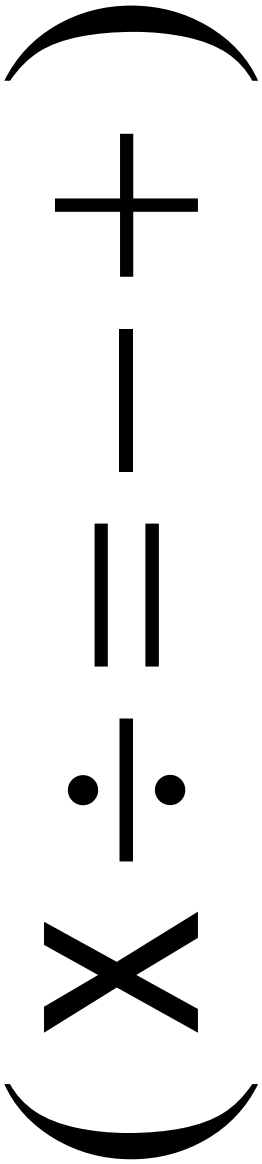
CHAPTER 1

Introduction



- A store sells shirts for $13.50 each. On Saturday, it sold 93 shirts. This was 26 more shirts than it had sold on Friday. How much money did the store make on the shirts sold on Friday and Saturday?
- Janet earns $12.50 per hour. Her company deducts 17% of her pay each week for taxes. Janet uses the following formula: $E = 0.83(12.50h)$ to compute her earnings (E) after taxes for the hours (h) she works. What will be Janet's earnings, after taxes, if she works 40 hours?
- You and your three friends are planning to go to a matinee movie on Saturday and then to a fast food restaurant for dinner. Movie tickets cost $5.00 each. A burger, fries, and soda cost $2.49 plus 5% sales tax. How much money will each person need? What will be the total cost for the group?

Each day, students encounter these types of problems in their math textbooks, high stakes tests, and everyday life. While it may seem to some that these problems are easy to compute, many students—especially those with mathematical learning difficulties—cannot solve these problems without additional instructional support.

Solve It! (Montague, 2007) is a proven instructional approach for students with mathematical learning difficulties—particularly those with learning disabilities. These students desperately need help in understanding, analyzing, solving, and evaluating

mathematical problems, primarily because no one has taught them how to think about mathematics.

Solve It! is a process for helping students think about mathematical problem solving. Cognitive strategy instruction—one of the most effective approaches for teaching students with mathematical difficulties (Swanson, 1999)—is at the core of ***Solve It!*** This approach—which was validated in several studies (Daniel, 2003; Montague, 1985, 1992, 1997; Montague, Applegate, & Marquard, 1993; Montague & Bos, 1986; Tarrága, 2007)—teaches students how to think by developing and activating the cognitive processes and strategies that effective problem solvers use. Using ***Solve It!***, students learn to apply, maintain, and generalize problem solving skills and strategies.

Although the type of cognitive strategy instruction found in ***Solve It!*** has been used for several decades, it is just now becoming integral to mathematics teaching (Woodward & Montague, 2002). In fact, as recently as 2006, the National Council of Teachers of Mathematics (NCTM) called for a more meaningful cognitive approach to teaching and learning mathematics in its response to low student performance on standardized tests. ***Solve It!*** offers just that.

The purpose of this guide is to provide facilitators—teacher team leaders, coaches, classroom consultants, professional development personnel, and university teacher educators—with strategies for helping teachers learn the ***Solve It!*** approach. This facilitator's guide assumes the use of the ***Solve It!*** program manual (Montague, 2003 [first edition]; Montague, 2007 [second edition]) that contains all classroom materials needed for implementation.

Why the Concern?

Consider these findings:

- *Students in our nation's schools consistently perform poorly on state (e.g., Florida Comprehensive Assessment Test), national (e.g., National Assessment of Educational Progress), and international (e.g., International Mathematics and Science Study) mathematics tests.*
- *From 1989 to 2006, the National Council of Teachers of Mathematics pointed to the dismal mathematics performance of students. While the work of NCTM—particularly the NCTM Standards—has helped educators improve students' mathematics learning in many ways, mathematical problem solving continues to pose significant challenges.*

Enhancing *Solve It!* Instruction Through Professional Development

Although teachers can and have learned the ***Solve It!*** approach from the program manual on their own, we have found that the quality of instruction is enhanced with professional

development. Through professional development—workshops, teacher study groups, teacher preparation courses, classroom coaching, classroom observations, etc.—teachers can be provided with opportunities to:

- Observe facilitators and colleagues model the ***Solve It!*** approach.
- Receive feedback on how well they have internalized the cognitive strategy instruction skills and processes.
- Compare experiences with the ***Solve It!*** assessment process.
- Share ideas for using ***Solve It!*** materials and lessons with students of differing abilities.
- Develop a support network of colleagues whom they can call upon as they encounter new difficulties.

Facilitators are an integral part of professional development. Their various tasks include:

- Setting the agenda and/or schedule for learning the ***Solve It!*** process.
- Arranging time for teachers to participate, whether it be in workshops, classroom observations, or one-to-one meetings.
- Organizing the activities and ensuring full participation.
- Trouble shooting implementation issues.
- Creating feedback loops in which teachers can share their progress and learn from others.
- Helping to ensure that the ***Solve It!*** process is implemented effectively.

This manual is designed to provide facilitators with useful tools for undertaking these various tasks. It is not prescriptive. Rather, it provides a variety of options that facilitators may find useful.

Organization of the Facilitator's Guide

The facilitator's guide provides a variety of professional development activities that correspond with the elements of the ***Solve It!*** approach. The essential elements for mastering the ***Solve It!*** approach are organized as chapters in this guide. They include:

- **Understanding the *Solve It!* approach.** This chapter provides suggestions for introducing ***Solve It!***
- **Becoming skilled in the *Solve It!* process.** This chapter provides suggestions for understanding and developing the cognitive strategy instruction that forms the basis for the ***Solve It!*** approach.
- **Becoming skilled in the *Solve It!* instructional components.** This chapter provides suggestions for developing the key instructional strategies that are used when presenting ***Solve It!*** to students.
- **Learning how to use the *Solve It!* assessment.** This chapter provides suggestions for administering, interpreting, and using the ***Solve It!*** assessment.
- Putting it all together—Integrating the ***Solve It!*** components. This chapter provides suggestions for organizing

Solve It! lessons. Attention is given to supporting implementation.

Each chapter contains a variety of professional development strategies and tools, including:

- **Background information.** For your convenience, information from the ***Solve It!*** program manual is summarized at the beginning of each chapter in this facilitator's guide. However, facilitators are encouraged to have read and studied the ***Solve It!*** program manual (Montague, 2003 [first edition]; 2007 [second edition]) before providing professional development.
- **Agenda for the topic.** The agenda presents a selection of activities that address the topic. While we encourage you to modify the activities to fit your style and the needs of your teachers, we suggest that you do not modify the basic content. We have found that the content is essential to effective implementation of ***Solve It!***
- **Introduction activities.** Several warm-up activities are provided that help orient participants to the topic. Warm-up activities are designed to activate prior knowledge of the topic and to help participants focus their attention. Feel free to modify these and/or use your own activities. However, we highly recommend using introductory activities that are linked directly to the content rather than those that are solely social in nature (e.g., traditional ice breakers).
- **Content presentation suggestions.** There are many ways to present content. We provide some suggestions for engaging participants in thinking about the content and developing appropriate skills.
- **Reflection/wrap-up suggestions.** Closing activities help participants reflect on what they have learned. They also provide an opportunity to summarize important learnings and to address next steps or areas still requiring study. Reflection encourages participants to feel "complete" as they leave the session. We encourage you to modify these and/or use your own activities. However, we also highly recommend incorporating reflection and/or wrap-up activities that are linked directly to the content in addition to ones that are solely housekeeping in nature (e.g. review agenda for the next session, complete workshop evaluation forms, etc.).
- **Facilitator tools.** In some cases, the activity will call for a handout or tool. These are included at the end of the chapter.

The appendices contain additional ***Solve It!*** resources. These resources can be used for your own personal enrichment and/or shared with participants. The resources include:

- **Brief article summarizing the *Solve It!* approach (Appendix A).** This makes an excellent workshop handout. It also can be used as a pre-reading assignment.
- **Annotated bibliography (Appendix B).** This annotated bibliography offers a comprehensive review of the literature and research base for ***Solve It!*** It is useful for further study and/or as support for adopting the ***Solve It!*** program.

- ***Solve It!* presentation (Appendix C).** This transcription of a ***Solve It!*** keynote presentation may be useful as you design your own presentations. It follows the PowerPoint presentation found on the CD-ROM inside the back cover of this guide.

Finally, the CD-ROM found inside the back cover contains a variety of ***Solve It!*** tools. These tools—most of which correspond to the ***Solve It!*** program manual—are organized as follows:

- ***Solve It!* video.** The video shows the developer, Dr. Marjorie Montague, as she provides an overview of the ***Solve It!*** approach with groups of students. Use this to orient participants to the ***Solve It!*** approach.
- **PowerPoint presentation on *Solve It!*** The presentation is available in PowerPoint and in PDF formats. It provides an overview of the ***Solve It!*** approach that is appropriate for introductory and/or keynote presentations.
- ***Solve It!* assessment tools.** The ***Solve It!*** assessment tools (e.g., pretests and posttests, interview protocol, etc.) are found here.
- ***Solve It!* instructional tools.** The tools (e.g., poster, cue card template, practice problems, mastery checks, etc.) correspond to the lessons found in the ***Solve It!*** program manual.
- ***Solve It!* student activity sheets.** The activity sheets correspond to the lessons found in the ***Solve It!*** program manual.

How To Use the Facilitator's Guide

It goes without saying that facilitators are expected to have a thorough understanding of the ***Solve It!*** program manual. Facilitators are encouraged to familiarize themselves with this publication and the ***Solve It!*** program manual before planning professional development activities. In addition, facilitators should have a solid understanding of cognitive strategy instruction. [*Note*: For an annotated review of literature related to the ***Solve It!*** program, see Appendix B.]

Facilitation assumes an understanding of participant needs related to mathematical problem solving. We have found that many teachers find that ***Solve It!*** challenges them to think about mathematical problem solving in new ways. They must shift from teaching mathematical problem solving as a formula that can be memorized to a set of cognitive processes that engage students in thinking about problems that can be solved using mathematics. In some cases, teachers may have little, no, and/or inaccurate knowledge of cognitive strategy instruction, which poses additional challenges to facilitators. Thus, when setting up the ***Solve It!*** sessions, facilitators should keep in mind the following:

- Learning a new way of thinking sometimes requires unlearning an old way of doing things.
- Learning how to think about mathematical problem solving is a complex cognitive skill that takes time to develop. The ***Solve It!*** process cannot be mastered in a one-hour workshop.

- The ***Solve It!*** approach assumes an understanding of computation skills and mathematical concepts (e.g., estimation) as well as other cognitive processes (e.g., reading comprehension, visualization, etc.).
- It is not enough to hear about cognitive strategy instruction. Teachers also must see it modeled.
- The cognitive strategies that make up the ***Solve It!*** approach are essential for effective mathematical problem solving. Teachers are cautioned about eliminating any of the strategies. To ensure fidelity of the ***Solve It!*** approach, teachers should practice ***Solve It!*** instruction with guided feedback before implementing the approach with their students.

Although the facilitator role may be shared (e.g., rotate the facilitation role, etc.), the guide assumes that someone will be serving in the role of facilitator. Regardless of the type of session—teacher study team, workshop, teacher preparation course, etc.)—facilitators help plan the agenda and ensure that participants:

- Engage in, discuss, and reflect on the content.
- Are presented with excellent models of the ***Solve It!*** approach.
- Are provided opportunities to practice implementing ***Solve It!*** with guided feedback before introducing it in their classrooms.
- Plan how they will implement ***Solve It!***, including how they will integrate it with their math curriculum and state/district standards.
- Receive adequate support in implementing ***Solve It!***

Facilitators also attend to the housekeeping needs of participants (e.g., ensuring adequate space, lighting, etc.).

Solve It! sessions should focus on the development of both knowledge and skills. The agendas in the following chapters provide general guidance for ensuring that participants develop both knowledge and skills for implementing ***Solve It!*** When planning a session, allow ample time for participants to think about the topic, observe models, and practice using the approach.

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