A TECHNOLOGY COURSE FOR PROSPECTIVE MATHEMATICS TEACHERS

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BACKGROUND

Teacher education in Illinois is currently in a period of change. All teacher education institutions are to have *standards-based* teacher preparation programs in place by the year 2003 (as apposed to the existing *course*-based programs). Under a *standards-based* program, institutions must certify that their teacher-education graduates are competent relative to performance standards. (The relevant state and national standards documents are listed in the reference section.) At Western Illinois University the Mathematics Department is presently in the pilot stages of redesigning their program. It has long been known that a single secondary teaching methods course is not sufficient to provide prospective teachers with all they need regarding teaching methodologies, the intricacies of the high school mathematics curriculum, assessment, *and* the use of technology for student learning. This has now become an acute problem, due to the increased expectations of the new standards. As part of W.I.U.'s pilot/redesign program, prospective high school mathematics teachers now take a three-course sequence: Technology in Secondary School Mathematics, Pedagogical Knowledge of Secondary School Mathematics, and The Teaching of Secondary School Mathematics. The purpose of this paper is to provide an explanation of the first of these courses, the Technology in Secondary School Mathematics course, which was taught for the second time in the fall of 2000. The content of the course will be described, followed by a section on some of the mechanics of delivering the course, and finally, some conclusions drawn from the first two offerings of the course.

COURSE CONTENT

The course has two "orthogonal" dimensions. The first is the *technology and instructional issues* dimension. The four aspects of this dimension are (a) graphics calculators, (b) computers, (c) the Internet, and (d) planning for instruction. The introductory (four to five) weeks of the course are an overview of the four aspects of the technology and instructional issues dimension. The second, orthogonal, dimension is the *content* dimension. Following the initial overview portion of the course, four content areas are investigated: (a) the teaching of function concepts, (b) geometry, (c) data collection, and (d) statistics. As each content area is considered, the four aspects of the first dimension are considered relative to the specific mathematics content area. Additional detail is provided in the two sections that follow.

Technology and Instructional Issues Dimension

The four aspects of the technology and instructional issues dimension are introduced in the beginning of the course. There are two purposes for this introduction. The first is to establish a baseline level of competence with using the

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technology. The second is to establish a structure for the balance of the course.

The basics of graphics calculator use are discussed, including menus, modes, tables, graphs, and use of the TI-GraphLink cable to the computer. The second aspect of this dimension is basics of computer use. Included here are file management, graphics, copying and pasting between different software packages, electronic spreadsheets, educational software evaluation, and MicroSoft PowerPoint. The third aspect is Internet use. Internet navigation, website evaluation, and creation of a basic webpage are covered. Finally, the fourth aspect of the technology and instructional issues dimension is planning for instruction. Publications and research on the use of technology in the classroom are reviewed. In addition, some strategies for structuring the mathematics classroom to utilize technology are introduced. For example, the one-computer classroom, a classroom set of graphics calculators, the five-computer classroom, and complete computer lab.

Content Dimension

The bulk of the course is an examination of four math topics that can be taught effectively with calculator and computer technology. Each time a topic is considered, graphics calculators, computers, the Internet, and instructional planning are considered to see how these could enhance student learning of the topic. The first topic, functions and relations, is central to mathematics, but is also complex, with many related concepts and often misunderstood by students. Dynamic software with linked representations are investigated in this course to learn ways the software can engage students and illuminate function concepts. Dynamic geometry software and Internet applets are considered for the teaching of geometry concepts. Data collection is done using calculator-based laboratories (CBL's), calculator-based rangers (CBR's), and LEGO dacta Technology Building Equipment. Data is analyzed using calculators and computers.

COURSE MECHANICS

One of the main goals of the course is to make students aware of the many resources that are available to them as future mathematics teachers. Toward this goal, one course assignment has students find four types of resources (print materials, software, Internet sites, funding sources for obtaining money to purchase technology) and type up a brief description of the resources. As is the case with many of the course assignments, these annotated resources are submitted electronically, and the instructor then compiles the information on a course website (see http://www.wiu.edu/users/mfjro1/wiu/stu/m475/for475.htm). One of the underlying principles of the course is that the course members are to share ideas (and otherwise share the workload). Other examples of this principle are the two, 10-minute presentations each student delivers, demonstrating a software package and a website, respectively. Students sign up for these presentations in advance, so that each student investigates (evaluates, and presents) a different software package from the other class members (and different websites).

Three important writing assignments of the course are papers the students write on how to use technology in the classroom. Rather than have these as typical college papers, the assignment is to write proposals to one's (future) school

administration for using technology in the secondary mathematics classroom. The papers propose designs for using, (a) a "low amount" of technology (classroom set of graphics calculators, for example), (b) "medium amount" of technology (five computers in the classroom, for example), (c) "high amount" of technology. The students do compile a few "technology" lesson plans in the course. However, this is not an emphasis of the course, as this is a focus in the teaching methods course, which is the third course in the three-course sequence.

The exams in the course are primarily made up of "performance items." For example, students solve a problem using the graphics calculator or computer spreadsheet and the calculator or computer file are shown to the instructor for evaluation. In addition, some philosophical questions are asked on the exams. The final examination of the course requires students to reflect and summarize the "who, what, where, when, why, and how of technology in the mathematics classroom to help students understand mathematics." In the pilot phase of the course, students were given the final examination questions prior to the exam session. Students prepared their answers prior to the exam session and a summary discussion (and electronic compilation of information) was held at the exam session.

CONCLUSION

The first two offerings of this course (Fall 1999 and Fall 2000) have been quite successful with the students gaining much from the course. The classroom utilized in the Fall 2000 semester was found to be ideal. The room had tables in the center of the room which were used for class discussions and demonstrations by the instructor, using a projection system. Around the perimeter of the classroom are computers. This made for a smooth transition from instruction/discussion to student work on the computers. Approximately one-third of the class time was spent with the students on the computers interacting with software, linked calculators, and the Internet. The "mining" and sharing of ideas were very good in the course. The instructor and students focused on free software and java applets available on the Internet, and commonly used software (such as PowerPoint and spreadsheets), realizing that many school districts have limited funds for computer software. As described above, the course was structured around two dimensions—each with four aspects. Realistically, there was not time to address all sixteen (4x4) topics in detail. However, the format proved to be a good structure for the course. The Mathematics Department at Western Illinois University plans to continue offering the Technology in Secondary School Mathematics in the future.

REFERENCES

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