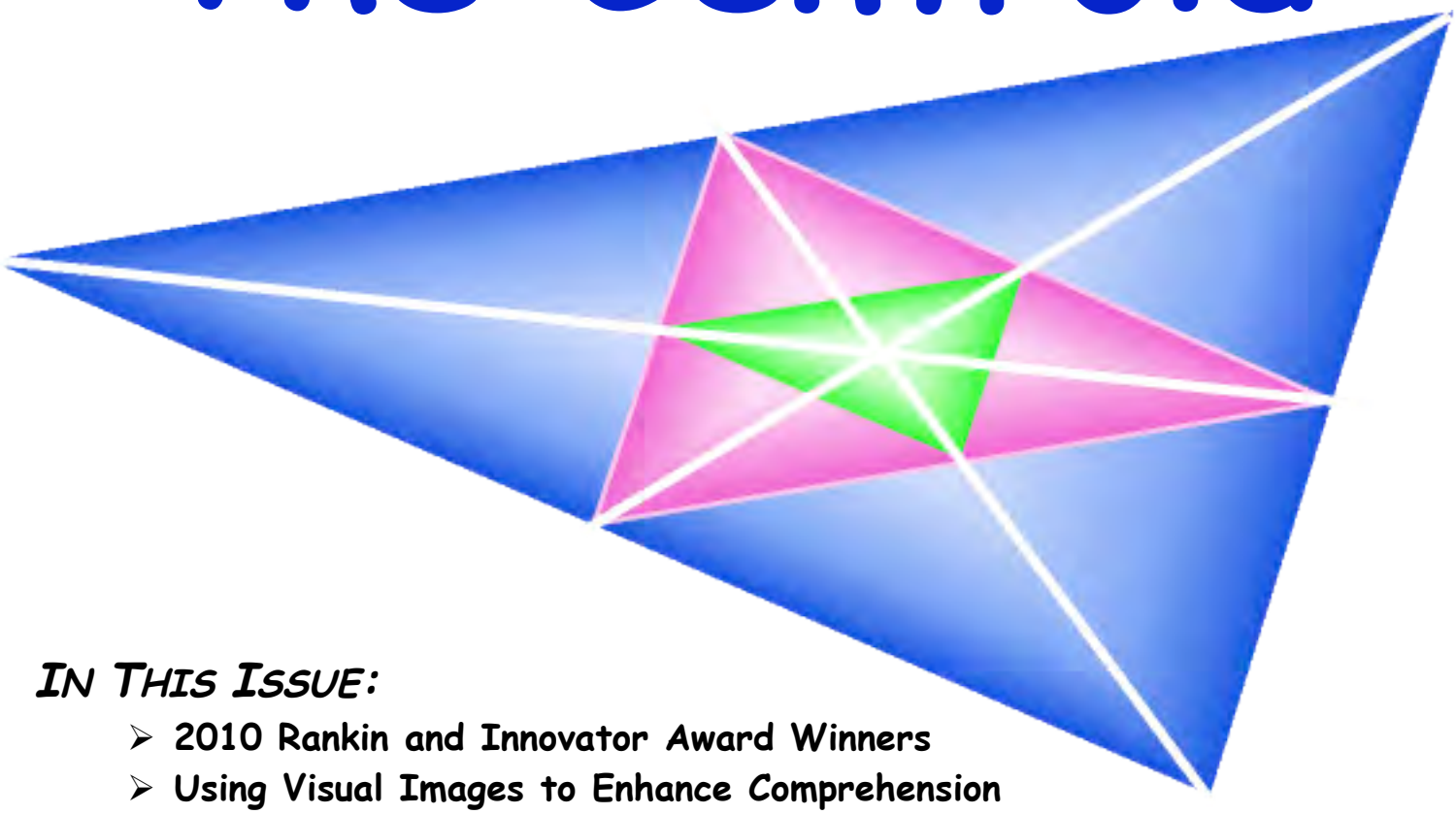
The Centroid



In This Issue:

Official Journal of the North Carolina Council of Teachers of Mathematics
Volume 37 • Number 1 • Spring 2011

The Centroid is the official journal of the North Carolina Council of Teachers of Mathematics (NCCTM). Its aim is to provide information and ideas for teachers of mathematics—pre-kindergarten through teacher education. *The Centroid* is published in January and August. Subscribe by joining NCCTM; see the Membership Form on the last page.

Submission of Manuscripts

We invite the submission of news, announcements, and articles useful to school mathematics teachers or mathematics teacher educators. In particular, K-12 teachers are encouraged to submit articles describing teaching mathematical content in innovative ways.

News and announcements (president's messages, award winner announcements, professional development announcements, etc.) must be received by December 1 for the spring issue and by July 1 for the fall issue.

Articles that have not been published before and are not under review elsewhere may be submitted at any time to the address below. Submit one electronic copy via e-mail attachment (preferred) or diskette in *Microsoft Word* or rich text file format. To allow for blind review, the author's name and contact information should appear *only* on a separate title page. Manuscripts should not exceed 10 pages double-spaced with one-inch margins. Figures and other pictures should be included in the document in line with the text (not as floating objects). Scannable photos are acceptable and should be large glossy prints mailed to the editor or minimum 300 dpi tiff files emailed to the editor. Proof of the photographer's permission is required. For photos of students, parent or guardian permission is required.

Manuscripts should follow APA style guidelines from the most recent edition of the *Publication Manual of the American Psychological Association*. References should be listed at the end of the article, and should also follow APA style, e.g.,

Bruner, J. S. (1977). *The process of education* (2nd ed.). Cambridge, MA: Harvard University Press.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

North Carolina Department of Public Instruction. (1999). *North Carolina standard course of study: Mathematics, Grade 3*. Retrieved October 17, 2005, from http://www.ncpublicschools.org/curriculum/mathematics/grade_3.html

Perry, B. K. (2000). Patterns for giving change and using mental mathematics. *Teaching Children Mathematics*, *7*, 196–199.

Ron, P. (1998). My family taught me this way. In L. J. Morrow & M. J. Kenney (Eds.), *The teaching and learning of algorithms in school mathematics: 1998 yearbook* (pp. 115–119). Reston, VA: National Council of Teachers of Mathematics.

General articles and teacher activities are welcome, as are the following special categories of articles:

- *A Teacher's Story*,
- *History Corner*,
- *Teaching with Technology,*
- *It's Elementary!*
- *Math in the Middle*, and
- *Algebra for Everyone*.

Editorial Board

About the Cover

The Centroid logo is based on the following theorem: The limit of the sequence of midtriangles of a triangle is the centroid of the triangle.

Copyright

Contact Information

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The Centroid

OFFICIAL JOURNAL OF THE NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS
VOLUME 37 • NUMBER 1 • SPRING 2011

Articles

News & Information

From the Editors

The 2011 spring issue is here. We hope you enjoy the articles we have included. Keep those submissions coming. We are particularly interested in articles from classroom teachers who have found techniques that work to help their students learn mathematics!

- Debbie Crocker and Holly Hirst

NCCTM 2011 Conference: October 27-28

Koury Convention Center, Greensboro

The 2011 State Mathematics Conference is a wonderful opportunity to share research, classroom strategies, activities, and resources with your colleagues that make mathematics come alive for your students. Take the time to fill out the online speaker enrollment form and be a part of this annual professional development opportunity. Encourage colleagues to present as well.

The deadline for submissions is May 23, 2011.

Follow the "Conferences" link on the website to access either the online form or a printable form to mail in.

<http://www.ncctm.org>

NCCTM Mathematics Logo Contest

The Celebrate Mathematics Committee sponsors the annual Math Logo Contest. The winning logo will be the mathematics logo for NCCTM for the 2010-11 school year. This logo will be used on a poster to promote interest in mathematics and as the basic design for NCCTM's 2011 T-shirt.

General Rules

Please be aware that a professional graphic artist will prepare the final art of the winning entry for printing. Though the illustration is an important part of the logo, entries are judged on idea or concept conveyed. Use of copyrighted work (clip art, cartoon characters, etc.) will automatically disqualify the entry. The words of the slogan should not be on top of or touch the design. Download and duplicate the information label and attach to the back of each entry. Entries submitted with incomplete information may be disqualified.

Please submit the entries on 8 1/2 by 11 paper in black ink or black marker only. Entries must be postmarked by **March 1, 2011**

Mail entries to:

Amy Travis
Math Logo Contest
3716 Manor Drive
Greensboro, NC 27403

2010 Logo Winner
Sara Bolton, Ridgecroft School

Presidents' Messages

State President
Wendy Rich
wrich@asheboro.k12.nc.us

Greetings! On behalf of the NCCTM Board of Directors I would like to say thank you for making this past conference a huge success. We had slightly over 2,000 people to attend the conference in spite of difficult economic times. I would like to extend a personal thank you to everyone that helped with the conference; Drew Polly and Amanda Northrup (Program Chairs), Donna Thomas and Elisabeth Murray (Conference Chairs), Vincent Snipes (Audio Visuals), Hollylynne Lee (Birds of a Feather Event), Karen Bartlett (Commercial Exhibits), Ana Floyd and Ryan Dougherty (Publicity), Tina McSwain (Troubleshooting), Kim Aiello, Shana Runge, and Melissa Wilson (Marketplace), Donna Boyles and Lisa Williamson (Registration Volunteers), Betty Long (Student Exhibits), Rebecca Hoover (Management Services), Marilyn Preddy (Conference Services), and all of the presenters who shared their knowledge and expertise. A special thank you to NCDPI's Mathematics Consultants for taking an integral part in helping us get prepared for all the changes headed our way in mathematics education across our state. There were many, many more volunteers that assisted by passing out tickets, working registration and NCCTM booths, assisting with the awards banquet, and quite frankly, assisting me in ways I couldn't have imagined. I can't thank you all enough. I truly hope everyone was able to take advantage of all that the conference had to offer. If you were not able to hear Phil Daro, one of the primary authors of the Common Core State Standards for Mathematics, please check out his power point on our website.

Mathematics remains strong in our state primarily through the dedicated service of our NCCTM members. I am blown away by the amount of time our members volunteer each and every day. I owe a huge debt of gratitude to all of our committee members, board members, and volunteers. I am proud to serve alongside so many wonderful mathematics educators! If you would like to be more involved in NCCTM, please contact me or your regional president. We are always looking for ways to better serve our membership.

Eastern Region President
Ray Jernigan
jernigan@suddenlink.net

As I reflect on the past two years as president of the NCCTM East Region, I am grateful for the opportunity to have worked with wonderful colleges across our state in the endeavor to support the teaching and learning of mathematics. We had a successful State Conference this past fall, and I highly recommend that you attend the 2011 Conference. I would like to express thanks for the many people serving on NCCTM boards and committees that make the conferences, our Journal, grants and materials possible for North Carolina teachers. They give generously of their time, energy, and resources - Thank You!

In the coming two years you will face some daunting obstacles: new curriculum standards, spending cuts, larger classes, and others. This is not the time to pull away but a time to pull together and strengthen support for our profession and NCCTM. I encourage you to become more active in your organization and encourage fellow teachers to join and take advantage of the services and opportunities that NCCTM provides. Your new president for the East Region is Dr. Ron Preston of East Carolina University. Please support and work with him to make this the best year ever for our organization.

Central Region President
Barbara McGill
motley455693@bellsouth.net

The 2010 State Conference held on October 28-29 and the Leadership Conference proved to be a success. To all of you that attended, I know you received some valuable information that can be used in your classrooms. To those of you who were unable to attend, you missed a treat! However, we are planning a Spring Conference to

be held on the campus of UNC-Greensboro on Saturday, March 5, 2011. More information will be posted on the website, so mark your calendar.

This is my last letter to the membership and there are persons I'd like to thank for their dedicated work in our region: vice-president for elementary, Bob Vorbroker, for middle school, Donna Thomas, for secondary, Billie Bean, and colleges, Kerri Richardson. We had two student representatives who provided their perspective to our group, Fanisha Fuller and Toi Jones. Each has sacrificed their time, energy, and expertise to help make our organization an effective one. Thanks to you for all you do for mathematics education and students in North Carolina. And to the president-elect, Pat Sickles, I know you will continue to represent the Central Region on the Board and in the organization in a professional manner. You have always done what it takes to get the job done! To the Central Region membership, I thank you for your trust in my ability to represent you these last few years. It has been a great ride! NCCTM is a great organization! It was especially powerful because of two of our (Central Region) more active members. . .Past State-President Wendi Rich and Past State-Vice President for Elementary, Anna Floyd. Thanks ladies for your leadership and assistance. It was super!

I hope to see you all at the Spring and Fall Conference in 2011and wish you well in your quest to educate the children of North Carolina in mathematics. Thanks!

Western Region President
Kathy Jaqua

kivey@email.wcu.edu

Two years really goes by quickly when you're having fun! I do appreciate the opportunity to serve as the Western Regional President for NCCTM during the past two years. As we all move towards the new Core Curriculum, it reminds me how we often see outside forces trying to drive what goes on inside our classrooms. And, while it is true that those forces can have some effect on what we do, in the end, the real decisions about what happens in our mathematics classrooms are in the hands of the teachers and students in those rooms. Outside forces can tell us what topics to address and what techniques to have student master, but only the inside forces (teachers and students) can determine how those tasks will be accomplished. It makes me comfortable to know that the ultimate choices are in the hands of the people who I have had a chance to work with, and learn from, during my time here in North Carolina and particularly over the past two years. I have seen teachers demonstrate fantastic lessons that engage anyone who participates in them. I have seen teachers cooperate within and across grade bands to improve everyone's knowledge of mathematics and mathematics teaching. I have seen teachers think deeply and critically about how to best help our students become mathematically proficient and more. It is a great honor that I have had serving as a Regional President, and I look forward to continuing my work with North Carolina's finest—her mathematics teachers! Continue your work as the inside force that propels our students towards knowledge, skill, and comfort with mathematics, and I'll be waiting to learn more from you.

Awards

2010 Outstanding Coach/Sponsor
Jill Tetsworth

Jill Tetsworth (center), pictured with Wendy Rich (left) and Harold Reiter (right).

The Coach/Sponsor Award has been newly established by NCCTM to recognize an individual who has made an outstanding and noteworthy contribution to mathematics and NCCTM by having formed, coached, and sponsored teams of students in mathematics competitions. At the 2010 Conference, Jill Tetsworth was recognized for her sustained efforts as the primary coach/sponsor at Northwest Guilford High School for eleven years. Her teams have done consistently well in the local competitions, in the run offs at UNCG, and in the comprehensives at the state level.

Learning Styles of the Struggling Algebra Student: A Statistical Snapshot

Ann D. Bingham
Peace College, Raleigh North Carolina

Although the North Carolina Department of Public Instruction requires algebra for the majority of high school students, many of our students come to higher education without a strong understanding of algebra concepts. In North Carolina, high school students in the College Tech Program and those in the University/College Prep Program do not graduate unless they have taken a second course in algebra. The required mathematical courses for these tracks are Technical Math II for the College Tech Prep and Algebra II for the University Prep students. Both courses include multi-step problem solving and exponential functions. Some of our students respond well to our teaching and succeed. Unfortunately many do not succeed and do not master the material taught. A longitudinal study by the National Center of Educational Statistics found that by the end of the senior year only 38% of the more than 9000 tested were able to draw an inference based on an algebraic expression and only 4% had mastered multi-step algebra problems that required evaluation of functions (Bozick & Ingels, 2008). This paper considers one possible way to increase the number of students who master the mathematics required in high school.

Math educators want to find ways to help students be successful. We know that they are quite capable of learning algebra; what are some ways that help us convince the students? My personal experience with students who thrived in geometry but struggled in algebra convinced me that visual representations could help some students succeed in algebra. I wanted to test this theory. Are there some students who learn better visually?

This study considered a certain group of students: those who had studied algebra in high school, but found themselves doing poorly on Math Placement tests when they entered the first year of college. These students were placed in College Algebra. These students were similar to the 96% in the NCIES study who had not mastered multi-step problems (Bozick & Ingels, 2008). The pedagogical techniques that are successful for some students are not working for these struggling students. The thesis of this paper is that these students would do better if they could learn the material in a manner that was compatible with their preferred learning style.

A review of the literature shows that there are many assessments for learning and personality styles. Kolb and Meyers-Briggs are familiar ones. Research has shown the assessments to be valid (Carlyn, 1977; Pickworth & Schoeman, 2002; Tzeng, Outcalt, Boyer, Ware, & Landis, 1984). We now know that students preferentially process information in different ways. My research suggests that there is a certain learning profile that fits the majority of College Algebra students

I chose the Felder-Silverman Learning Styles Index ([LSI], Felder & Silverman, 1999) as the instrument to assess learning styles. The LSI Index is an online test designed for college students where the time involved is five minutes or less and results are immediate. The LSI has been studied and its reliability has been assured (Felder & Spurlin, 2005). For this current study, the LSI was administered to 104 College Algebra students.

The learning styles are divided into four categories: Active versus Reflective, Sensing versus Intuitive, Sequential versus Global, Visual versus Verbal. Active students obviously prefer to be active and to try things out before spending much time thinking. They learn by discussing with others and working in groups. The reflective learner works well alone and thinks through problems before attempting the exercises. The sensing learner prefers the applications of an idea as opposed to the theoretical implications, and the intuitive learner is the opposite – he or she likes to think about the abstract concept first and then move on to the applications The global learner looks at the big picture first and then gets down to details. The sequential learner enjoys learning material one step at a time. Verbal learners are most at ease with written and oral communication, while visual learners prefer diagrams, charts, and other visual representations.

The Felder-Silverman LSI asks 44 bimodal questions such as: “I prefer to work in groups” or “I prefer to work alone.” The students involved were given an extra credit point for turning in the LSI sheet. After getting their extra credit, the names were then removed and the survey was anonymous. The Felder-Silverman LSI immediately prints out an assessment. Figure 1 shows a sample of the printout.

We see in the printout in Figure 1 that each category has the two different styles labeled on the ends of a number line that represents levels from 11 on one side of the scale to 11 on the other side of the scale. For example, consider the first two lines. The scale is for Active to Reflective Learning Style. After answering the

Results for: Jane Doe

ACTIVE X REFLECTIVE

11 9 7 5 3 1 1 3 5 7 9 11

SENSING X INTUITIVE

11 9 7 5 3 1 1 3 5 7 9 11

VISUAL X VERBAL

11 9 7 5 3 1 1 3 5 7 9 11

SEQUENTIAL X GLOBAL

11 9 7 5 3 1 1 3 5 7 9 11

Figure 1. A Felder-Silverman LSI Assessment

questions of the survey a score is given ranging from the strongest Active learning style to the strongest Reflective learning style.

An X is placed above the number scale to designate the learning style for that category. In this example, the X is placed above the 3 of the Reflective side. So this student has a slightly Reflective learning style. A student who had an X placed on the 11 of the Reflective side would be an extremely Reflective learner.

The LSI results allow the student to see which learning style they seem to have and how strong the preference for that style is. A student who scores a 1 for Active Learning would be more comfortable in a lecture class than a student who scores 11 for Active Learning. To do analyze the data, the scales have been changed in the discussion of results below so that the Reflective, Intuitive, Verbal, and Global are rated as negative numbers, e.g., most reflective is -11. This research suggests that the majority of the algebra students are both visual and active learners. In fact, 44% of these students are one specific type: active, sensing, sequential, visual learners.

Results for Reflective/Active Category

In this study, 76.9 % of the students were classified as Active learners on the LSI. We see from the box plot in Figure 2 that the middle 50% of these students scored between 1 and 5 on the Active side of the range. The active learner tends to do well when actually moving. Group activities can be particularly helpful. We understand the problems and the time constraints of group activities, but for these learners the advantages outweigh the disadvantages.

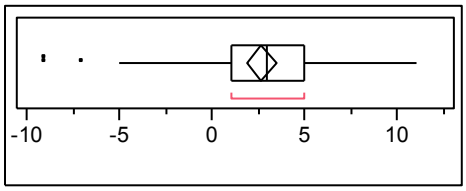

Figure 2. Reflective (-) versus Active (+) Results

Figure 3. Students using a scarf to demonstrate transformations of functions.

The Felder-Silverman website recommends active learners work best by doing and talking about the material. In class, discussion and group work are very helpful to these learners. Study groups are wonderful ways for active learners to learn. Active learning in the algebra classroom is most often accomplished by having the students do exercises as classwork. But some other ways to use their active learning style involve physical movement in the classroom. If there is sufficient room, a coordinate system taped on the floor with masking tape works very well. In Figure 3, students are working on transformations of functions by physically manipulating a graph on a Cartesian coordinate system.

Some students do well when they are actively trying problems on the computer. For example, a website on quadratic relations allows students to graph parabolas by using a slider to choose the values in the equation (Toogood & Blond, 2009). For the active student, doing many active problems would be more helpful than the textbook problem that has four parabolas to visually match with their equations.

Results for Verbal vs. Visual Category

More than 80% of our struggling algebra students are more visual than verbal learners. The middle 50% scored between 1 and 7 on the visual side of the chart.

Visual learners find visual representations most helpful. When the instructor uses diagrams, charts, photographs, or videos, the visual learner learns more easily. Visual learners do well when they organize learning with concept maps and color code their notes. Making use of educational media is also encouraged. The visual learner in algebra will often do better with a graphic representation first. This slight difference in presentation may make a huge difference in student outcome.

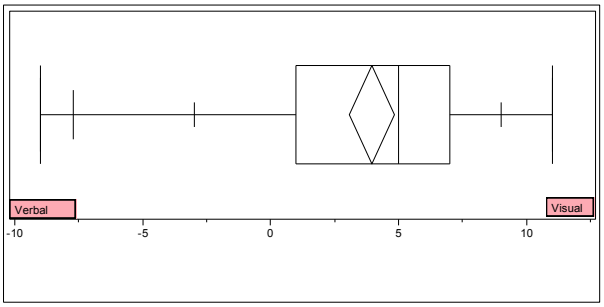

Figure 4. Verbal (-) versus Visual (+) results

For example, algebra students often struggle with absolute value inequalities. If the graphical representation is presented before the analytic, some students will be able to understand the concept more easily. First, students must know how to graph a function and then be able to graph different absolute value functions. Once that is established, the active learner who graphs both sides of the inequality, the absolute value function and the constant function, can see where the inequality is true. Visual students may benefit from using colored pencils for this process, as in Figure 5. Time spent on this activity before the students actually solve the inequality analytically may help the learning process.

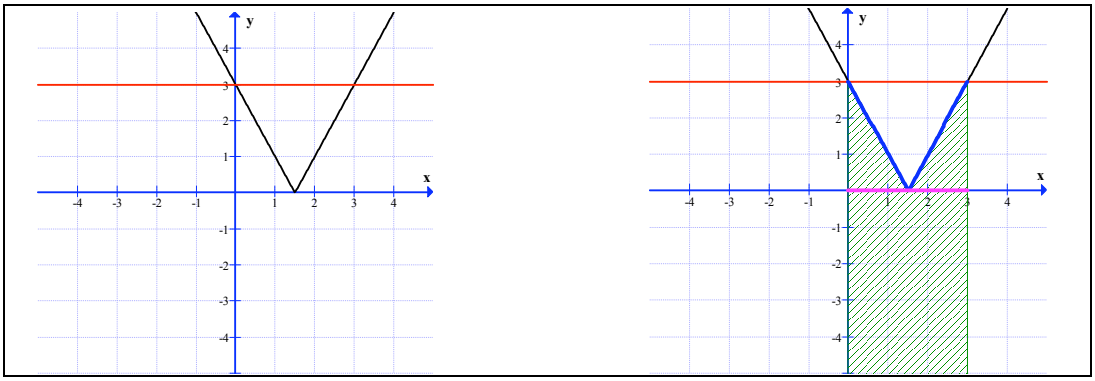

Figure 5. For the problem $|2x - 3| < 3$, students graph $y = |2x - 3|$ and $y = 3$. Students can then see where the two functions intersect and color the parts of $|2x – 3|$ that are less than 3 in blue.

Results for Intuitive vs. Sensing Learners

The Sensing learning style is the preferred one for 80.8% of the students (Figure 6). The sensing student likes real world facts. Since algebra is applicable in the real world, we need to share that with the students. The algebra textbook usually has many real world word problems, which may be helpful to the sensing learner.

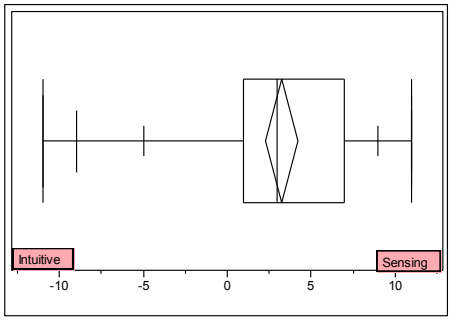

Figure 6. Intuitive (-) versus Sensing (+) results

One way instructors can help these students is by using examples and exercises that correspond to the student's world. A problem finding the equation of a line for the total cost of buying an iPod at \$69 and x number of songs at \$.98 each is easier for this student than the more typical textbook question "find the equation of a line with slope = .98 and y-intercept = 69." As educators we know that the students need to understand the most general case, but these students do better starting with realistic examples. Another example that can seem more relevant to the student is from the website "Fun and Sun Car Rental" (Lanius, 2009) which provides a problem of multiple different linear equations to select which car rental company to choose to minimize cost based on number of miles driven.

Results for Global vs. Sequential Learners

Again there is a style that is predominant for these students: Sequential more than Global. This is an advantage in algebra, since the texts tend to present each concept in a sequential style. In this study, 79.8% of these students are more sequential than global. The middle 50% fall within the levels 1 to 7 of sequential as opposed to global.

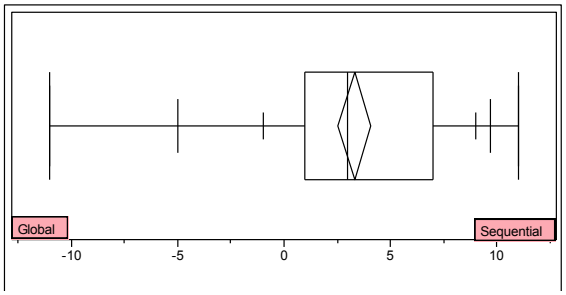

Figure 7. Global (-) versus Sequential (+) results

Conclusion

The college prep students who struggle in algebra are assigned to algebra courses, either Intermediate Algebra or College Algebra, when they arrive at their place of higher education. There are certain ways of learning that are predominant in this group and the outcomes may be improved if high school algebra educators can continue to offer the material in a variety of ways. The results of this survey show that some educational techniques may serve this population better. The suggestion then is to continue to present material in multiple ways, but that many of our struggling algebra students will respond better if the active, visual ways of learning are emphasized. The graph in Figure 8 shows the percentage of students from this study identified with each of the 16 possible learning style combinations. The active, sensing, visual, sequential learning style is predominant with 42.3% of the students having that exact combination.

The method used by educators when introducing a new concept affects outcomes in these students. Instructors should introduce concepts aimed for the visual, active, sensing, sequential learner first, before expecting students to gain facility in transferring knowledge to analytic form. This is a small difference in the way algebra instructors design lesson plans, and yet it may contribute to better algebra students in the future.

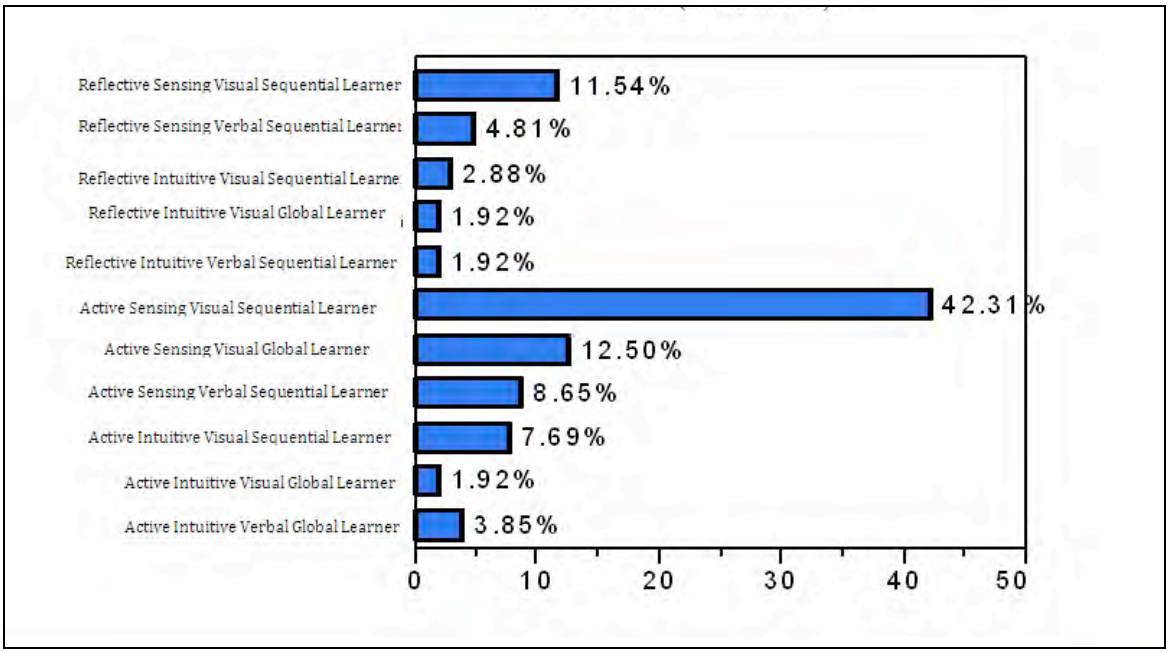

Figure 8. Percentage of students in each category combination

Certainly having instructors cognizant of the learning styles of their students is not a panacea, but this information is one more aid to the teacher. This study shows that most of the students are visual learners, and most are active learners. We even see that one set of the 16 possible types is prevalent in these struggling algebra students. High school teaching is a labor-intensive job and teachers do not have the time to redo their entire set of lesson plans. Still, with a few tweaks the lessons could be formulated in a way that would reach more students. If we know that students are more visual, we can start with the graph instead of doing the graphs later. We can plan our classes to include movement if the struggling students do better with movement. And we

can choose the homework assignments that will seem more relevant to the students if that helps the student put the time into learning the material.

I wish all students learned mathematics easily. My goal is that this paper gives the instructor a bit more information and helps the student find a way to finally learn the algebra.

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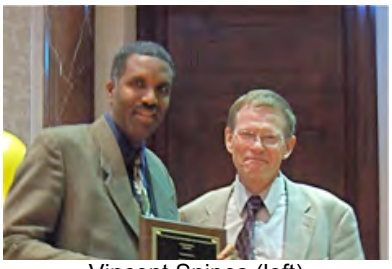
Awards

2010 Innovator Award Winners
Vincent Snipes
and
The Charlotte Home Educators Association



Vincent Snipes (left)
pictured with John Goebel

Susan Schafer (left)
pictured with John Goebel

The Innovator Award was established to recognize individuals or groups who have made an outstanding and noteworthy contribution to mathematics education and/or NCCTM by having founded, initiated, pioneered, or developed a program in mathematics education of service to a geographic region of the state or the entire state. At the 2010 Conference, NCCTM presented Vincent T. Snipes with the individual Innovator Award and the Charlotte Home Educators Association with the group Innovator Award.

Dr. Snipes is Interim Director of the Center for Mathematics, Science, and Technology Education and Associate Professor of Mathematics Education at Winston-Salem State University. Dr. Snipes was recognized for establishing the Mathematics Contest site at Winston Salem State University in 2004 and conducting the contest in years 2005 through 2009.

The Charlotte Home Educators Association was established to "promote better communication, support, fellowship, and unity among Charlotte homeschoolers." The Charlotte homeschool Association was recognized by NCCTM for its long and dedicated efforts in starting and maintaining a Homeschool Mathcounts Chapter. Susan Shafer accepted the award on behalf of the Association.

Twenty Ways to Enhance All Students' Mathematical Understanding

Tyrette S. Carter and Loury Ollison Floyd
North Carolina A & T State University, Greensboro

The beauty of mathematics is often lost in its formulas and procedures. Many students often find this subject extremely difficult because they are focused on the processes and simple facts rather than the complex language that assists in composing logical and critical thoughts for problem solving. Over the years, there has been a shift in the learning and teaching of mathematics. The subject has moved from an elitist course to a requirement for all. Through this shift, the National Council of Teachers of Mathematics' (NCTM) Equity Principle and the IDEA Amendment require that all children have access to learning mathematics. The Equity Principle states, "This does not mean that every student should be treated the same. But all students need access each year they are in school to a coherent, challenging mathematics curriculum that is taught by competent and well-supported mathematics teachers" (NCTM, 2000, ¶ 1).

To meet the goal of equal access to the curriculum and to enable students to engage with lessons in a meaningful way, teachers must be prepared to provide useful alternatives in terms of curricular materials, instructional delivery, and assessment tools. Students must develop a conceptual understanding of the curriculum through integrating the content standards with the process standards rather than memorizing facts (NCTM, 2000). Well-adapted materials without an effective method of teaching and adequate assessment tools are practically useless. However, the proper tools and instructional methods coupled with teachers who encourage students to actively and directly participate in the learning experience enhance every student's mathematical abilities. Through the 20 suggestions provided in this article teachers can develop meaningful and rich mathematics experiences for all students.

1. Teach for understanding. Build an understanding of the content from the concrete to the abstract. Provide experiences that focus on conceptual understanding that lead to procedural knowledge rather than memorizing or recalling facts, formulas or steps. Also, allow students to analyze their ideas so that they develop a connection between their conceptual and procedural knowledge.

2. Provide opportunities to communicate. Have students communicate their ideas through listening, speaking, and writing. Teachers should provide numerous occasions for students to discuss in small groups, large groups, and whole classes. Teachers should incorporate strategies such as Think-Pair-Share, Jigsaw, and Graffiti models to allow quiet, shy students opportunities to communicate their understanding and build their confidence. Also, utilize journal logs to allow students to write their thought processes while completing a problem or task, which helps students extend their thinking and understanding and enables them to better express their ideas.

3. Connect learning to the real world. Create a community of learners, which includes families, business leaders, school administrators, health officials, doctors, lawyers, local governmental officials, and others who play a role in the community at large. Allow community leaders to visit and participate in classroom discussions related to their occupations. Build partnerships, so that students see the applications of topics learned in the classroom. Students must see mathematics in action through real world projects and assignments to help them the relevance of learning a particular topic.

4. Incorporate multiple instructional strategies. Provide a variety of methods that incorporate the process standards (communication, connection, reasoning & proof, problem-solving, and representation). Incorporate mastery learning, discovery, inquiry-based and direct instruction approaches to allow students to construct their own knowledge and build on their prior understanding. Keep in mind when using a mastery learning approach many other strategies may be incorporated to meet students' varied learning styles and thinking skills.

5. Demonstrate multiple ways to represent. The NCTM Principles and Standards states "Representing ideas and connecting the representations to mathematics lies at the heart of understanding mathematics" (2000, p. 136). Students must be allowed to represent their knowledge of a problem to display their understanding in a meaningful way. Remember that graphs, charts, story/language contexts, pictorial representations, or symbolic representations are ways that students must explore when communicating their solutions to problems. Students should be able to explain their representations and understand others representations to determine how and if

these methods belong in their schema. However, researchers suggest that teachers must determine "which representations are worth sharing with the whole class" (Chapin, O'Connor, & Anderson, 2003, p. 95).

6. Allow students to problem solve. Teachers must provide students with daily problem solving experiences because this aids in students' abilities to think and reason logically. "Good problems give students the chance to solidify and extend their knowledge and to stimulate new learning" (NCTM, 2000, ¶ 2). Help students develop multiple heuristics to strengthen their reasoning and thinking skills and arrive at a solution. Remember, a problem for one is not necessary a problem for all. Therefore, create authentic problems and exercises to help students stretch and reinforce their mathematical knowledge.

7. Encourage students to justify their thinking. Through requiring students to justify their thinking and provide reasons for their solutions, students create arguments for their mathematical thought processes. Teachers are encouraged to help students monitor their thinking because this enables them to iron out their confusions and deal with conflicting ideas. Thus, students will begin to produce schemas for their current knowledge and associate this knowledge with new schemas.

8. Work with families. When parents and families are involved in children's learning, children are more willing to attend school and notice the importance and value of education (U. S. Department of Education, 2007). Children do better in school when parents are involved. Wherry (2007) states "Parents' influence on the school success of their children is profound and research shows that, with just a little help, encouragement and direction from the school, parents can contribute even more to their children's success" (p.1). When teachers include families in students' learning, teachers understand the social, cultural, and economical backgrounds of students and determine how best to create activities that meet the learning needs of all students to enable them to be successful lifelong learners. Since families are the first line of education for students, teachers must support this effort through the following: creating newsletters describing mathematics in the child's classroom; writing parent letters that report ways in which parents can assist with students' successes and challenges; sending reports or letters that demonstrate how the parents can help with homework activities support real-world applications; providing family math nights to develop parent awareness of "new math" in the classroom and mathematics thinking of children and parents; scheduling parent teacher conferences that are student led and allowing classroom visitations to demonstrate students' work skills. Building these relationships with families help students to eliminate their math anxieties, make connections, communicate their knowledge, and motivate them to better comprehend mathematics.

9. Create a positive learning environment. The physical environment influences a child's ability to learn and understand the content. Create an environment that has a comfortable temperature, appropriate seating arrangements, soothing and warm colors, which is welcoming and supportive to promote mathematical thinking and communication. The teacher must also develop a rapport with all students to understand and know their frustrations, challenges, and accomplishments to aide in the students' mathematical growth. Set and maintain high expectations for all; remain open to students' ideas and be nurturing of their understanding. Convey to the students that they have a shared responsibility in their learning. This creates an atmosphere that allows the teacher and students to set classroom norms for their mathematical development and learning.

10. Connect concepts/topics. Making connections with students' prior knowledge builds a deeper understanding of the content. Break the content into "bite size" pieces (Schoenfeld, 1992). This allows the content to be chunked to allow students to take in small amounts of information and relate this to previously learned topics. As the curriculum is connected and learned through a layered effect, students are constantly chunking and associating new information that fits into their current scheme of thinking.

11. Use appropriate technology. Essential to teaching and learning of mathematics is the utilization of technology because it influences what students are taught and enhances their learning. Use as a tool to assist student learning not as the learning itself. The NCTM Technology Standards states "Students can learn more mathematics more deeply with the appropriate and responsible use of technology" (2000, ¶ 1). Integrate technology into the learning so that students are better able to connect abstract ideas with concrete or semi-concrete representations to cultivate a profound learning encounter.

12. Differentiate instruction. ". . .creat[e] multiple paths so that students of different abilities, interest or learning needs experience equally appropriate ways to absorb, use, develop and present concepts as a part of the daily learning process" (Theroux, 2004). The teacher must assess students on an ongoing basis to determine their readiness and level of understanding to inform and guide instruction. Provide activities and lessons that accomplish national, state, and local learning standards and objectives, but cater these objectives to students'

learning styles and abilities. Connect the concepts within the curriculum and to other subjects, as well as the real world to make the ideas come alive and meaningful to increase students' understanding. Know the students to determine the necessary instruction for all students to achieve success.

13. Assess developmental readiness. Children should learn concepts and skills that are age appropriate. It is important to include mathematical goals that are linked to the classroom, local and state curriculum, as well as NCTM guidelines to assess the developmental milestones appropriate for the concept. For example, if a student exhibits difficulty with a particular concept, teachers must look at previously learned concepts to check for complete understanding.

14. Possess strong content knowledge. Teachers should constantly improve and expand their mathematical understanding by taking refresher courses and attending professional development conferences. Having a strong content knowledge allows teachers to provide students with various representations and methods to approach a problem and make better connections within the subject, as well as the real world. Through an increased understanding combined with various pedagogical strategies, teachers are better able to assist students with constructing their knowledge and achieving success.

15. Read in the content area. Connecting mathematics to literature is not only important, but also can be easily done. If students are given opportunities to improve their reading skills and understand the appropriate vocabulary in mathematics, then students become better problem solvers. Allowing students to use reading strategies such as QAR (question answer response) enables students to better comprehend what the text is asking and devise a better plan to solve a particular problem. By aiding students with reading strategies in the content area and including opportunities for students to read and be read to, students become better readers and independent problem solvers and mathematicians (Bratina & Lipkin, 2003).

16. Operate as a reflective practitioner. Reflecting should inform teaching and aid in the development of new ideas and approaches to help students succeed. Not only should teachers incorporate this in their daily lesson planning, but also they must include reflections as a means for their students to question and assess their problem solving strategies and their comprehension. Through metacognition practices, teachers and students are able to observe how students construct their understanding and build on their knowledge.

17. Model culturally responsive teaching. A culturally competent educator is one who is aware of the differences that exist between the teacher, students, and families in terms of race, culture, and beliefs (Floyd & Vernon, 2007; Kea, Campbell-Whatley, & Richards, 2004). Teachers should design instructional tools and strategies to increase the probability that information in general education classrooms will be learned by students with diverse learning needs. Use examples and visuals that incorporate the cultures, ethnic backgrounds, genders, learning styles and ideas of the students within the classroom.

18. Minimize math anxiety. Recognize that mathematics anxieties exist, yet provide activities that meet students where they are and celebrate their current knowledge to build new understanding, while lessening future anxieties. Once anxieties are faced students are able to move beyond the myths and fears and accomplish their goals. Have students share their feelings and experiences then give students strategies to help them work through their frustrations. Assist students by questioning and giving clues to aid them in solving a problem. Hold high expectations and minimize anxieties so that the anxieties do not consume the dispositions of students, which may increase students' mathematical success.

19. Apply strategic integration (Kame'enui & Simmons, 2003). Carefully plan lessons and activities that control combinations of what the students already know with what they must learn so that the relationship between these two elements is clear and results in new or more complete knowledge. For example, utilize interviewing and questioning techniques to analyze students' current thinking about solving proportions as a basis for solving and understanding similar triangle problems.

20. Provide meaningful homework and class assignments. Homework should be an extension of skills taught during the school day. Completing practice or reinforcement activities may build confidence in students. Involve families in these efforts. Provide families with questions they can ask to help students with understanding. Remind parents that they do not need to be experts; however, they can ask what, how and why questions: "What is the problem asking you to figure out; What did you do in that problem; How might you start the problem; Did you do an example similar to that in class today or this week; Can you show me your notes from today and explain what you discussed in class; and Can you explain why you came up with that answer?" (Brahier, 2005, 337). These questions help stimulate conversation for students to better communicate their thinking and understanding.

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NCTM National Meeting

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From the NCTM email news blast: It's time to register for NCTM's 2011 Annual Meeting in Indianapolis, April 13–16. Join us to hear from leading experts in math education and choose from more than 650 presentations. Whether you're a classroom teacher, administrator, new teacher, or math coach, there's something for everyone in Indianapolis! Visit the online preview to learn more about the meeting and the presentations offered.

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Featured Presenters:

Jeffrey Travis: ***FLATLAND: The Power of Story in Mathematics***
Jeffrey Travis, director of the new IMAX 3-D movie *Flatland: The Movie*, will show clips from the movie and discuss the power of story-telling in mathematics and in geometry in particular.

Bathsheba Grossman: ***The Art of Geometry***
Bathsheba Grossman will describe the emergence of a geometrical artist and the development, themes, and techniques of the speaker's sculpture, in context with the vital, growing field of mathematical art.

<www.nctm.org>

Using Visual Images to Enhance Comprehension

Nancy Bell Ruppert
UNC Asheville, Asheville North Carolina

Visual literacy is emerging as a tool for teachers to increase motivation, comprehension, and retention of information (Offer & Bos, 2009; Sibbet, 2008; Stull & Mayer, 2007). Gifted students, students with special needs, ESL students, and average students benefit from the use of visual images (Heinze, 2004; Jones, Long & Finaly, 2007; Rose, Cundick, & Higbee, 1983). Teachers who use visual tools involve their students in critical thinking. Teachers who allow students to use technology to develop their own visual images to convey information are helping prepare adolescents for the 21st Century skills of collaboration and productivity (Place, Hillyard, & Thomas, 2008; Ulbig, 2007). It is an exciting time in education for teachers to begin to think outside the realm of traditional teaching (lectures, notes) and assessing (multiple choice and essay exams) to consider multiple modes of instruction as well as multiple opportunities for students to engage in authentic communication of content (Huifen, & Dwyer, 2010; Spalter & Van Dam, 2008). When used effectively, visual images help students develop critical thinking skills, allow students to communicate their knowledge, and provide visual representations that provoke questions.

Critical Thinking is What Good Readers Do

Critical thinking involves using background knowledge, clues from the text or pictures, predicting, questioning, or inferring what might happen and making connections between text, events, and self (Beers, 2006). Marzano (2004) describes background knowledge as what students know prior to teaching them. He states, "what students *already know* about the content is one of the strongest indicators of how well they will learn new information relative to the content" (2004, p. 1). Therefore, the first task of a teacher is to give students knowledge and experiences prior to teaching them. When teachers combine developing background knowledge with teaching students specific strategies for developing their critical thinking skills, students have more skills to communicate mathematically. Teaching critical thinking can be traced to Dewey (1966). Teachers who teach thinking skills give all learners an advantage (Beers, 2006). Those students who already think prior to learning can enhance their natural talents; and those who have not developed the skills can learn specific strategies for learning that will help them make better sense of the mathematics.

When teachers allow students to illustrate their knowledge they gain insight into the learners' strengths and weaknesses. The visuals serve as a springboard for dialogue and questioning. Visual images offer teachers tools for helping students develop critical thinking skills. Visuals can also be used for students to illustrate their own knowledge while developing skills of collaboration and productivity. The following scenarios illustrate the use of visual images in four different ways.

Using Visual Images to Illustrate Concepts

The first illustration is one of the most elementary uses of visuals, but the tool can be very powerful. Kristen is teaching a vocabulary lesson on the slope and *y*-intercept of functions to an 8th grade classroom. In her class, students have not been introduced to vocabulary such as *y*-intercept, slope, constant, or function. Instead of starting with her own definitions, she has her students explore, predict, and verify their findings. Using a graphing calculator, Kristen has her students predict, graph, then post predictions of what happens to the graph of the equation of a line. Her special needs students are paired with average students so that they can discover information together. Her worksheet for students to organize their observations is presented in Table 1. The key element of this use of visuals is to have students critically analyze what they see.

Once students have created their own predictions, they work in small groups to discuss the functions given. From this experience Kristen engages students in an exercise called K-W-L. First students share what they "know" about equations, slopes, and intercepts. They then add what they "want to know." At this point, students may want to know vocabulary. At the end of the lesson, students write what they have "learned" and new vocabulary is added to the word wall. A word wall is a section of the classroom where vocabulary and illustrations exist related to what students are learning. While these vocabulary words in this activity are new to

the students, they have been using visuals to gather knowledge about the relationship between equations and their graphs.

Table 1. Worksheet for the linear graph investigation activity

Equation	What I think will happen to the line.	What actually happened.
$y = x$		
$y = 2x$		
$y = 3x$		
$y = 4x$		
$y = x + 1$		
$y = x + 3$		
$y = x - 1$		
$y = x - 3$		
Create your own.	What do you think will happen?	What happened?

The activity is an alternative to giving students definitions of vocabulary first. By exploring how a function looks, students have a visual first of where the *s*-intercept is and how a slope affects the graph of a given equation. Thus, the exercise provides students with some experiences (background knowledge) prior to digging deeper into how functions behave on a graph. Developing background knowledge is a term that is used to describe all the parts associated with a given piece of content. Giving students the opportunity to work with partners gives them practice in communicating their knowledge and problem solving.

Using Visual Images to Make Predictions

A second way to use visual images is to have students observe illustrations and make predictions. Once students have an initial vocabulary, they can begin to examine visual images to communicate their knowledge. In this scenario, we enter high school algebra II class. Sean is teaching students about vertical shifts of a polynomial function. Initially he shares the equation $y = x^3$. He then adds 6 to the function. Using imovie®, he created a 1-minute movie that illustrates a visual shift when 6 is added. He uses this as a warm-up to a lesson on describing the relationship between functions and their graphs. Before students take their previous work out they "predict" what they think happens when the constant is changed. They write down their predictions. He shows the clip again. By showing the clip again his ESL students are able to hear the words and see the effect of the constant on the graph. Together in groups they return to their work to test their conjecture. In groups students present their information to the class.

As part of this lesson, Sean talks to his students about what 21st Century skills they are using. The list is posted on the classroom wall including: problem solving, collaboration, communication, risk-taking, questioning. The students talk about the process skills they have been engaged in (communication, representation, problem solving, connections, reasoning and proof). Their classroom merges communication with visual images as students develop their abilities to analyze functions and their graphs. This use of visuals is more abstract than the first method because students have to be able to analyze what they are observing.

Using Visual Images to Develop Understanding

A third way to consider visuals is to allow students to develop their understanding by implementing visual imagery. Let's look into another classroom. Troy is using a scenario to teach pre-algebra students about mathematical reasoning. In this scenario students draw pictures of what they are hearing to see if they can come up with equations. Troy says, "Suppose you work 20 hours a week at $7.00 an hour. Once you have made $140.00 you have to take $2.50 out a day for lunch. At the end of a month (four weeks), how much money will you earn?" Students work together to draw illustrations and associate their work with an equation. Students use chart paper to draw illustrations of their knowledge. Students collaborate, illustrate, ask questions, and justify their answers in groups prior to sharing their results with the class. In this classroom, Troy grouped his students by ability. While the previous scenario can happen in small groups or with an entire class, this use of visuals is

in small groups. The teacher moves around the classroom. Once all groups have completed the exercise, they share their findings with one another using common vocabulary.

Using Visual Images to Illustrate Knowledge

In the previous examples, students were using visual images to represent concepts, make predictions, and develop their knowledge. A fourth way to use visuals is to have students illustrate their knowledge. Katie, a sixth grade teacher, allows students to illustrate their knowledge of concepts throughout each unit of study. Throughout most of the year she used "low technology" activities. Forms of "low technology" include writing skits, writing songs, or creating hand-made brochures and images that relate mathematical concepts to everyday life. Technology tools such as imovies®, moviemaker®, and other forms of "high technology" were used to allow students to illustrate their knowledge. Because students are on different ability levels, projects are graded using the following rubric:

__ You followed the directions.
__ The content is accurate.
__ You illustrated the project.
__ You reflected on your learning.
__ Your project was on time.

Most of the products involved "low technology" strategies. The "high technology" tools take much longer to produce. In both settings students were allowed to use their own examples to illustrate and communicate their knowledge. In both types of projects, students wrote scripts, had them approved, created illustrations of their content and worked together to illustrate concepts. The rubric focuses on content. Students of all ability levels were able to be successful with this type of activity.

Step out of the Classroom

In each of the above scenarios, students engaged in their own thinking and predicting, worked with a partner or a team, reinforced the skills they were developing, focused on communication, and applied their knowledge to a real-life situation. At all levels, students asked questions and worked collaboratively. Together, they brainstormed what they knew and, in the end, had to communicate their knowledge.

Using visual images to teach and to have students communicate and illustrate their knowledge allows students to engage in, explore, and explain their learning prior to digging deeper into content. Once students have participated in visual experiences, they can be given visual images to predict concepts. Visual experiences can be used to stimulate students' imagination and understanding. Finally, students can be given the opportunity to create their own "visual evidences" of their knowledge. By infusing visuals in the classroom, students develop their critical thinking skills, their background knowledge, and their abilities to ask questions.

Some people think that allowing students to develop background knowledge takes too much time. I disagree. If we do not take the time to allow our students to think about mathematical concepts, if we do not provide our students opportunities to ask questions, they will not learn how to think mathematically. They will only be giving information back to us, the lowest level of thinking.

In each of these classrooms, students who created their own knowledge were able to remember the concepts longer and were able to communicate their understanding of concepts. Visual images are tools that need to be used intentionally to develop students' knowledge. Teachers can use visual images to help students illustrate concepts, make predictions, develop understanding, and illustrate their own knowledge.

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Awards

2010 Rankin Award Winner
Rebecca B. Caison

At its 40th Annual State Mathematics Conference held in Greensboro, NC on 28-29 October 2010, the North Carolina Council of Teachers of Mathematics (NCCTM) presented Rebecca B. Caison, a mathematics teacher at Cedar Ridge High School in Hillsborough, NC, with the W. W. Rankin Memorial Award for Excellence in Mathematics Education. The Rankin Award is the highest honor that NCCTM can bestow upon an individual.


Rankin Winner Rebecca Caison (center), pictured with Emogene Kernodle (left) and Wendy Rich (right)

Ms. Caison was recognized for a career of more than 35 years in which she has given so much to the profession. During her career she has been a high school math teacher, a department chair, a consultant for Texas Instruments, a principal writer for *Resources for Algebra* published by the North Carolina State Department of Public Instruction, a contributor to the North Carolina Algebra II Standard Course of Study, and a dedicated leader and a skilled instructor of algebra and calculator workshops around the state.

Ms. Caison was also honored because of her outstanding service to NCCTM and the math teachers of North Carolina. One math teacher observed, “Ms. Caison has consistently done the ‘nitty-gritty’ work it takes to keep NCCTM running well.” Ms. Caison has served as the Conference Chairman for Commercial Exhibits for NCCTM, State Secretary, State Logo Contest Chairman, and as the Central Region President.

Among her many awards, Ms. Caison received the 2003 Presidential Award in Secondary Mathematics, the 2002 Radio Shack National Teacher Award, and was twice named the Walter M. Williams High School (Burlington, NC) Teacher of the Year. She is also a National Board Certified Mathematics Teacher.

Of Ms. Caison it was said, “She has always put students first, and is known for enriching the classroom with technology, hands-on activities, and motivating lessons. She is highly respected by students, parents, and colleagues alike. She is a team player, is recognized for patience in collaboration with others, and has long been an outstanding example and inspiration for math teachers all across North Carolina.”

Problems to Ponder

Spring 2011 Problems

Holly Hirst, Appalachian State University

Grades K–2: You have twenty-five cents in nickels and your friend, Jordan, has forty cents in nickels. How many more nickels does Jordan have?

Grades 3–5: Trace ate half of a pizza for lunch. Then Shekama ate one third of what was left when Trace was finished. How much of the pizza is left for you?

Grades 6–8: José's mom is 42 years old. She had José's brother, who is three years less than twice as old as José, when she was 19. How old is José?

Grades 9–12: In Soixante-Dix land, there are 70 pennies (P) in one Franck (F), the main unit of currency. A burger, one order of fries, and 2 soft drinks cost 2F and 49P. A burger, two orders of fries, and a soft drink cost 3F. Two burgers, one order of fries, and a soft drink cost 3F and 67P. What is the cost of a soda, a burger, and one order of fries?

Directions for submitting solutions

1. Neatly print the following at the top of each solution page:
   - Your full name (first and last)
   - Your teacher's name
   - Your grade
   - Your school
2. Submit one problem per page.

Students who submit correct solutions will be recognized in the next issue of The Centroid. We wish to publish creative or well-written solutions from those submitted. If you would rather not have your solution published, please so indicate on your submission. Proper acknowledgement is contingent on legible information and solutions.

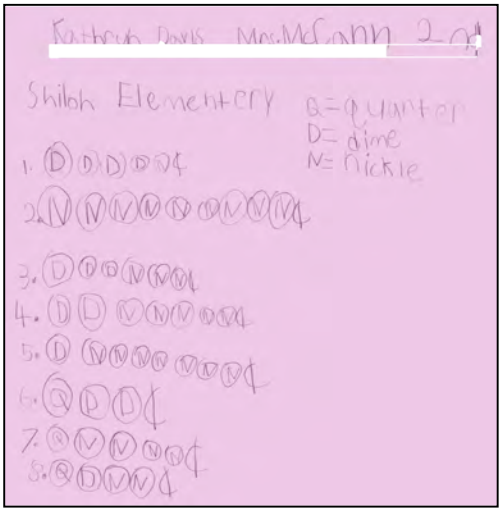
Send solutions by 1 June 2011 to:

Problems to Ponder, c/o Dr. Holly Hirst
Dept. of Mathematical Sciences
Appalachian State University
Boone, NC 28608

As these problems are intended to stimulate independent thinking, it is expected that a submitted solution indicates the student completed a significant part of the work. Please try to have the students use complete sentences when they write up their solutions to promote effective communication of their ideas.

SOLUTION: Grades K-2 Fall 2010 issue

A box of raisins costs 45¢. Jordan has quarters, nickels, and dimes. How many different ways can Jordan pay for one box of raisins?



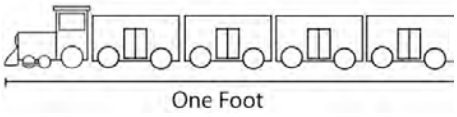
Example Correct Solution by Kathryn Davis, Shiloh Elementary School (Mrs. McCann).

Other Correct Solutions were submitted by: Benton Heights Elementary School of the Arts (Ms. Groft): Bryan; **East Elementary School (Ms. Hinson):** Itzel, Melissa, Tamy; **Hemby Bridge Elementary School (Mrs. Stanley)**: David "Lex" Vause.

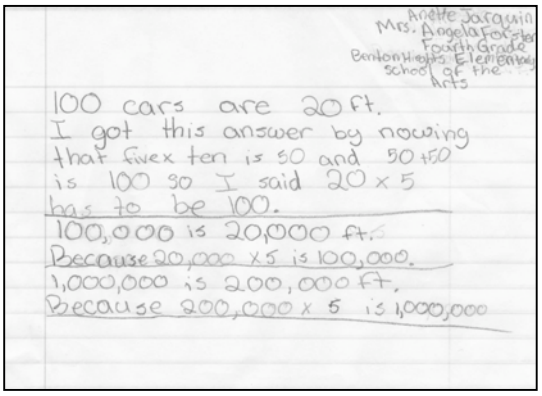
Editor's Note: *Many students submitted partial solutions, missing one or two of the eight possible combinations.*

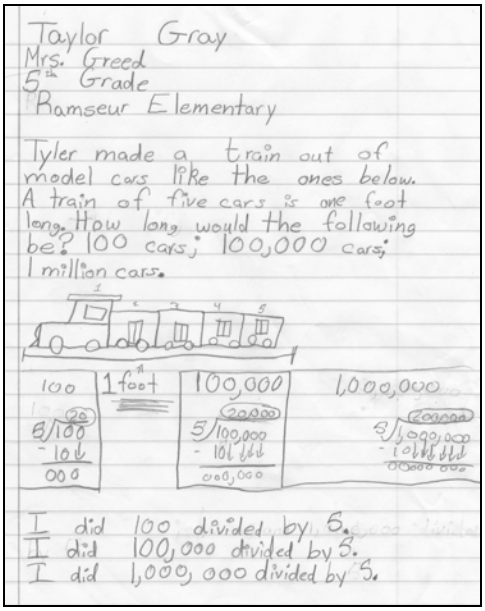
SOLUTION: Grades 3-5 Fall 2010 Issue

Tyler made a train out of model cars like the ones below. A train of five cars is one foot long. How long would the following trains be? 100 cars; 100,000 cars; 1 million cars.



Example Correct Solutions by Anette Jarquin, Benton Heights Elementary School of the Arts (Mrs. Foster) and Taylor Gray, Ramseur Elementary School (Mrs. Greed).





Other Correct Solutions were submitted by: Antioch Elementary School (Mrs. Carrasquillo): Fernando Trejo; **Benton Heights Elementary School of the Arts (Mrs. Foster):** Christopher Aguilar, Daquavis Autry, Hender Hernandez, Brenda Nunez, Ollie Van Shepherd III**; Benton Heights Elementary School of the Arts (Mrs. Meagher):** Kathrine Ann Fraley, Trinity Williams; **New Town Elementary School (Mrs. Erb):** Devon Hillhouse; **New Town Elementary School (Mrs. Smith):** Jeffrey Holzman; **Ramseur Elementary School**

(Mrs. Allmon): Gustavo Munoz Vazavez; **Ramseur Elementary School (Mrs. Greer):** Aubrey Adkins , Rachel Byrd , Maria Cifuentes, Cris Flores, Nicholas Hill, Leonardo Marin, Natalie McNeill, Ramon Ortiz, Samara Marquez Reyes, Kyle Winbarn; **Shiloh Elementary School (Mrs. Carland):** Ryan Abel, Mitchell Bird, Mary Burnette, Luke Burnette, Brian Castello, Ashley Renee Davis, Camryn Dean, Drew Hayes, Sam Howell, Alyssa Kennedy, Andrew Lane, Elijah Miles, Jamie Nikonowicz, Emma Olson, Nicholas Ridge, Stewart Rodgers, Hunter Sizemore, Micah Skeen, Marin Taylor, Shianne Williams; **Shiloh Elementary School (Mrs. Milutin):** Jace Fellers; **Stallings Elementary School (Mrs. Hodges):** Brett Bates; **Walter Bicket Elementary School (Ms. Wessel):** Darius Ledbetter; **Wesley Chapel Elementary School (Ms. Hafliger):** Donna Han; Abigail Johnson, Carissa Segerlin.

Editor's Note: *Many other students were able to handle 100 and 100,000 cars, but had trouble working with one million.*

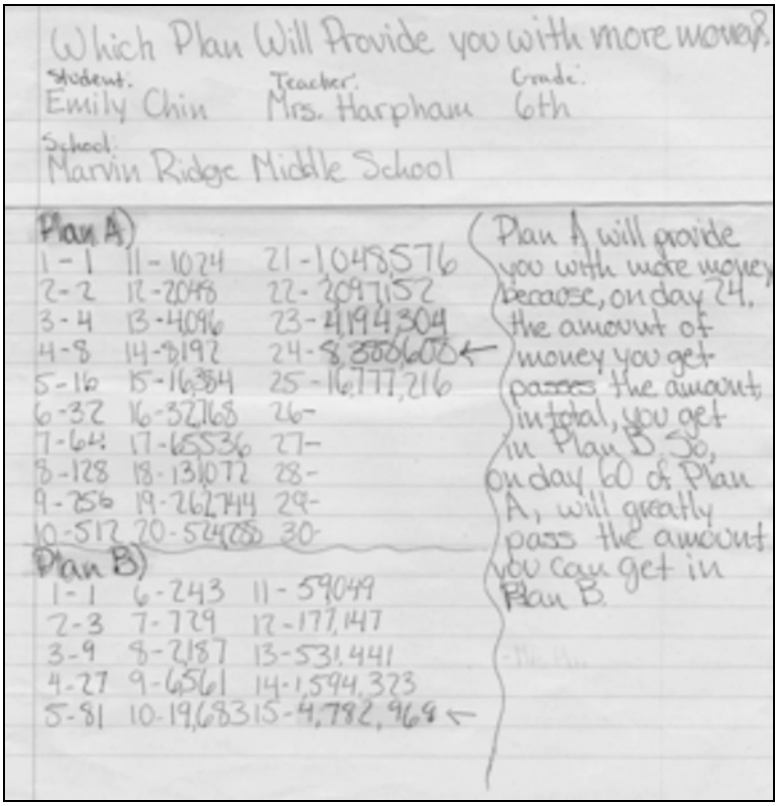
SOLUTION: Grades 6-8 Fall 2010 issue

Which plan would provide you with more money?

(A) receive one penny on day 1, two on day 2, four on day 3, doubling each day until day 60

(B) receive one penny on day 1, three on day 2, nine on day 3, tripling each day until day 15

Example Correct Solution by Emily Chin, Marvin Ridge Middle School (Mrs. Harpham).



Correct Solutions were received from: Benton Heights Elementary School of the Arts (Mrs. Foster): Kristal Albarez, Cameron Allman, Kevin Angeles, Eric Barajas, Devine Covington, Bryan Cruz, Jose Cruz, Amado Fapia, Gisselle Jarquin, Anette Jarquin, Abigail Keziah, Amilia Marsh, Nasia Moser, Sky Ramirez, Aayani Rushing, Angel Sturdivant, Jacqueline Torres, Dmonyia, Sandra; **Benton Heights Elementary School of the Arts (Mrs. Meagher):** Hailey Carelock, Jovan Sanchez, Sandra; **Bertie Middle School (Mrs. Carlton):** Corey Fennell, Patrice Gilliam, Bailey Mizell, Damian Morgan II, Eboney Slade; **Bertie Middle School (Ms. Jefferson):** Imunique Man, Ricardo Rodriquez, KeShawn Squire; **Bertie Middle School (Ms. Ruffin):** Jakyra

Bowser, William Corey, Trevor Reigart; **Bertie Middle School (Mrs. Sauls):** Darius Davis, Deiante Morris, Armoni Speller, Tyrik Stephenson, Aniya Williams; **Bertie Middle School (Mrs. Tyson)**: Sedrick Demery, Tatyana Watford, Damontraye White; **East Elementary School (Mr. Hare):** Crystal Guiller; **East Elementary School (Ms. Maggio):** Luis Garcia Morales, Alesandro Moran; **East Elementary School (Mrs. McDonald):** Nyasia Bennett, Destiny Byrams, Alex Cuoningue, Tijah Hailey, Hasim Heth, Zach Isenhour, Mynor Lopez, Lus Nava, Nadia Oxendine, Ja Quan, Emmanuel Reyes, Kyasia Smith, Chantel Thomas, Meikel Watkins, America; **Marvin Ridge Middle School (Mrs. Harpham):** Alexa Coe, Hannah Cook, Sarah Corbi, Zac Curtis, Corey Davis, Preston Davis, Ava Erfani, Cayla Hashe, Emma Hennessey, Lea Holevas, Coby Kurtz, Grace Lynn-Lato, Leah Meissner, Brett Merkel, Rahi Patel, Allie Randall, Anna Redford, Austin Ries, Kristen Robinson, Lauren Rush, Lauren Rush, Kyle Schwartz, Leah Shelton, Justin Smits, Rachel Tavolacci; **Marvin Ridge Middle School (Mr. Myers):** Aparna Bejoy, Mark France, Samuel Graham, Kodi Obika, Sydney Schwar, Morgan Sufnarski; **Ramseur Elementary School (Mrs. Cockrum)**: Lidia Lopez, Tyler Toomes; **Ramseur Elementary School (Mrs. Eller):** Bradley Ray Adams; **South Asheboro Middle School (Mrs. DeCoeur):** Taylor Coe, Madeline Coggins, Monica De La Vega, Sydney Eaton, Andrew Gavin, Cindy Ho, Sam Kemp, Courtney King, Heather Malin, Lucas McLeod, Jay R., Felix Zonos; **South Asheboro Middle School (Mr. Hynd):** Bailey Allgood, William Aquino, Hannah Brown, Parris Brown, Katy Cernava, Candace Church, Connor Criscoe, Lindsey Farmer, Hannah Ferguson, Adam Gross, Wilson Kidd, Abigail McBride, William Moon, Jessica Moore, Hunter Morgan, Alicia Peterson, Angelica Talley, Tra Walls, Abbie Worsham; **South Asheboro Middle School (Mrs. Runnfeldt):** Parker Clayton, Austin Romero, Molly Wells; **South Asheboro Middle School (Ms. Salamone):** Tatiana Chavez, Benjamin Clauser, Gleisy Cruz, Maegan Fontana, Allison Kauffman, Amber Moon, Preston Russell; **South Asheboro Middle School (Ms. Thomas):** Manuel Badillo, Mary Crum, Kory Edmundson, Julia Farmer, Will Ford, Alex Gimenez, Ayisha Ihtasham, Brittany McNeill, Eli Nance, Ashton Russell, Rebecca Smith, Megan Stout, Carly Wallace, Rolleen Wang, Amy Yates, Lynette.

Editor's Note: *Many other students came to the correct conclusion, but did not show how they reached their answer.*

SOLUTION: Grades 9-12 Fall 2010 Issue

Is there a polynomial, p, with integer coefficients such that $p(1) = 2$ and $p(3) = 5$?

No correct solutions were received. Still want to find the solution? Here is a hint: $p(3) - p(1) = 5 - 2 = 3$. Can this ever happen?

Julia Robinson Math & Computing Festival

For Female Middle School Students, UNC - Charlotte, March 26, 2011

UNC Charlotte will host the fourth annual Julia Robinson day, designed to engage middle school girls in mathematics. Mathematicians ranging from college undergraduates to first-rate professionals will work with students on a variety of challenging math activities. Below are two prize problems to whet your appetite. Check the website for more information, prize problems, and to register.

> *The 1 through 6 problem.* Take the digits 1 through 6 in order, insert arithmetic operations and parentheses, and build the numbers from 1 to 20. For example, we can write 1 as ((1 + 2) + (3 - 4)) + (5 - 6).
>
> *The huge number problem.* Let N be the huge number N = 13579111315…1999 obtained by writing down, in order, the representation of the first 1000 odd positive integers. (a) How many digits does N have? (b) How many times does the digit 6 appear in N? (c) What is the product of the 2009th digit and the 2010th digit of N?

<http://education.uncc.edu/oeo/jrmf/>

Mini-grant Report

Family Math Night at Reidsville Middle School!

Ruth H. Williamson, Reidsville Middle School

Example 24 Game Card reprinted with permission from 24Game.com

In the fall of 2008 the mathematics department at Reidsville Middle School in Rockingham County began discussing the possibility of involving the community with our students doing math. The consensus of the teachers was to offer an activity that would be challenging in a fun way, encouraging teachers, parents, and other community members to work together. Some of the teachers were familiar with the 24 Game from Suntex International, Inc.[1] and suggested that the game would provide the perfect balance of recreation and rigor.

I applied for and received an NCCTM Mini-grant, enabling me to purchase 16 sets of the 24 Game, including Single Digits; Factors/Multiples; Integers; Fractions/Decimals; Variables Single/Double Digits; and Algebra/Exponents. The mathematics department planned for a spring 2009 event. We also received support from our PTSO and local churches so we could offer a reduced cost for the hot dog supper that everyone enjoyed before the Real Fun began. Mathematics teachers explained the directions for the 24 Game and then students began working with their families to write expressions for 24 on their individual white boards. When a group found a "stumper," other folks helped to find an expression for 24.

The 24 Game cards continue to offer a strategy for reviewing computational skills and an opportunity for students to work together. Thanks NCCTM!

Applying for Mini-grants

NCCTM provides funding for North Carolina teachers as they develop activities to enhance mathematics education. This program will provide funds for special projects and research that enhances the teaching, learning, and enjoyment of mathematics. There is no preconceived criterion for projects except that students should receive an on-going benefit from the grant. The mini-grants are awarded by each of the three regional organizations to members ***within their geographic boundaries***. A total of $15,000 is available each year for mini-grants, with each region awarding approximately $5000 in grants to its members. In recent years, approximately 30-35 proposals have been funded, for an average grant of just less than $800.

Directions

The application is available on the NCCTM website <http://www.ncctm.org>. Read all directions carefully, and fill out the application and cover sheet completely. Failure to correctly list the NCCTM region and membership number will cause your application to not be considered. Grant proposals must be postmarked or emailed by September 15, and proposals selected for funding will receive funds in early November. You will receive an email confirmation of receipt of your proposal. If you do not receive a confirmation within one week, follow up with the Mini-grant Coordinator. Be sure that your NCCTM membership is current and active for the upcoming year! Each year we have applications that cannot be considered because of the membership requirement.

[1] From the http://www.24game.com/ website: First In Math is a curriculum supplement that gives students the fundamental skills they need to achieve their academic goals. It delivers fluency in basic addition, subtraction, multiplication and division, while advancing higher-order thinking skills such as mental math, problem solving, pattern sensing, reasoning and number sense through Deep Practice. There are games sets for purchase as well as an online game environment. A typical game involves drawing a card with four numbers and expressions and determining how to arrive at a total of 24 using arithmetic operations specified by the particular version of the game.

Awards

2010 Outstanding Mathematics Education Award Winners

Reported by

Bampia A. Bangura, North Carolina A&T State University

For the last 40 years, each Fall NCCTM has sponsored the selection of Outstanding Mathematics Education Students. The Special Awards Committee requests nominations from all colleges and universities with teacher preparation programs in North Carolina. Nominees receive a certificate and a one-year membership in NCCTM. Top award winners are recognized at the Awards Program at the NCCTM Annual Conference. A second plaque is presented to each college or university in recognition of its honoree.

The recipients of this year's awards are: **LAUREL ADRIENNE COBB** from Western Carolina University in the Western Region and **AMANDA LEE KETNER** from Elon University in the Central Region.

LAUREL ADRIENNE COBB completed a Bachelor of Science in Mathematics Education and a Bachelor of Arts in Spanish in 2010. Very active in mathematics and mathematics education related activities at Western Carolina, Laurel served as Vice President of the NCCTM student affiliate in 2007-2008 and as president in 2008-2009. She was a student representative to the Teacher Education Council and a member of the Mathematics Club, a student affiliate of the MAA. Laurel attended the NCCTM State Conference in 2006, 2008, and 2009. She tutored mathematics to Spanish-speaking elementary students and assisted in the annual State Mathematics Contest in 2008. She studied abroad in Granada, Spain, in the Summer 2009.

In addition to her many campus involvements, Laurel also participated in several community and civic activities: Music Library Staff, Historian Chief, Band Videographer, and a member of the WCU Baptist Student Union since 2006. Laurel had been a dedicated mathematics student at Western Carolina and gives nothing less than her best. One of her professors described her as a truly amazing young woman and that Western Carolina was fortunate to have her as a Teaching Fellow.

AMANDA LEE KETNER is a senior who is pursuing a Bachelor of Science in Mathematics with a concentration in Mathematics Education. She will graduate in May 2011. Like many before her at Elon, Amanda has been actively involved in the mathematics and mathematics education programs. As an officer (President and Vice President) of the NCCTM affiliate at Elon, she has helped to recruit mathematics education students to attend the NCCTM Fall conferences. In addition to getting her fellow students to attend conferences, Amanda has worked with the NCCTM Affiliate at Elon to hold events that benefit pre-service teachers. Amanda also worked extensively in the area of Mathematics Education research. She is active in the Elon University MAA affiliate; she is a North Carolina Teaching Fellow and is involved in recruiting new Teaching Fellows.

In addition to her involvement in mathematics ventures and studying abroad in London for a semester, Amanda has been extensively involved in community and civic activities at Elon as President of the Methodist fellowship, a member Alpha Phi Omega, and President of Iron Tree Blooming, as well as a member of Elon University's Marching Band. Amanda is described by one of her professors as a committed student who exemplifies the qualities we are looking for in a mathematics teacher with a passion for Mathematics.

Outstanding Administrator Award

Connie Cheston, NCCTM Middle Grades VP for the Eastern Region

Connie Cheston, K12 mathematics coordinator for Pitt County Schools, has received the 2010 NC Science, Mathematics, and Technology Education Center Outstanding Administrator award. Congratulations, Connie!

Awards

Rankin Award Nominations

The Rankin Award is designed to recognize and honor individuals for their outstanding contributions to NCCTM and to mathematics education in the State. Presented in the fall at the State Mathematics Conference, the award, named in memory of W. W. Rankin, Professor of Mathematics at Duke University, is the highest honor NCCTM can bestow upon an individual.

If you have nominated someone in the past who has not received the award to date, or if you would like to nominate someone new, please submit as much of the following information as possible!
Nominations are accepted at any time.

Please submit the following information. Use as many typewritten pages as needed. If possible, attach a vita of the nominee.

- Name of the nominee
- Current position
- Your relationship to the nominee (e.g. principal, co-worker, etc.)
- The nominee's contributions to mathematics education, NCTM, NCCTM, etc. (Please include information on specific offices held and honors received by the nominee.)
- Any information about contributions to the community, teaching, and education that would be of value to the Rankin Award Committee in its deliberations
- Other relevant information
- Letters of endorsement from other colleagues may be included.
- Date of nomination

Nominator* Name
Current position; Business or educational institution
Preferred mailing address; Preferred telephone number

*The Rankin Award Committee reserves the right to use portions of nomination information in the presentation of the award if the candidate is selected.

Send to: Lee V. Stiff
326-D Poe Hall, Box 7801
North Carolina State University
Raleigh, NC 27695-7801
Sending information in the form of emails is okay: lee_stiff@ncsu.edu

NCTM iPhone App

The NCTM app gives iPhone users easy, efficient access to timely NCTM information—from new publications releases and best sellers to the latest information on upcoming conferences and professional development opportunities. Download it now from iTunes!

Awards

Innovator Award Nominations

The North Carolina Council of Teachers of Mathematics accepts nominations for the Innovator Award at any time. The purpose of this award is to recognize and reward individuals or groups who have made an outstanding and noteworthy contribution to mathematics education and/or NCCTM by having founded, initiated, pioneered, or developed some program in mathematics education of service to a geographic region of the state or the entire state. Further, this program must have been sustained for a period of at least three years. A number of organizations have made significant contributions to mathematics education in North Carolina; the Committee encourages the nomination of organizations as well as individuals. Any NCCTM member may submit nominations by sending in the form below. Nominations will be retained in the active file for at least three years.

NOMINATION FORM

Name of Nominee: _____

Present Position: _____

Outstanding contributions to mathematics education in North Carolina, which serves as the basis for this nomination:

Additional information that would be of value to the selection committee:

Signature: _____ Date: _____

Name (print/type): _____

Position: _____

Business or Institution: _____

Address: _____

Phone: Business _____ Home: _____

Email: _____

Send to: John Goebel
2 Creekview Lane
Durham, NC 27705

Donating to the Trust Fund

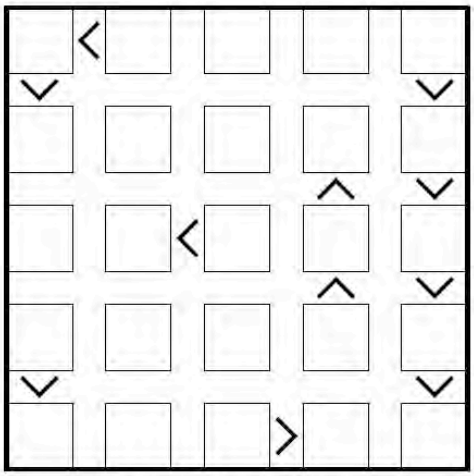
If you wish to memorialize or honor someone important to you through a donation to the NCCTM Trust Committee, please send your donation to:

Rebecca Hoover, NCCTM Business Manager
P.O. Box 4604
Cary, NC 27519

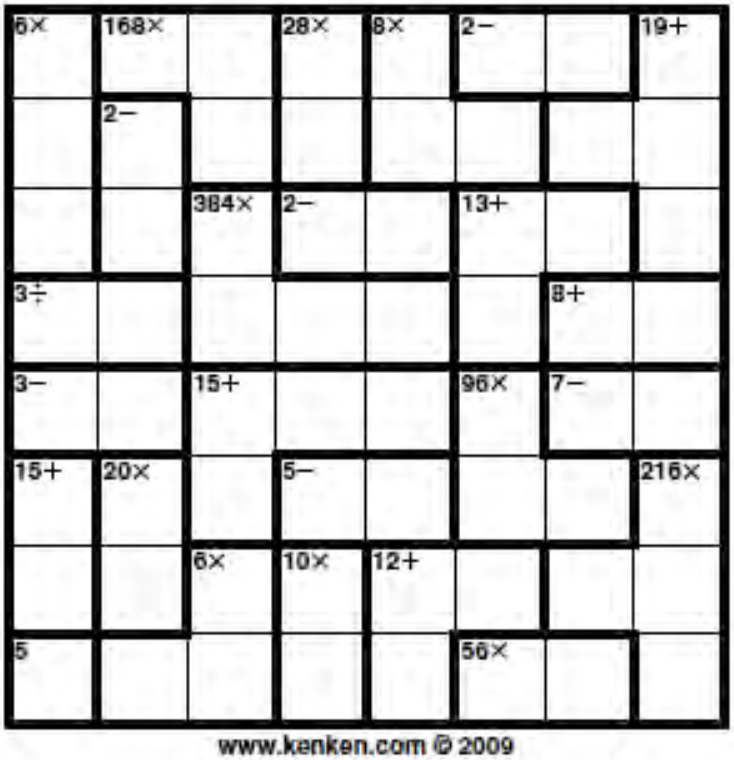
Contributions (checks) should be made payable to Pershing LLC for the NCCTM Trust Fund. Please provide the name of the person being honored or memorialized through the donation and the name and address of the person that NCCTM should notify of your gift. For more information, contact John Kolb, Trust Fund Chair.

Puzzles

Futoshiki: Place the digits 1 through 5 the cells so that each row and column contains each digit once, and all of the inequality symbols are satisfied.



www.sudoku-puzzles.net



www.kenken.com © 2009

KenKen: Place the digits 1 through 8 in the cells so that each row and column lists each digit only once, and so that each outlined block totals to the given number using the given operation (in any order).

Solutions are posted on the Centroid page.

NCCTM Trust Fund Scholarship

North Carolina Council of Teachers of Mathematics

$600 scholarships are available from NCCTM to financially support North Carolina teachers who are enrolled in graduate degree programs to enhance mathematics instruction.

Applicants must be:

- Currently employed as a pre-K - 12 teacher in North Carolina;
- Currently an NCCTM member (for at least one year) at the time of submitting this application;
- Currently enrolled in an accredited graduate program in North Carolina;
- Seeking support for a mathematics or mathematics education course in which they are currently enrolled or have completed within the previous four months of the application deadline.

Applications will be reviewed biannually, and the deadlines for applications are:

- **March 1**
- **October 1**

Send completed applications to:
NCCTM Trust Fund Chair
1302 Oakview Dr.
Greenville, NC 27858

Direct inquiries to:
Robert Joyner, Chair
phone: (252) 756-6803
e-mail: rjoyner3@suddenlink.net

(Please print all information.)

PERSONAL INFORMATION:

Name: _____

Home address: _____
Street

_____, NC _____
City Zip

Home phone: _____ Home e-mail: _____

NCCTM membership number: _____

EMPLOYMENT INFORMATION:

How many years of teaching experience? _____

Currently employed in what school system? _____

School name: _____

School address: _____

School phone: _____ School e-mail: _____

Current teaching assignment: _____

Principal's name: _____

COURSE INFORMATION: (One course only)

Institution of higher education: _____

Graduate degree program in which you are currently enrolled: _____

Course name: _____ Course number: _____

Dates of enrollment: *(circle one)* Fall semester Spring semester Summer session Year: _____

Name of course instructor: _____

PROFESSIONAL ACTIVITIES WITHIN PAST 5 YEARS WITH EMPHASIS ON ACTIVITIES RELATED TO MATHEMATICS EDUCATION:

BRIEF STATEMENT OF FUTURE PROFESSIONAL GOALS:

REQUIRED SIGNATURES:

Applicant signature: _____ Date: _____

Principal's signature: _____ Date: _____

Instructor signature (if currently enrolled): _____ Date: _____

REQUIRED ATTACHMENTS:

Please attach a copy of

1. A letter of acceptance to an accredited graduate program in North Carolina;
2. Official verification of enrollment in the graduate course described in the COURSE INFORMATION above if the course is currently being taken, **OR** official transcript containing the grade awarded to the applicant if the course described in the COURSE INFORMATION above has been completed.

NOTE: Applications must be complete to be considered. If your application is approved, an official course grade report must be submitted to verify successful completion of the course before scholarship funds will be issued.

Internal Revenue Information for Grant Recipients: Please be aware that NCCTM is required to report all grants of $600.00 or more to the Internal Revenue Service. In such a case you will receive an IRS Form 1099-MISC from NCCTM. However, you should be able to avoid the payment of any income tax on this. NCCTM has been advised that, if you receive one of the NCCTM grants, you must include the grant proceeds in income unless you made a binding commitment to have the proceeds paid directly to the sponsoring school.

NORTH CAROLINA COUNCIL OF TEACHERS OF MATHEMATICS

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Name: _____ Home Telephone: (___) - ____

Address: _____ School Telephone: (___) - ____

City: _____ State: _____ Zip: _____ E-mail: _____

School System: _____

POSITION
- ❑ Teacher
- ❑ Department Chair
- ❑ Supervisor/Administrator
- ❑ Full-time College Student
- ❑ Retired
- ❑ Other _____

LEVEL
- ❑ K-3
- ❑ 4-6
- ❑ Junior High/Middle School
- ❑ Senior High
- ❑ 2-Year College/Technical
- ❑ 4-Year College/University

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❑ New ❑ Former/Renewing Member # _____

MEMBERSHIP DUES

❑ 1 year:	$20.00	_____
❑ 3 years:	$50.00	_____
❑ Full-time Student:	$10.00	_____
❑ Contribution to Trust Fund:		_____
Total Payment Enclosed:		_____

Payment by ❑ Check ❑ Visa ❑ MasterCard

Card # _____

Exp. Date _____

Signature _____

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Payments by credit card may be mailed or faxed to
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