Educators everywhere can recount times when their students have been exemplary teachers. In one of my multigrade classes, while grade 2 students were exploring how multiplication works, it was a keen kindergarten student who helped the 2nd graders see that we were adding same-sized numbers over and over. As the 2nd graders struggled to master the concept, Breann observed what they were doing and said, “All of the numbers are the same, Mrs. Duffy.”

Years later, in another grade 2 math class, Lizzi’s cheery request opened the lesson: “Mrs. Duffy, may I show you what I learned about addition?” Lizzi randomly chose numerals and wrote them in two 20-digit rows on the whiteboard. Then, adding from left to right, she exclaimed, “See! You can use regrouping in any size of addition question.” As a result of Lizzi’s explanation, even the struggling students readily mastered regrouping in both addition and subtraction. When students can make contributions of such caliber, a love of learning is kindled, which enables students to see past the classroom walls to embrace the challenge of preparing “for the joy of service in this world and for the higher joy of wider service in the world to come.”

Memories of the effectiveness of these student-led teaching experiences inspired me to investigate approaches that multigrade teachers can use to nurture their students’ ability to teach and encourage one another. Peer tutoring, where one student acts as tutor and the other as tutee, emerged as a most helpful and positive instructional tool.

However, it soon became obvious that training would be needed to ensure that peers became effective tutors, and that developing question-asking skills would be the key to implementing an effective peer-tutoring program.

This article will first review the research on peer tutoring and how it can benefit multigrade students. Then some designs will be suggested for questioning strategies that facilitate the use of mathematical language during both whole-class and peer-tutoring sessions. After exploring ways to incorporate peer-tutoring sessions into the multigrade class, some easy-to-apply guidelines for peer tutoring and mathematical questioning techniques will...
follow. The last three sections will include examples of how to apply this information in math lessons.

**Research Reveals the Benefits of Peer Tutoring**

Research suggests that peer tutoring is a reliable and effective way to vary class instruction. Researchers, reviewers and meta-analysts have shown that peers can be reliable teachers. Depending on its design, peer tutoring can produce both short-term and long-term gains for tutors and tutees in all subjects with the greatest gains seen in mathematics. In algebra classes, peer tutoring has been shown to be as effective as class instruction. Analysts therefore encourage the use of peer tutoring as a supplement for teaching, rather than solely to add variety to drill-and-practice activities. Peer tutoring fits well in the multigrade class because it saves time and makes it easier to organize and assign tutoring pairs, since varied combinations of students are available in a single classroom: Cross-age groups, with the best age range of two to four years, are available for work that reviews concepts already introduced to older students. Same-age groups are also available in the multigrade classroom. They can benefit from either reciprocal peer tutoring or general tutoring techniques, which enable peers of any ability to tutor.

**Relationship Building a Bonus**

Tutoring also has positive affective benefits. Multigrade teachers can readily organize same-gender pairs and student-chosen pairs, which increases students’ enjoyment of activities because it enhances their sense of belonging and rapport as they relate with friends and children similar to themselves.

Peers relate well to one another better because they have much in common. Thus, peer tutoring can positively affect class dynamics and encourage cooperation as students gain insights into the teaching process and engage in meaningful practice. This helps class members to become productive citizens who show concern for others and use their time more productively. They develop the interpersonal skills needed for Christian witness, and their caring actions reveal that God is growing them in His kingdom.

**Time Savings and Flexibility**

The activities used by peer tutors can also be incorporated into unstructured periods, which provides further time savings and flexibility for the multigrade teacher. The use of math games during tutoring sessions can make the subject more meaningful and interesting to students. As students learn these games and find the activities to be rewarding, they will enjoy playing them at a learning center, which further reinforces math concepts and facilitates mastery of other curriculum subjects.

Multigrade teachers need instructional techniques that result in optimal learning within limited time frames because their time is frequently interrupted or restructured. Peer tutoring helps teachers and students make better use of time and allows teachers the flexibility to effectively implement short on-task sessions (i.e., 15 three-minute sessions during a three-week unit). Amazingly, peer tutoring actually can make a multigrade class easier to manage. Class size is cut in half when the teacher uses a reciprocal peer-tutoring model in which partners take turns tutoring each other.

Children with special needs receive more individualized instruction and companionship because of increased

Throughout this article, the author’s students model techniques for peer tutoring.
“engaged academic time” and because the teacher is able to deal promptly with incorrect responses. Most important, as students’ needs are met, the peer-tutoring sessions allow the teacher more time to assess and gain new perspectives on students’ strengths and to analyze how best to meet their needs. Throughout the tutoring sessions, the teacher can encourage the use of mathematical terms, support tutors and tutees in their use of prompts, facilitate and reinforce positive interactions among peers, troubleshoot by finding skilled tutors and asking them to model a difficult step for their classmates, and make adjustments for the next tutoring sessions.

**Getting Started**

So how do you get started? First, be sure to plan the specific, mathematically related objective(s) that you want your students to meet as you develop a script, or series of prompts, for the peer tutors to use. Research has shown that structuring the tutoring sessions is beneficial because structure promotes high-level mathematical thinking. Scripts, also called prompts, scaffolds, or temporary supports, have been used effectively by tutors to teach their peers algebra, rounding numbers, and bar graphs. Further, scripts help tutors facilitate high-level thinking because this tool helps them model questions appropriately, independently scaffold, or adapt a task to meet a peer’s needs. Scripts provide tutors with vocabulary that enables them to encourage their peers to give more accurate mathematical explanations. Mathematics readily lends itself to structuring, as it has its own vocabulary. Structuring lessons also establish meaningful goals, giving students a sense of purpose while allowing the strengths of individual students to blossom.

**Zeroing in on the Language of Mathematics**

Choose key questions to encourage the use of appropriate terminology and to provide scaffolds for tutors to use during their work with the tutee. If you
have students brainstorm relevant mathematical language in small groups, question starters from both mathematics and language arts will provide insights on how to craft lesson-specific scaffolds. First, consider the five basic teaching scenarios that encapsulate mathematics instruction: patterning, sorting, following examples, correcting non-examples, and modeling. Figure 1 provides examples of questions developed from these ideas for a lesson on addition with regrouping. Curriculum guides and reference books provide additional sample questions and vocabulary.31

Collaborative Reading Group designs32 also offer guidelines for teachers as they design scaffolds for their student tutors. A collaborative group design can be especially valuable because the assigned roles allow students to work from perspectives that emphasize their individual learning strengths,33 and can make them better tutors as well. Any type of collaborative role can be emphasized during each tutoring session or questions can be taken from each modality. Teachers also have the option of assigning tutoring pairs to share their work collaboratively with other partners. Math-related descriptions for prompts used from the perspective of each role are shown in Figure 2.

### Figure 1. Sample Scaffolds Related to the Five Mathematical Basic Teaching Scenarios

<table>
<thead>
<tr>
<th>Role Name</th>
<th>Role Description</th>
<th>Sample Mathematical-Based Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patterns:</strong></td>
<td>“What patterns do you see?” (Regrouping, adding 5’s)</td>
<td></td>
</tr>
<tr>
<td><strong>Sorting:</strong></td>
<td>“How can we change this question so that we can solve it more easily?” (Student rewrites the question vertically.)</td>
<td>“What do we need to remember as we rewrite this question?” (To line up the place values.)</td>
</tr>
<tr>
<td><strong>Following Examples:</strong></td>
<td>“Is this question done correctly? How do we know?”</td>
<td>“Can you show me your first step? Second? ... Last?” “Can you tell me exactly what to do so I can solve this question?”</td>
</tr>
<tr>
<td><strong>Correcting Non-examples:</strong></td>
<td>“Is this question done correctly? How do we know?”</td>
<td>“What math word was forgotten? How do we correct it?”</td>
</tr>
<tr>
<td><strong>Modeling:</strong></td>
<td>“What can we use to model this? Can you show me?” (Picture or base 10 blocks) “How can we show that we are regrouping in our picture?”</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 2. Using Roles to Create Prompts for Peer Tutoring Groups

<table>
<thead>
<tr>
<th>Role Name</th>
<th>Role Description</th>
<th>Sample Mathematical-Based Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question Master</strong></td>
<td>Metacognitive analyzer</td>
<td>“What do we know about this question?” “What is easy for you?” “What is challenging?” “What related math ideas have you used?” “Have you been consistent?”</td>
</tr>
<tr>
<td><strong>Practice Master</strong></td>
<td>Analyzes the main idea of the lesson</td>
<td>“What is the most important math idea to remember when you (add, subtract, balance an equation)?” “What are you trying to find out?” “Please tell me where you started.” “Explain how you solved this problem step by step.” “First you…. Next…. Then…. Last…..”</td>
</tr>
<tr>
<td><strong>Vocabulary Enricher</strong></td>
<td>Defines terms from lesson</td>
<td>“What does multiplication mean?” “What words in the question tell you that you are (multiplying)?” “Please, show me other ways to write the number 1.”</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>Connects math ideas to self, to other questions, to world</td>
<td>“When/where have we (added) before?” “Why is _______ useful?” “What math ideas did we see at the zoo?” “What math would we see at a farm?” “Let’s design a math field trip.” “If I were blind, how would you explain this problem to me?”</td>
</tr>
<tr>
<td><strong>Illustrator</strong></td>
<td>Creates graphic organizers or visual representations of math</td>
<td>“How can we create our own question like this?” “How can we create a problem that is one step more complex?” “Please show me this question with base 10 blocks.” “Let’s make a (game, cartoon, diagram, flow chart).”</td>
</tr>
</tbody>
</table>

Deciding How and Where to Use Peer Tutors

After developing your prompts, the next step is to determine where and how you want to use your peer tutors. Warm-up lessons, quick reviews, drills, and even peer-tutoring training sessions are three- to five-minute activities that work well with peer tutors.34 Perhaps you wish to begin a new math unit with a cross-age project or a cooperative problem-solving activity—peer tutoring can help you assess your stu-
students’ current application of mathematical language.

Peer tutoring can also be incorporated into daily teaching as an instructional strategy for entire lessons as well as for practice, reinforcement, and re-teaching. For example, you could use a specific questioning series to teach one to three students (same ability or cross-age), and then have these students use the same questions to tutor partners, who then tutor others. When using peers as instructors in this way, teachers have the option to tier the level of practice exercises either within the same grade or across grades. See Figure 3. Or perhaps after a whole-class lesson with the teacher, grade 8 students could review multiplication of decimals and whole numbers. They could then teach grade 6 multiplication for only decimals. grade 6 tutors could teach 3-digit by 2-digit multiplication to grade 5 students, who in turn review the concept of repeated addition with students in grade 2.

Using Reciprocal Peer Tutoring

Another idea for practice time, reinforcement, and re-teaching: Include reciprocal peer tutoring, where the student has a prompt card that shows each step for a problem. As Figure 5 shows, the tutor makes an initial attempt at completing the question. If the response is correct, he or she tries another question or switches roles with the tutor. If the answer is incorrect, the tutor indicates the step from which the tutee should begin work and provides a second chance. If the answer is still incorrect, the tutor models the solution, after which the tutee repeats it and then goes onto another problem. The tutor and tutee may switch roles after a certain number of questions or after a stated time period.

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**Figure 3. Example of Tiered Problems for a Fraction Unit***

<table>
<thead>
<tr>
<th>Level A</th>
<th>How can 2 people share 3 brownies?</th>
<th>How can 2 people share 5 brownies?</th>
<th>How can 4 people share 3 brownies?</th>
<th>How can 3 people share 4 brownies?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy:</td>
<td>Repeated halving</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level B</th>
<th>How can 4 people share 3 brownies?</th>
<th>How can 3 people share 4 brownies?</th>
<th>How can 3 people share 5 brownies?</th>
<th>How can 6 people share 4 brownies?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy:</td>
<td>Dividing into 1/4, 1/3, 1/6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level C</th>
<th>How can 3 people share 5 brownies?</th>
<th>How can 3 people share 2 brownies?</th>
<th>How can 6 people share 4 brownies?</th>
<th>How can 5 people share 4 brownies?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy:</td>
<td>Halving plus Level B strategies</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Adapted from Lori Williams, *Teaching Children Mathematics* (February 2008), p. 326.

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**Figure 4. Sample Reciprocal Peer Tutoring Worksheet**

<table>
<thead>
<tr>
<th>First Try</th>
<th>Second Try</th>
<th>Model</th>
<th>Third Try/Comments</th>
</tr>
</thead>
</table>

---

**Figure 5. Sample Prompt Card—The Steps of an Effective Tutoring Session**

**Greeting:** “Hi. How are you doing?”

**Set the stage:** “Let’s look at our assignment. What are we working on today?”

**Work Time:** “Please, show me… ”

**Closing:** “Thank you for _____. Let’s record our work.”

**Figure 6. Ideas for Reinforcing a Classmate’s Correct Answer**

“Good work. Thoughtful answer.”

“Good, you used regrouping [or any relevant mathematical term] in this question.”

“You put a lot of effort into _____. ”

**Figure 7. Ideas for Helping a Classmate Correct an Answer**

“That’s close. Try again from here.”

“What math fact do you need? How does that change things?”

“What math words would help us?”

“You regrouping is clear to here.”

“How can you follow through from here?”
Motivation

Once you have chosen a tutoring model, consider the option of incorporating a rewards system. Rewards may be contingent upon individual academic performance or used to validate goals for cooperation within groups. For example, Hawkins et al. asked students to generate their own ideas for reinforcers. Then, during each session, the teacher randomly chose whether the rewards would be contingent upon appropriate tutoring behavior or perfect test scores.

Previous to setting peer tutors to work, the teacher must incorporate tutor training into everyday lessons. Coaching in both math language and interpersonal support strategies helps tutors work more comfortably and successfully. When students are prepared, this helps them to take ownership of their tutoring sessions.

Some simple, easily planned interpersonal support strategies can be implemented to make peer tutoring more meaningful and to encourage accountability and responsibility for all students. A tutoring session can be role-played. As Figure 6 shows, effective tutoring sessions should begin with a greeting, followed by a question to establish the purpose for the session. Next comes the body of the session, then its conclusion. Within the main section of the tutoring session, tutors need to know how to respond to both correct and incorrect answers. The teacher can make specific suggestions or take five minutes to brainstorm ideas with the class.

Teachers can scaffold communication development for tutors and tutees by making reference cards for “The Steps of an Effective Tutoring Session” (Figure 5), “Ideas for Helping a Classmate Correct an Answer” (Figure 7), “Today’s Math Words,” and “Ideas for
Reinforcing a Classmate’s Correct Answer” (Figure 6).

Record-Keeping Strategies
The teacher must plan a strategy for pairs to record their work independently. Charts that students can use to track their progress give sessions a sense of purpose, help students develop a feeling of accomplishment, and provide accountability.42 The teacher will also want to create a record chart on which to record his or her observations during tutoring sessions. On the students’ record charts, there should be a place for comments so that tutors can reflect on the lesson that they have tutored.

Debriefing can be helpful because students, like teachers, need feedback on their teaching skills,43 and students may make helpful suggestions for future lessons.44 Tutor involvement in assessment and planning has been evaluated positively in the literature.45

As you consider how tutors can help the teacher structure subsequent sessions, the positive impact of peer-tutoring techniques on the tutor needs to be re-emphasized. Peer tutoring has been used purposefully and effectively to both teach and tutor new math skills. Student tutors especially advance in proficiency as they teach mathematics to their peers.46

The reciprocal peer-tutoring system uses prompt cards that enable tutors to evaluate their peers even though the tutors are still learning or consolidating their own skills.47 Teachers may also compose mathematically focused scripts that enable tutors to practice higher-level mathematical thinking skills.48 Tutoring helps students develop both interpersonal and intra-personal skills, which enhance their experience in mathematics and make the subject a favorite class.49

Conclusion
To summarize, research and practice show that peer tutoring works. The multigrade classroom is an ideal fit for peer-tutoring programs. Structured lessons, flexibility of design, scaffolds such as prompt cards and role plays, students’ use of mathematical language, and the development of positive interdependence all make peer tutoring in mathematics class practical and user-friendly. As your tutoring program grows, you will find that lesson development becomes a partnership with students. Positive interdependence grows among students and between students and their teacher. This benefit far outweighs any extra initial preparation time.  

NOTES AND REFERENCES
1. Students’ names in this article have been changed to protect their privacy.


11. Cross-gender pairs sometimes show limited results, but appropriate peer training could readily overcome these challenges.


16. Topping and Bamford, “The Paired Maths Handbook,” op. cit.; and Topping, et al., “Cross-Age Peer Tutoring in Mathematics With Seven- and 11-Year-Olds: Influence on Mathematical Vocabulary, Strategic Dialogue and Self-Concept,” have developed some math games. As I reviewed the games and the information accompanying them, I saw the need to be sure that activities match the curriculum and the abilities of students.


21. Juanita V. Copley, “Questions Specific to Patterns, Functions, and Algebra,” in Spotlight on Young Children and Math, Derry Korleka, ed. (National Association for the Education of Young Children, 2003), p. 24. This is algebra for Pre-K to grade 1, but the general questioning strategy applies to older children.


35. Williams, “Tiering and Scaffolding,” op. cit.
36. The teacher will need to watch the progress of the lessons because by this point, grade 5 students may need a short group lesson to review and support their understanding of the idea of how repeated addition is related to multiplication.
43. Goodlad and Hirst, Peer Tutoring, op. cit., p. 141.
46. Sparks, “Researchers Find That Students Learn by Tutoring Virtual Peers,” op. cit.

Guest Editorial Continued from page 3

Each of these articles in this issue is meant to inspire and encourage you as you lead students into the adventure of mathematics.

The Coordinator for the special section on mathematics in this issue, Wil Clarke, Ph.D., is Professor of Mathematics at La Sierra University in Riverside, California. The editorial staff of the JOURNAL express heartfelt appreciation for his assistance throughout every phase of the production of the issue from the selection of topics and authors through the peer review process, revisions, and preparing the final manuscripts.

NOTES AND REFERENCES
1. 1 Peter 3:15 (NKJV), italics supplied. Texts credited to NKJV are from the New King James Version. Copyright © 1979, 1980, 1982, by Thomas Nelson, Inc. Used by permission. All rights reserved.
4. Ibid.