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PREFACE

Ministry of Christian Schools

Parental expectations of Christian schools include

- excellent discipline;
- high academic standards;
- low teacher-student ratios;
- dedicated, conscientious teachers.

Many Christian schools offer these advantages. But the real distinction is that Christian schools proclaim Jesus Christ as the Son of God and Savior of the world. Teaching Jesus Christ, then, is "the real difference" between Christian and public schools. In Christian schools, teachers and students witness personally and publicly to their faith in Jesus Christ. Students study the Bible and worship God daily. Teachers relate Jesus Christ to all aspects of the curriculum. Teachers and students share Christian love and forgiveness.

Those who teach in Christian schools are privileged with the opportunity to

- teach the Word of God in its truth and purity;
- acknowledge the Bible as God's infallible Word and the Confessions as the true exposition of the Word;
- identify God's Word, Baptism, and the Lord's Supper as the means through which God creates and sustains faith;
- emphasize Law and Gospel as the key teaching of Scripture;
- seek to apply Law and Gospel properly in daily relationships with students, parents, and other teachers;
- teach all of what Scripture teaches (including Christian doctrines) to all students, no matter what backgrounds they have;
- share with students what Jesus the Savior means to them personally;
- equip students to proclaim the Good News to others;
- encourage students to find the support and encouragement found only in the body of Christ, of which Jesus Himself is the head.

In Christian schools, Christ permeates all subjects and activities. Religion is not limited to one hour or one class. Teachers seek opportunities to witness in every class and to relate God's Word to all aspects of life. Through this process, and by the power of the Holy Spirit, students grow in faith and in a sanctified life, and view all of life, not just Sunday, as a time to serve and worship God.

In summary, it is intrinsic to ministry in a Christian school that all energies expended in the educational process lead each child to a closer relationship with the Savior and with other members of the Christian community.

How to Use This Guide

The Concordia Curriculum Guide series is designed to guide you as you plan and prepare to teach. The introductory chapters provide foundational information relevant to the teaching of mathematics to students in a Christian school. But the majority of the pages in this volume focus on math standards and performance expectations together with ideas and activities for integrating them with various aspects of the Christian faith. This volume does not provide a curriculum plan or lesson plan for any particular period or day. Instead, it provides a wealth of ideas from which you can choose and a springboard to new ideas you may create. You may use this curriculum guide with any textbook series.

The math standards included in this book are informed by the standards developed by the National Council of Teachers of Mathematics (NCTM) (see also Chapter 3) and are provided as a compilation of the math standards and performance expectations adopted by the individual states. In order to offer a well-coordinated curriculum design, the math objectives for this grade level relate to and connect with the standards provided at other grade levels.

The standards, then, can serve you and your whole faculty in several ways. They can help you

1. plan your teaching in an organized way;
2. coordinate your teaching of a subject with the teaching in other grades in your school;
3. select textbooks and other learning or teaching materials;
4. evaluate your current instruction, materials, and objectives;
5. implement procedures for school accreditation;
6. nurture the Christian faith of your students as you teach mathematics.

We assume that teachers will use materials in addition to those included in the guide, but, since many materials do not integrate the Christian faith, we have provided suggestions for specific methods to use as you teach day by day. Everyone has a different teaching style. No one will be able to use all the ideas in this volume. As you think about practices that will work for you and would be helpful in your classroom, consider these possible ways to find and use ideas from this volume:

- Read the entire volume before school starts. Highlight the ideas you think you can use.
- Write ideas in your textbooks. List the page numbers from this volume that contain suggestions you would like to use in connection with a lesson or unit.
- Throughout the year, designate periods of time, perhaps at faculty meetings, to discuss portions of this volume as you seek to improve your integration of the faith in math. Brainstorm, develop, and implement your ideas. Then follow up with other meetings to share your successes and challenges. Together, find ways to effectively use the suggestions in this volume.
- Plan ways to adapt ideas not closely related to specific lessons or units in your secular textbooks. Inside your plan book clip a paper with a list of suggestions from the volume that you would like to use. Or list each idea on a file card and keep the cards handy for quick review. Use those ideas between units or when extra time is available.
- Evaluate each suggestion after you have tried it. Label it as "use again" or "need to revise." Always adapt the suggestions to fit your situation.
- Think about integrating the faith each time you plan a lesson. Set a goal for yourself (e.g., two ideas from this volume each week), and pray that God will help you to achieve it. You will find the index at the back of this volume especially helpful in finding faith-connecting activities relative to specific topics.
- If the ideas in the Concordia Curriculum Guide series seem overwhelming, begin by concentrating on only one subject per month. Or attempt to use the suggested ideas in only two to four subjects the first year, then add two to four subjects per year after that.

Probably the most effective teaching occurs when teachers take advantage of natural opportunities that arise to integrate the faith into their teaching. In those situations you will often use your own ideas instead of preparing a lesson plan based on teaching suggestions in this guide. Use the white space on the pages of this book to record your own ideas and activities for integrating the Christian faith. We hope this volume will be an incentive to you to create your own effective ways to integrate the Christian faith into the entire school day.

We believe that Christian schools are essential because we believe that our relationship with Jesus Christ permeates every part of our lives. That is why our Christian faith permeates our teaching. That is why we teach in a Christian school.

CHAPTER 1

The Importance of Being Mathematical

Jane Buerger

Jane Buerger is a graduate of the secondary mathematics program of Concordia University Chicago. After graduation, she taught mathematics at Lutheran High School in Houston and later for the Clear Creek Independent School District and San Jacinto Junior College, also in the Houston area. Dr. Buerger joined the faculty of Concordia College—New York in 1986 as a professor of mathematics and education. During that time she also served as chair of the divisions of science and mathematics and of teacher education. Dr. Buerger earned her master's degree at the University of Houston and her doctorate at Teachers College, Columbia University in New York. In 2005, she returned to her alma mater, Concordia University Chicago, to serve as dean of the College of Education.

Why Do We Have to Do This

The situation is familiar. Math class seems to be going along fairly well; children appear to be catching on to the new concept being taught. There is time for the children to try some new exercises, perhaps similar to what they will be working on later in class or at home. Then a voice is heard from the back of the room. "Why do we have to learn this stuff?" It's a good question, and we, as teachers, should consider why it is being asked before we jump in with an answer.

Why do children ask the question? Do they ask the same thing about their other subjects? Is mathematics somehow different? Is there a good reason for learning how to compute ½ ÷ 4?

One answer that doesn't work very well is any variation of "You'll need to know this someday." "Someday" might be replaced by "next year in sixth grade," "in high school," "to get into college," or "when you're grown up." Children live in the here and now, and it's hard for them to imagine a future when their success will be measured in their ability to do long division. Add to that the fact that, in this country at least, it is socially acceptable to not be "good at math," and the questions that children ask about why they have to learn "this stuff" seem logical.

As teachers, we are responsible for knowing the content that we are teaching. We are also responsible for knowing why our students need to learn that content and then structuring our lessons so that the *why* becomes obvious. We need to design our curricula so that children have a chance to make the connections between their classroom and their world outside of school.

Teaching mathematics is a special challenge. Textbooks are putting more emphasis on having the children solve nonroutine problems, but, in order to be successful at this, children need to master a number of basic skills first. The way to master a skill, whether it is multiplying whole numbers, playing the guitar, or shooting free throws, is practice, practice, practice. For many of us, this was all there was to mathematics. We would learn a new skill, and then we would work pages and pages of exercises. Eventually there would be some word problems, which were really just more exercises in disguise.

Practicing computational skills has a purpose. No responsible mathematics teacher says that children don't need to know their multiplication facts. However, if we never expose children to meaningful situations where being able to multiply (without the help of a calculator) is important, then we are doing a real disservice to them.

So then, how can we help our students see the value of learning "this stuff"? We can structure our lessons and units to help our students develop a sense of how mathematics fits into their world. Following is a list of four reasons why

mathematics is important for our students. This is the grown-up version. It will be up to us as the grown-ups to plan lessons that will lead our students to develop their own list of why mathematics is important to them.

Reason 1:

The attitudes and strategies necessary for successful mathematical problem solving carry over into other areas of life.

Mathematical problem solving does not mean working the typical textbook word problems that are really just computational practice in disguise. Even when the textbook authors attempt to be relevant by including references to favorite activities, the truth is that the exercises don't pique the students' interest or give them a real reason for finding a solution. For this discussion, a *problem* will mean a novel situation where the student doesn't have a set rule for approaching it. The student will have to use computational skills in the process, but the procedures will cause the student to develop mathematical thinking and possibly discover mathematical concepts that are new, at least to that student.

A true mathematical problem for some students might be trying to decide if they can earn enough money for some special project, perhaps buying gifts for children in a shelter. George Polya, in his book *How to Solve It*, identified four steps in the problem-solving process. The first step is *understanding the situation*. At this step, we realize that gifts cost money and that, in order to buy the gifts, there must be a way to earn that money.

The second step is *devising a plan*. What do we have to know to solve this problem? We need to know how many children are in the shelter, what type of gifts would be appropriate, and how much these gifts would cost. We need to know what type of fund-raising would be appropriate and would raise the funds we need. We need to decide how we can obtain this information and what we will do with the information when we get it.

The third step is *executing the plan*. We gather all the information about the cost and number of gifts and the amount we could expect to earn.

The fourth step is *looking back*. We need to see if our answers make sense in the context of the problem. If it turns out that we need $1,000 to buy the gifts and our projected fund-raising will result in only $300, then perhaps we need to go back and reexamine our project. Maybe less expensive gifts would be in order; maybe we need to find another way to raise the money.

The point of all of this is that problem solving, in mathematics and in life, must begin with true understanding and careful planning. Too often, students approach mathematical problems by looking for key words, such as *altogether*, and then add every number in the exercise. By allowing students to work on more novel situations, we allow students to take the time to think, to understand, and to look back later to see if their solutions make sense. The procedure won't allow students to solve ten routine word problems for tomorrow's homework, but it will enable them to use mathematical skills as part of a larger process that may actually be practical to them. The procedure will also serve students well as they tackle problems outside of the classroom, whether the problems are rocky relationships or situations involving personal finances or time management.

Reason 2:

Mathematics enhances other subjects in the school curriculum (and vice versa).

The idea here is to integrate mathematics into the curriculum so that students can actually gain a better understanding of math at the same time they are learning about other subjects. For example, students can gain a better understanding of Hindu-Arabic numerals by studying early numeration systems that did not use place value or zero or that had a base other than ten. A unit on the Roman Empire might include a study of Roman numerals, which could lead to the following questions: What would it be like to add in

Roman numerals? Why didn't the Romans need a symbol for zero? Studies of other ancient civilizations could lead students to ask how the numeral for *twenty* would have been written by the Babylonians, the Greeks, or the Mayas. Which of these systems is most like our own? Which is the most different? Depending on the age of the students, this can lead to simple writing of the numeral or a discussion about the value of numeration systems with place value. A good source for this type of information would be a mathematical history text such as those written by Eves (1990) or Lewinter and Widulski (2002).

The topic of measurement can also serve as an example of how this integration of academic subjects can be accomplished. Although both math and science classes often include work with measurement, many students don't have a clear understanding of the concepts of length, area, and volume and how they fit together. As part of a science unit on animals, young children might be asked to measure the length and height of a pet in some nonstandard unit of measurement, such as pencils or even dog biscuits. The data can be used to compare the sizes of the animals without encountering the difficulties young children can have with standard rulers. The story *Measuring Penny* (Leedy, 1997) can be a connection to reading. Older children may enjoy the story *How Big is a Foot?* (Myller, 1990), which describes the confusion when different people's feet are used to make a bed for a queen. Beginning with such nonstandard units of measurement can help children become comfortable with the process of measurement before they are forced to learn how many inches in a foot or yards in a mile.

The need for a standard unit of measurement can be used to look at early units of measurement, such as the cubit. How long was a cubit? What were the dimensions of Solomon's temple in our system of measurement? Who determined the standard units that we use today? One social studies application might be a discussion of the implications of the United States being the only major economic power that does not use the metric system.

There are numerous other examples of places where mathematics can be integrated into other subjects. Art class can include discussion of shapes, stories from children's literature can be used to introduce mathematical topics, and simple statistics can be used to study scores during physical education. In addition to teaching about measurement, science classes can include work with ratios and proportions.

One area that is sometimes overlooked is the relationship between writing and mathematics. The four steps of mathematical problem solving listed previously correspond to Fulwiler's (1987) stages in the writing process: starting, searching, composing, revising, and editing. Except for the fact that Fulwiler's "revising" and "editing" are combined in Polya's "looking back," the lists are strikingly similar. Writing and mathematical problem solving are two areas that can often cause problems for students and adults. In both processes, people tend to jump into the composing or executing (computing) stage before adequate planning, and in both processes, people tend to skip the final stage of checking the reasonableness of answers or the quality of written work. Research has shown that mathematical problem solving can be enhanced by the use of informal or journal writing during the problem-solving process. Asking students to explain their final results will help them clarify their mathematical and verbal thoughts, leading to clearer writing and more successful problem solving.

We do need to remember, however, that our students don't live their lives in our classrooms. To make mathematics meaningful for them, we need to look outside the school walls—and this leads to the third reason for learning mathematics.