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Abstract

Kennesaw State University's comprehensive, nine-credit-hour, methods course integrates general and mathematics-specific pedagogical training with a structured four-week field experience prior to student teaching. This course blends essential units on conceptual understanding of mathematics, lesson planning, assessment, classroom management, and diversity with mathematics-specific methods. All topics are aligned with National Council of Teachers of Mathematics standards and Georgia Performance Standards. Throughout the course, students complete a variety of assignments that require them to practice the skills highlighted in class readings and discussions, and they adapt and generalize those skills during their field experiences. Students have numerous opportunities in class and in the field to implement and to reflect upon pedagogical and assessment strategies and to receive feedback from course instructors, from other students, and from collaborating teachers. This intense course has many benefits and challenges for both the instructors and the students, but it is one of the most highly anticipated courses of secondary mathematics education majors at Kennesaw State University. With strong support of department administrators and the entire mathematics education faculty, this methods class has been quite successful in preparing the seniors for their student teaching experiences.

The Kennesaw State University Mathematics Methods Model

Course Overview

At Kennesaw State University, all secondary mathematics education majors enroll in a comprehensive nine-credit-hour methods course, entitled "Teaching of Specific Subject" (TOSS), usually in the semester prior to student teaching. This course includes twelve weeks of intensive classroom instruction, with three three-hour class meetings each week (usually, Monday, Wednesday, and Friday mornings). In the middle of the semester, TOSS students complete a four-week, half-day field experience during which class sessions are suspended. At their assigned middle or high schools, the students observe classes and various school functions and teach a unit, of their own design, under the guidance of a collaborating teacher and university supervisor. TOSS instructors serve as university supervisors, but, with large classes, additional mathematics education faculty assist with observations. Students earn six credit hours for successful completion of the classroom portion of the course and three credit hours for a successful field experience. This credit allocation enables students to repeat only the field experience if they were unsuccessful in that aspect of the course but were successful in the classroom portion.

In order to qualify for acceptance to TOSS, candidates complete an application process under the guidance of their academic advisors during the semester prior to enrollment. Prerequisites for acceptance into the course include admission to teacher education through the Bagwell College of Education and successful completion of two courses, an education course entitled "Learning, Motivation, and Classroom Management" and a mathematics course entitled "Advanced Perspectives in School Mathematics I."

Course Units and Assignments

The TOSS course includes five primary units designed to help students develop teaching skills that they can apply in their first teaching experiences. Joyce and Showers (1995) suggest that teachers can develop new skills through a process that closely integrates theory and practice. This process includes the development of the theory and rationale behind the skill, the demonstration of the skill, an opportunity to practice and to receive feedback on the skill, and the

adaptation and generalization of the skill through sustained coaching. In order to help prospective teachers develop new skills, TOSS instructors compile a coursepack of readings that introduce students to the theories behind the teaching skills related to each unit of study. Instructors then facilitate classroom discussions that address the theories, the associated teaching skills, and the benefits and challenges of implementing the teaching skills. They also design classroom activities through which they demonstrate skills. Students complete assignments that enable them to practice their teaching skills and to receive extensive feedback from their instructors and from their classmates. The TOSS instructors then coach the students in their skills throughout their field experiences, and other mathematics education professors continue to coach students throughout their subsequent student teaching experiences.

In addition to the five major TOSS units, instructors integrate two ongoing content strands throughout the course. First, students read and discuss the Georgia Performance Standards (Georgia Department of Education [GADOE], n.d.) during the first week of class, and these standards are discussed in relation to every topic throughout the remainder of the course. Also, each week, instructors integrate examples of various mathematics teaching methods and strategies, as endorsed by NCTM (2000) and GADOE (n.d.), into the class. Such lessons include data collection, analysis, and regression activities that require the use of graphing calculators, calculator-based laboratories, and/or computer software; exploration of fractions and geometry with manipulatives; and problem solving activities that require cooperative learning.

The first TOSS unit centers around conceptual understanding of mathematics or learning mathematics with understanding, as promoted by NCTM (2000) and many mathematics educators (e.g., Brownell, 1935; Hiebert & Lefevre, 1986; Skemp, 1976). This unit actually begins prior to the start of the course with a pre-semester writing assignment that requires students to read much of *Principles and Standards for School Mathematics* and to reflect on the vision of mathematics education presented by NCTM (2000). During the first week of class, students read an article that describes the differences between conceptual and procedural knowledge (Skemp, 1976) as well as a case study of a student who has developed only procedural knowledge of mathematics (Erlwanger, 1973). In class, instructors and students discuss the readings and view film clips of teachers who are implementing lessons designed to promote conceptual understanding of various mathematics topics. Students work on problems that challenge their understanding of mathematics from a conceptual perspective. Students also search on-line sites for lesson plans that promote conceptual understanding of mathematics for

various grade levels. Through these activities, students begin to develop skills in identifying what types of classroom instructional strategies promote connection-making in mathematics.

After students have committed to promoting conceptual understanding in their own teaching, they begin to develop their own lessons in the second unit of TOSS. Students read about Bloom's Taxonomy as it is applied by a mathematics teacher (Kastberg, 2003) and practice using this taxonomy as a tool for designing classroom questions, activities, and assignments that promote higher order thinking and connection-making. Next, instructors and readings introduce learning outcomes, and TOSS students practice writing outcomes for various grade levels. Students then identify various modes of instructions (e.g., lecture, discovery lessons, collaborative problem-solving sessions) and critically analyze each mode's benefits and challenges from both teacher and student perspectives.

After these discussions, TOSS instructors guide students through the development of a detailed lesson plan. Students begin to construct their own comprehensive lesson plans, both individually and in groups. Instructors require that each lesson plan submitted be aligned with GPS and include a strong opening activity and a closure. Instructors allow flexibility in delivery of new material so that TOSS students have the freedom to create student-centered discovery lessons that do not conform to the structure of traditional lesson plans. All group lesson plans are taught in class, with each group member participating in the delivery of the lesson. Classmates and instructors provide feedback. Students continue to hone their lesson planning skills when they create the unit plans that they will implement in their field experiences. The unit plan project requires detailed lesson plans for every day that students will teach in the field. A few weeks before the field experience, the students submit their unit plans to their instructors for feedback, and they then complete any required revisions. When unit plans are approved by TOSS instructors, students provide their plans to their collaborating teachers for their feedback and approval. Adaptation of lesson plans continues throughout the field experiences, and collaborating teachers and university supervisors coach students on the implementation of their units.

Upon completion of the unit on lesson planning, students learn how to assess the impact of their lessons on student learning. In the assessment unit, students read about and discuss strategies of formative and summative assessment. Bloom's Taxonomy is reintroduced in this unit as a tool for developing alternative assessments and open-ended questions. Students practice writing open-ended questions on various mathematical topics and receive feedback from their

peers and instructors. Instructors demonstrate and discuss various questioning techniques, such as calling on individual students, wait time, and verbal feedback. Next, instructors begin lessons on test construction and scoring techniques. They provide students with sample mathematics tests, and students discuss strengths and weakness of each sample. In groups, students create their own tests and present them to the class for feedback. As a next step, each group creates a scoring rubric for the test that they created and present the rubric to the class. Rubrics are compared and contrasted, and instructors share examples of rubrics that were developed by other educators. The TOSS midterm is the culminating activity for this unit. The midterm assignment requires students to create a test on both mathematical and pedagogical material from TOSS and to design a rubric for scoring the test. On the day of the midterm, students exchange tests and complete the tests they are given. After test administration, the test creator grades the test, and each student writes a reflection on the test that he or she took with respect to the assessment techniques learned in the course. The midterm grade is based on the effectiveness and appropriateness of the test created, on its corresponding rubric, and on the reflection on the test taken (not on the performance on the test taken). Continued skill development in summative assessment occurs when students develop quizzes and the test for the unit plan that they create for the field experience. TOSS students also gain additional experience in formative assessment as they develop their questioning skills in the classroom, with feedback from their university supervisors and collaborating teachers.

After the lesson planning and assessment units have been completed, TOSS instructors turn their attention to classroom management. Students read about various classroom management strategies and policies, and they discuss Kohlberg's stages of moral development, as interpreted by Thies-Sprinthall and Reiman (1990). Classroom discussions address appropriate classroom management strategies and discipline policies for various age levels. In groups, students develop sample classroom management policies and share them with their peers and instructors for feedback. Other activities include role play of discipline situations and shared experiences about appropriate and inappropriate discipline strategies that students have witnessed in the classroom (either as students or as observers). A second topic of this unit is parent communication strategies. Course instructors prepare various scenarios with parents that teachers might expect to encounter (e.g., confrontational parent/teacher conference, parent who wants advice on how to help her/his child be more successful, situations that might occur at open house). Groups discuss how to handle the various scenarios and then share their thoughts with the class. The culminating

project for this unit requires students to write a letter to the parents of their future students. The letter should be appropriate to send home on the first day of school and should outline classroom rules and policies. Students have ample opportunities to practice and to adapt their classroom management and discipline skills, with feedback from their supervisor and collaborating teacher, while teaching their units during their field experiences. Some students even have the opportunity to observe parent conferences and other parent interactions with their collaborating teachers.

The final TOSS unit occurs when students return from the field experience. This unit begins with the creation of a comprehensive list of the types of diversity that students encountered during their field experience (e.g., ethnic, gender, family responsibilities, learning styles). Students then read and discuss various issues related to a diverse student population, such as the achievement gap and the need to vary instructional techniques to accommodate different learning styles. Discussions also challenge students to become aware of their own prejudices and biases that might influence their behavior and interactions in the classroom. As a culminating activity, students develop a set of strategies and considerations for successfully teaching a diverse population. Continued experience with the topics from this unit occurs during the student teaching experience.

Each of the five units in TOSS is designed to help students develop teaching skills and to provide meaningful opportunities to practice those skills, both in the classroom and in the field. Instructors are diligent in providing constructive feedback and in eliciting the feedback of classmates so that a variety of ideas and perspectives are presented. In addition, standards-based mathematics teaching methods are incorporated throughout the course, and topics and assignments are explicitly aligned with the Georgia Performance Standards. Throughout the semester, the students compile an online portfolio of their classwork and reflections that provides an excellent foundation from which they can build their student teaching portfolios.

Structure of the Field Experience

The four-week TOSS field experience is designed to provide students a first opportunity to implement their newly acquired mathematics skills in the public schools; however, students are provided significant structure, guidance, and support at all times. TOSS students spend two weeks in the field observing various classes and becoming acquainted with the various administrative and departmental structures in the school. They spend the other two weeks teaching the unit that they designed to two groups of students. This experience provides all of the

conditions identified by Sprinthall and Thies-Sprinthall (1983) that promote teacher development. These five conditions are a significant new experience, guided reflection and analysis, balance between experience and reflection, support and challenge, and continuity.

The creation and implementation of the unit plan serve as the significant new experience. As part of the field experience, TOSS students complete assignments that require them to reflect on their teaching and observations. During the weeks that the students are not teaching, they complete ten formal observations. Five of these observations are focused on various aspects of the teaching of mathematics: content (i.e., the nature of messages that teachers relay about the characteristics and importance of mathematics), discourse (i.e., the types of questions that teachers ask), the teacher's homework practices, the teacher's use of class time, and teacher expectations and stereotyping (i.e., issues of equal access in mathematics teaching). The other five observations are the individual student's choice. They can observe other classes (mathematics or other disciplines), and they can observe other events in the school (e.g., assembly, ballgame, lunch period). For each of the ten observations, students are required to submit both a description of the observation and a reflection on their observations (i.e., their reactions and feelings about the classes and events they observed and their analyses of the aspects that were effective or that could be improved). In addition to the observations and reflections, students are required to submit overall reflections on their experiences in the schools and the effectiveness of their teaching.

Two major analytical and reflective assignments are required as part of the field experience. For the first assignment, students videotape a lesson that they teach, watch the video, and critique their own teaching by answering a series of questions about the various teaching skills they incorporated. The second major assignment is a program-required assessment, entitled Impact on Student Learning. To complete this assignment, students must gather data that enables them to determine the effectiveness of their teaching on an entire class, on two subgroups, and on two individuals. Students must also reflect on any patterns of student achievement that emerge through their analyses and must attempt to explain why such patterns might exist. To conclude the assignment, students must develop short-term and long-term strategies for addressing any identified weaknesses in teaching or assessment practices. Through these experiences and reflections, Sprinthall and Thies-Sprinthall's second and third conditions (guided reflection and analysis and balance between experience and reflection) are satisfied.

The university supervisors and collaborating teachers for the field experience provide

Sprinthall and Thies-Sprinthall's fourth condition, support and challenge. Instead of a letter grade, students receive a "satisfactory" or "unsatisfactory" mark for the field experience portion of the course. The non-graded nature of this experience allows the university supervisor and collaborating teacher to serve as mentors rather than evaluators. The collaborating teachers observe the students each day that they are teaching and provide constructive feedback and suggestions, as documented by a daily conference form. The university supervisor observes students at least once during their teaching experience and provides feedback and specific suggestions to challenge the student to improve.

Sprinthall and Thies-Sprinthall's final condition for teacher development, continuity, is satisfied by the design of the field experience. Rather than teaching a few days, students have an opportunity to implement and to assess an entire unit. Furthermore, during the next semester, they continue their teaching experience in student teaching.

The four-week TOSS field experience is designed to provide students with a highly structured first teaching experience that exposes them to some of the realities of teaching; however, they receive a great deal of support and feedback from both the collaborating teacher and the university supervisor. The students not only implement lesson plans of their own design, but they also analyze and reflect on their practice and have the opportunity to begin to address some of their weaknesses. Students consistently state that the field experience is the highlight of the TOSS course and that it was the most significant factor in preparing them for student teaching.

Benefits and Challenges of the TOSS Model

As with any instructional model, there are both benefits and challenges associated with the TOSS model. Perhaps the greatest benefit is that this model integrates theory, practice, analysis, and reflection. Students read and discuss theories that suggest skills that are likely to enhance student learning. Carefully designed classroom activities and course assignments allow students to practice these skills immediately. The field experience provides sustained practice, prior to student teaching that requires students to adapt and to generalize their skills to a real classroom setting.

The structure of the class meetings – three meetings a week for three-hour blocks – allows everyone in the group, instructors and students, to become well acquainted. Once a positive and professional dialogue is established, class discussions become very interesting and productive. The emphasis on group work also encourages collaboration and promotes the kind of teamwork

that will be very helpful when TOSS students become full-time teachers. Classmates also become a support system, and excellent dialogue appears on the electronic class discussion board during the field experiences when students are not seeing one another everyday in class. The extensive time spent in class also enables instructors to establish strong mentoring relationships with students. If instructors are thoughtful, positive, and constructive in providing feedback, students begin to trust their instructors and are less defensive when instructors offer suggestions for improvement.

Another benefit of this course is the level of preparedness and motivation of the students. TOSS students are seniors who are very excited about their impending student teaching experiences. They have completed most of their mathematics and education classes and are ready to learn to apply their knowledge in the classroom. With very few exceptions, the students are an enjoyable group with which to work.

There are also some challenges inherent in the TOSS model from both instructor and student perspectives. Teaching the course requires a strong commitment of time and energy. Fortunately, at Kennesaw State University, teaching TOSS is an instructor's full teaching load for the semester. Planning for large class blocks is time consuming, as is the process of providing extensive feedback on the many course assignments.

In addition to planning and grading, coordinating the field placements and observations is time consuming and can be challenging as well. Because many of the students have to return to campus for afternoon classes, it can be challenging to secure placements with experienced teachers who have schedules that provide the opportunity to teach two sections of the same course during the morning hours. Driving to all of the schools to complete the observations during the four-week field experiences can also be a challenge, especially if some students are having a difficult time with teaching and need greater support and more visits from the university supervisor. The mathematics education faculty at Kennesaw State University, however, is committed to supporting the TOSS students; other professors are willing to assist with observations.

Another potential challenge that can arise in the field is a conflict between the student's and collaborating teacher's teaching philosophies. Sometimes, due to the pressure of high stakes testing and other factors, the collaborating teachers are not open to innovative teaching techniques and prefer that the TOSS student employ a more traditional teaching approach. In other cases, even with the collaborating teacher's support, students may be resistant to student-

centered lessons because they are not accustomed to that type of instruction. When these situations arise, it is very important for the university supervisor to be available to the TOSS students in order to advise them on how to be successful in the teaching experience while not alienating the collaborating teacher or her students.

From the student's perspective, the TOSS course is also a great investment of time and energy, and students often become fatigued in the middle of the course when they are preparing and revising their unit plans in anticipation of the field experience. Most of them are taking other classes as well. To address this challenge, the TOSS instructors attempt to inform the TOSS students' other professors of the due date for the unit plans prior to the start of the semester. Some of these professors are willing to adjust the due dates of their major assignments in order to provide TOSS students time to complete this major assignment.

Some students find the transition from thinking like a mathematics student to thinking like a mathematics teacher very difficult. While some students can make this transition easily before the field experience, others find themselves forced very quickly to adopt a teacher perspective in the field. For some TOSS students, this transition can be overwhelming, and they are unable to complete the teaching requirement in their field experience. Those students have to repeat the field experience the following semester and, therefore, must delay student teaching.

Though the Kennesaw State University methods model has some inherent challenges, the benefits of the structure of the course outweigh those challenges. Students appreciate the opportunity to practice their teaching skills, both in the classroom and in the field, prior to student teaching. The relationships that the students develop through their collaboration in class often extend into their student teaching experiences and into their teaching careers. TOSS students continue to collaborate and to support each other long after the last class meeting. With strong support from administrators and from other department members, this course has been very successful in preparing student teachers and has become one of the most highly anticipated classes of the secondary mathematics education majors.

References

Brownell, W. A. (1935). Psychological considerations in the learning and teaching of arithmetic. In W. D. Reeve (Ed.), *The teaching of arithmetic. Tenth yearbook of the National Council of Teachers of Mathematics* (pp. 1–31). New York: Teachers College, Columbia University.

Erlwanger, S. H. (1973). Benny's conception of rules and answers in IPI mathematics. *Journal of children's mathematical behavior, 1*, 7–26.

Georgia Department of Education (GADOE). (n.d.) Georgia standards.org: Gateway to education and professional resources. Retrieved August 18, 2007, from http://www.georgiastandards.org/math.aspx.

Hiebert, J. & Lefevre, P. (1986). Conceptual and procedural knowledge in mathematics: an introductory analysis. In J. Hiebert (Ed.), *Conceptual and procedural knowledge: the case of mathematics* (pp. 1–27). Hillsdale, NJ: Lawrence Erlbaum Associates. Columbia University.

Joyce, B. & Showers, B. (1995). *Staff development for student achievement*. New York: Longman.

Kastberg, S. E. (2003). Using Bloom's Taxonomy as a framework for classroom assessment. *Mathematics Teacher, 96*(6), 402–405.

NCTM. (2000). *Principles and Standards for School Mathematics*. Reston, VA: The National Council of Teachers of Mathematics, Inc.

Skemp, R. R. (1976). Relational understanding and instrumental understanding. *Mathematics Teaching, 77*, 20–26.

Sprinthall, N. A. & Thies-Sprinthall, L. (1983). The teacher as an adult learner: A cognitive-developmental view. In G. A. Griffin (Ed.), *Staff development: Eighty-Second Yearbook of the National Society for the Study of Education*. (pp. 13–35). Chicago: University of Chicago Press.

Thies-Sprinthall, L. & Reiman, A. J. (1990). *Strategy guide for teachers*. Raleigh, NC: Wake County School System.