete redesign of teacher education. *Educational Leadership, 49,* 4-10.

Harmon, S. W., & Jones, M. J. (1999). Planning and implementing web-based instruction: Tools for decision analysis. In K. E. Sparks & M. Simonson (Eds.), *Selected research and development papers presented at the 1999 National Convention of the Association for Educational Communications and Technology* (pp.423-427). Houston, Texas: AECT.

Herrington, A., Sparrow, R., Herrington, J., & Oliver, R. (1997). *Investigating teaching strategies in mathematics classrooms* [Book and CD-ROM]. Perth: MASTEC, Edith Cowan University.

Hutchinson, C. J., & Gardner, J. Y. (1997). Using the Internet to improve the student teaching experience. In J. Willis, J. D. Price, S. McNeil, B. Robin, & D. A. Willis (Eds.), *Technology and Teacher Education Annual, 1997* (pp. 1204-6). Charlottesville, VA: AACE.

Jonassen, D. (1995). Supporting communities of learners with technology: A vision for integrating technology with learning in schools. *Educational Technology, 35*(5), 60-63.

Jonassen, D. H., & Reeves, T. C. (1996). Learning with technology. In D.H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 693-719). New York: Macmillan.

Kennedy, M. (1991). Some surprising findings on how teachers learn to teach. *Educational Leadership, 49,* 14-17.

Lowther, D. L., Jones, M. G., & Plants, R. T. (2000). Preparing tomorrow's teachers to use web-based education. In B. Abbey (Ed.). *Instructional and cognitive impacts of web-based education* (pp.129-146). Hershey, PA: Idea Group Publishing.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook.* (2nd ed.). Thousand Oaks, CA: Sage.

Morgan, D. L. (1988). *Focus groups as qualitative research.* Newbury Park, CA: Sage.

Mousley, J., Sullivan, P., & Mousley, P. (1996). *Learning about teaching: An interactive tutorial program to facilitate the study of teaching* [CD-ROM and handbook]. Adelaide: AAMT/CSMSE, Deakin University/Australian Catholic University.

Nie, N. H., & Erbring, L. (2000). *Internet and society.* Stanford Institute for the Quantitative Study of Society. Available: http://www.stanford.edu/group/siqss/. [Accessed 25 May, 2000].

Richardson-Koehler, V. (1988). Barriers to the effective supervision of student teaching: A field study. *Journal of Teacher Education, 34,* 28-34.

Roddy, M. (1999). Using the internet to unite student teaching and teacher education. *Journal of Technology and Teacher Education, 7*(3), 257-267.

Strommen, E. F., & Lincoln, B. (1992). *Constructivism, technology and the future of classroom learning.* Available: http://www.ilt.columbia.edu/k12/livetext/docs/construct. Html. [Accessed 25 May, 2000].

Wilson, B. G. (Ed.). (1996). *Constructivist learning environments: Case studies in instructional design.* Englewood Cliffs, NJ: Educational Technology Publications.

Zeichner, K. (1981). Are the effects of university teacher education "washed out" by school experience? *Journal of Teacher Education, 32,* 7-11.

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