

Preface

College and university mathematics departments shoulder a wide range of responsibilities and duties. Perhaps two of the most fundamental missions of any mathematics department are

1. the creation (or discovery) and preservation of mathematical knowledge, and
2. the communication of mathematical knowledge (to other professional mathematicians, students and the public).

The purpose of this book is to describe a set of tools and experiences for helping mathematicians to develop and enhance their instructional skills. By instructional skills we mean the ability to represent and communicate mathematical ideas and information to people who are not professional mathematicians. While creating this book, we have focussed on the challenges found in the teaching of undergraduate mathematics—especially the “introductory” classes taken by students at almost every college and university.

An important premise of our work is expressed by our belief that experienced mathematicians have important and unique contributions to make to the development of new mathematics instructors—contributions that cannot always be found in the (necessarily) more generic advice expressed through writings about college teaching and learning in general. As such, this book has been written for use by members of mathematics departments who are accomplished teachers but who do not necessarily have an extensive background in, or experience with, instructor development.

We have used various versions of these training experiences to address the developmental needs of graduate student instructors, post-doctoral and new regular-rank faculty, as well as adjunct and part-time faculty who were new to their institution. In our experience, with

- the provision of appropriate training experiences,
- support and advice from experienced instructors, and
- clear ideas concerning the nature and objectives of the course they are teaching,

instructors with little or no prior teaching experience can quickly become competent (and sometimes very skillful) teachers.

This book describes a semester-long program of professional development. It is intended to build upon an intensive pre-semester orientation course, such as the one described in [103]. The semester-long program integrates different forums for the examination, discussion and refinement of instructional practices. In our experience, this integration of multiple forums can enable training personnel to precisely tailor their advice, support and efforts to address the specific needs of individual instructors. For example, through the forum of a weekly training meeting, inexperienced instructors can be familiarized with fundamental “nuts and bolts” issues of running a classroom, while at the same time more experienced instructors can participate in discussions and evaluations of advanced philosophical and scholarly writings on learning and teaching through an educational issues seminar.

Over the last two decades, innovative instructional methods and powerful technological tools have become more commonly used in college mathematics courses, especially the “introductory” courses such as college algebra, precalculus, calculus, differential equations and linear algebra. The materials and training experiences described in this book are all highly compatible with these newer instructional methods. We have attempted to include a selection of materials that we believe will complement the excellent references on the teaching of university-level mathematics that are already well-known and widely available.

The contents of this book can be divided into five broad categories:

1. ideas for the structure of an integrated program of professional development (Chapter 1 and Appendix B),
2. suggestions on how to use the materials in the book (Chapter 2),
3. a description of (and supporting materials for) a brief pre-semester orientation session (Chapter 3),
4. support for a program of weekly training meetings (Chapters 4–16 and Appendix A), and
5. procedures and forms for conducting a system of class visits and feedback (Chapter 17).

Notes on 3–5 are given below.

Ideas on the structure of a professional development program

We believe that professional development is an ongoing process; one is not at the end of the professional development road after a one-semester training program. A successful, rich, and ongoing program of professional development will include many different forums for discussion and learning. To support this vision, we describe in Chapter 1 a fully-integrated model of such a system. We hope that this model will serve as a starting point for other departments who wish to do more in the way of professional development.

Support for a pre-semester orientation session

In Chapter 3 we describe a pre-semester orientation session. This session is designed to last for one day, and it is divided into three blocks.

Block A is intended for all new instructors and introduces the teaching resources, traditions and conventions of your department. Block A addresses issues such as the goals of the courses in your department, assessment of student work and course administration.

Block B is designed for beginning instructors and serves as an introduction to the basic ideas and methods of student-centered instruction.

Block C is primarily for instructors with little or no classroom teaching experience. This session provides an opportunity for new instructors to practice teaching, be videotaped and to receive feedback on their teaching.

The short sessions described in Chapter 3 may also be viewed as initiating discussions of teaching issues that will be resumed in the training meetings planned for the rest of the semester and described in Chapters 4 to 15.

Support for a program of weekly training meetings

The program of training meetings in Chapters 4–15 combines training in the use of nontraditional techniques of classroom activity, such as cooperative group work and active student participation in class, with the kinds of “nuts and bolts” issues that beginning instructors need to know, such as grading homework, proctoring exams, and working with students in office hours. The selection of subjects for the training meetings reflects our experience that many novice instructors can quickly become competent users of nontraditional teaching techniques. Simultaneously, they can acquire the knowledge of the more mundane responsibilities of instruction. It is assumed that participants in the training meetings have already finished preliminary training, such as the orientation session described in Chapter 3, or the course detailed in [103], including sessions on setting up a course, giving lectures, answering questions, and leading cooperative activities.

Each training meeting begins with an introduction to the content of the meeting that includes our rationale for advocating the teaching methods described and our reasons for structuring the meetings as we did. Each meeting is then described in detail, and many include extensive collections of background and

supporting materials for distribution during the training sessions. We intend that meeting leaders will be able to run an effective training meeting with a minimum of preparation, by closely following the suggestions in the meeting chapters. The chapter for each training session is organized into the sections described below.

1. **Description and purpose of the meeting:** A very brief outline of what the meeting is about, and what participants will get out of it.
2. **Goals for the meeting:** A list of the training objectives for the meeting.
3. **Preparations for the meeting:** A checklist for the meeting leader to ensure that all preparations are carried out.
4. **Agenda for the meeting (to be distributed to participants):** A list of the topics that will be dealt with during the course of the meeting.
5. **Outline for running the meeting:** A detailed description of the meeting, including a “time line” for meeting leaders to follow, and full instructions on what to use each segment of meeting time for. (Some meetings include several different outlines, each reflecting a different format for the meeting, so that meeting leaders have more flexibility in how they will conduct the meeting.)
6. **Ideas for expediting the meeting:** Suggestions for cutting corners in the interest of saving meeting time.
7. **Suggested reading:** A short annotated bibliography that points the meeting leader to other sources relevant to the topic treated in the meeting. These readings can be used by the meeting leader in preparation for the meeting, or they can be suggested to the meeting participants as follow up.
8. **Meeting materials:** Handouts and background material for distribution during the meeting.

Since the range of experiences that we describe in this book will not be completely consistent with the goals and methods of every professional development program, there will be teaching issues that we have not substantially addressed, but which are nonetheless highly relevant to the reader. To address this need, in Chapter 16 we provide a framework for adapting materials to the specific needs of other programs. There we describe the development of an additional training meeting, but our emphasis is less on the content of the particular meeting and more on the method that we use for developing new meetings from scratch.

Finally, Appendix A is devoted to planning and running successful meetings. This appendix identifies common criticisms of meetings, and suggests ways that these difficulties can be addressed. The appendix describes methods for running meetings—such as assigning roles—and indicates how these methods can be successfully implemented in the academic setting. It also describes examples of difficult or disruptive participant behavior, and suggests numerous strategies for dealing with these “people problems.” Finally, this appendix gives a method for meeting improvement, together with a questionnaire, and suggests an alternative to training meetings that can be used to continue the professional development of instructors who have “graduated” from the program of training meetings.

Support for a system of class visits and feedback

In Chapter 17 we describe different kinds of classroom visits—observational visits, student feedback sessions, and peer visits—that we have used while training instructors—ranging from beginning graduate students to senior faculty—at the University of Michigan, Duke University, Taylor University and Harvard University. We describe (in considerable detail) procedures for conducting each kind of visit, including how to set up visits, what to do while in the classroom, how to write a report, and how to conduct the subsequent meeting with the instructor visited. In addition, we list the advantages and disadvantages of each kind of visit. We include a plan for a semester-long program of class visits, along with a large amount of practical wisdom concerning instructors’ reactions to visits, and many of the problems that can occur.

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