Effective Teaching Circles: Support for Math Anxious Students

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Teaching circles are an innovative mechanism to support faculty and improve student learning. This article describes the use of instructor teaching circles to support math-anxious students at a mid-sized urban university, including the purposes, formation, and sometimes surprising outcomes associated with using this method. Teaching circles for supporting math-anxious students provide a specific case study exemplifying potential uses of circles to solve other types of instructional problems.

In the fall of 1998, the University of Nebraska at Omaha (UNO) implemented an innovative teaching support mechanism called "Teaching Circles." UNO is a midsized land-grant university in the Midwest that considers student-centered education to be at the heart of its mission. Teaching circles were created to further that mission. This paper describes the process of developing a teaching circle to support faculty of math-anxious students and, indirectly, the students themselves. The goal is to provide a model for faculty support that may be useful to other institutions.

History of Teaching Circles at UNO

The university's teaching-focused Center for Faculty Development was the original sponsoring unit of the Teaching Circles in 1998. Since that time, these circles have continued as an extremely successful process in promoting faculty development. Hundreds of UNO faculty members have participated in teaching circles in the last ten years. Initially, there was a $300 stipend for every faculty member who participated by meeting at least seven times in one academic year. As state budgets tightened, however,

the Center for Faculty Development was temporarily eliminated, then restructured. Stipends were cut to $50 and then were not funded at all for a period of time. Teaching circles, nevertheless, continued without faculty remuneration throughout this difficult period of budget cuts, indicating that the faculty highly values this process.

What is a teaching circle?

Faculty teaching circles feature in-depth discussions centered on teaching-related topics and are composed of small groups of faculty (approximately 3-10) who commit to meet regularly over a period of time to address questions and concerns related to their teaching and to their students' learning. Teaching circle faculty have an opportunity to interact with colleagues across disciplines, to exchange ideas about teaching in an informal setting, to build a teaching portfolio, and to feel more positive about teaching. At the beginning of each academic year, all faculty members are invited to a Teaching Circles organizational session where various topics are suggested and/or faculty can form their own group around a topic of interest. Sample topics have included active/collaborative learning, case study approaches to learning, biology teaching experience, on-line teaching, service learning, "clickers" in the classroom, assessment issues, and relieving anxiety in math-related courses.

Formative stages of a teaching circle in math anxiety

Shortly after the implementation of the teaching circle concept at the university, budget shortfalls eliminated learning assistance programs for both faculty and students. The math anxiety teaching circle filled a resource gap for faculty and, indirectly, for their students because a primary support center for students, the learning center, was permanently closed during this time.

Five years ago, this teaching circle started with five members: three statistics teachers from psychology, sociology, and criminal justice; the director of the university mathematics laboratory; and the former director of the learning center, now an advisor of math-anxious students in a multicultural scholarship program.

Not only were the academic backgrounds of the faculty diverse, but through the course of the teaching circle, shared experiences revealed even greater diversity among the university's math-anxious students. They spanned all ages, both sexes, a variety of race and ethnic groups, different levels of mathematics preparation, multiple disciplines, and varied experiences with math anxiety or anxiety in general. According to Ashcraft (2002), "Math Anxiety is commonly defined as a feeling of tension, apprehension, or fear that interferes with math performance"(p.181).The mathematics teaching circle came together because, regardless of differences in disciplines and the diversity of students, faculty involved shared a common dilemma and sought solutions jointly.

Meetings took place at various times and in various locations, often on campus during the day. One year the location shifted to a local restaurant for breakfast. Coordinating meeting times for several faculty members from different departments proved challenging, but with creativity and determination, participants found a common time. A certain amount of dedication for the goal is required and each member was committed to making a difference for math-anxious students.

Processes used in UNO's Teaching Circles

For the first year, the group spent a lot of time sharing stories of the frustration involved in dealing with math-anxious students. It was helpful to all circle participants to gain perspective from each professor's point of view. Similar stories surfaced from each of the disciplines represented, and it was enlightening and encouraging to discover that faculty experiences with math-anxious students were so similar across disciplines. The former director of the learning center, who now served as a student advisor, also related a number of frustrating stories she heard frequently from mathematics and statistics students.

After the initial stage of sharing classroom experiences about math-anxious students, the focus shifted to seeking as many different strategies as possible. At each meeting, strategies were shared and discussed among the remaining four members (one professor chose to drop out). In order to accomplish its goals, the members of the teaching circle began by determining that a literature review of the existing math/statistics anxiety literature

would be useful. Each member decided to explore the literature of her own discipline to determine what research had been done, what tools were available, and which strategies had been used by others to help students deal with their anxiety. Members also researched the nature of math/statistics anxiety compared to other types of anxiety. Each member brought summaries of current research and especially good articles and bibliographies to meetings for sharing with the others. The second year of this teaching circle was well underway when the group, which now met monthly, decided that a number of strategies were being generated by group members that had not been described in other literature. The group identified the need for a handbook for both teachers and students to provide tools to identify and deal with math/statistics anxiety. Discussions began to focus on the specific tools: a diagnostic section for students to describe their mathematics history, a mathematics anxiety measure, and a series of quick diagnostic tests which group members would design that would assess the baseline skills that students need to be able to succeed in the current mathematics or mathematics-related course.

After discussions with publishers of mathematics support textbooks, the group decided not to focus on a handbook, but instead to maintain the original focus of providing support to students and each other. However, the handbook idea had lasting benefits to the group by helping to identify classroom needs and by suggesting that the circle could serve as a mechanism for production of multiple outcomes, such as research projects, presentations, and publications.

Strategy Development

Members mutually determined how important it was to assess the mathematics skills of individual students. Some math-anxious students simply lacked critical prior knowledge and entry-level skills; their anxiety was based in reality. First-day diagnostics such as "quick 'n dirty" premeasures of minimum basics skills were needed for a variety of levels of mathematics/statistics classes. Each instructor would be forced to predetermine the minimum mathematics skills a person needed in order to learn the new skills in the class. At that point, students lacking mathematics skills critical for the course were counseled to drop the course and

obtain the background they needed for success at a later time. This was particularly important for the students enrolled in statistics courses. Although the faculty were willing to help as much as possible, students reluctant to drop a course were strongly encouraged to obtain tutoring outside of the classroom. It was also necessary to assess the level of existing math anxiety, and a simple measure was developed by the developmental psychologist in the circle (See also Onwuegbuzie & Wilson 2003 for other measures).

The strategies came from multiple sources. Group members' own classroom experiences, formal training, and trial-and-error were important components. One professor used immediate reinforcement strategies such as games with candy rewards for correct answers. One used mastery learning techniques to lower anxiety; another formed study groups to meet outside of class for extra credit and held test reviews outside of class. The group developed lists of uses for mathematics to add relevance to the learning process, designed exercises with examples of mathematics or statistics in the news, and incorporated journaling—the use of diaries to learn about the circumstances that resulted in anxiety. The group sought out resources to enhance its knowledge and increase effectiveness (see, for example, Ritchey, 2000). These included a short course on teaching math-anxious students (Ritchey & Petee, 2004), books on using humor in the classroom (Pyrczak, 1996, 1999; Krantzler, 2003), and a workshop on maximizing retention in college.

The literature review revealed other techniques such as using diagnostic exams, understanding different types of anxiety, and gathering mathematics histories to facilitate self-exploration among students with regard to the genesis of their attitudes toward mathematics. Another important strategy was the use of relevant study skills. Two members had experience teaching study skill workshops, so other members benefitted from their expertise. A third member was a developmental psychologist who provided guidance on the developmental appropriateness of strategies. The fourth member, the director of the university mathematics laboratory serving over 1,000 students a semester, provided an ongoing reminder of the scope of the problem.

The sharing of these specific strategies among circle

members resulted in others in the circle trying these strategies in their classrooms. Group reflections revealed that not all were equally successful, but this broadened their views of potential strategies and facilitated a creative problem-solving process among the group so that members could learn from one another.

Research as a Strategy

After conducting the literature review and sharing strategies on a regular basis, the group became interested in doing original research in this area and broke into research dyads for these classroom projects. Hypotheses to confirm or reject anecdotal evidence became a focus of the group. The two statistics professors designed and conducted a diary study to track statistics anxiety over the course of the semester in several statistics courses—both at the undergraduate and graduate levels. One component of this study was a before and after quantitative mathematics anxiety assessment. This study revealed early on that both the causes of mathematics anxiety and the solutions for coping with it were diverse. While research revealed several types of math-anxious students, it also reinforced the need to avoid "cookie cutter" approaches to its resolution.

Another research project was started on the importance of obtaining students' mathematics histories as well as information on different teaching styles of instructors as a follow up to previous research that was published by Rech and Harrington (2000). This work was a qualitative and quantitative study that explored variables that affect students' mathematics performance, and data were gathered from personal interviews which included extensive mathematics histories.

Conclusions

The mathematics teaching circle met monthly over a five-year period and served several useful functions. During that time, group members presented this project at a national developmental education conference in October, 2004 (Harrington, Powell, Rech & Tilton-Weaver, 2004). The group also won the Outstanding Teaching Circle Award at the university and used its insights gained to improve classroom instruction and to provide better support for math-anxious students.

Members of the circle continue to communicate and meet occasionally. Not only has the group surveyed the field for techniques and approaches to mathematics/statistics anxiety and shared its findings, it has also acted as a support group for dealing with the difficulties students have with the material, with their attitudes toward the material, and, often, their negative projections onto the material or the instruction. In-depth diagnosis of mathematics anxiety provided ongoing discussion which resulted in faculty becoming more sensitive to the ways to assist students. A positive outcome was that the survey of the field brought a number of strategies to the fore as detailed throughout this paper and in the appendix. Everyone took something back from each meeting that was immediately useful with current students.

Perhaps the biggest impact this teaching circle project had on all participants is that it made faculty members look closely at both viewpoints: the teacher's and the student's. The anxiety that is so closely associated with mathematics cannot be ascribed simply to either "too tough teaching" or to "work-avoiding, whining students." This is a complex issue, but some strategies can be utilized to improve the climate in mathematics-related coursework on college campuses. The faculty involved thinks this teaching circle has provided the opportunity to help not only in their own classrooms but also perhaps those of colleagues at universities around the country.

The University of Nebraska at Omaha has now opened several resources for student assistance, including a speech center, a writing center, and a mathematics and science learning center. The Faculty Development Center has been able to reinstitute stipends for teaching circle participation. These resources have certainly been helpful to both faculty members and students. Whether increased resources are available or not, however, teaching circles thrive as a source of support for faculty. As schools across the country experience the fluctuations of the current economy, the implementation of teaching circles can provide great rewards with minimal expense.

Appendix: Lessons Learned from the Faculty Teaching Circle for Math-Anxious Students

Some Tips for Helping Math-Anxious Students:

- Assess preparation and refer to appropriate course or tutoring if needed.
- Acknowledge mathematics/statistics anxiety.
- Acknowledge that students can succeed if they work and that you will assist them.
- Form study groups for in-class and out-of-classroom (extra credit) sessions.
- Make explicit the tie between lectures and homework.
- Provide a detailed study guide prior to exams; go over it in a review in class. Give a short sample exam to familiarize students with question types.
- Build trust by making the study guide coincide with the exam.
- Provide a formula sheet for those that will be on exams—have students annotate it before the review and go over it.
- Use definitional formulas rather than computational formulas to promote understanding.
- Send home practice questions that students prepare, compare, and then present on the board in class (each group presents one problem and explains it). This lowers anxiety by presenting answers that are agreed upon by the group so that at least a student is not "incorrect" all alone!
- Give "test your knowledge" quizzes after each unit—work in small groups, go over in class. Do not grade.
- Play games and give prizes (with humor).
- Let students hand write a 3 x 5 card to use in the exam so that they don't "panic." Instruct them to include the items "I just know I'll forget on the test."
- Emphasize the everyday importance of the subject matter.

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