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Connections

AMTE Association of Mathematics Teacher Educators

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A Tale of the Mathematics Curriculum

Sid Rachlin, East Carolina University
AMTE President

Once upon a time in the land of Mathematica, the king was very upset. "My subjects do not understand math!" he cried. "To anyone who can teach my subjects to understand math shall go riches of gold, and land, and oil, and tributes of every sort."

Now the wisest in all of the kingdom were the canines, for as everyone knows, the greater the number of K, the more mathematics one is capable of doing. Surely the canines would know how to make the subjects understand math. From amidst the canines came forth a mathematician and a master teacher of mathematics to take on the challenge of creating a new mathematics: a begle and a beberman. Well, actually there were three who came forth. The third was named Morris. When asked to join in the venture of making math meaningful, he scorned the whole concept of a new math and deKlined.

Not the least bit taken aback by this affront, the canines began their quest for the means to make math meaningful. The beberman returned first. "The way to make math meaningful," he said, "is through UICSM: Understanding ⇔ I Can Speak Mathematically." Following closely behind the beberman was the begle who countered, "The real way to meaningful mathematics is through SMSG: Structure Makes Sense Grow."

The king was pleased. Surely by teaching his Ss this new math, their understanding would increase significantly. It was decreed that all subjects in the kingdom were henceforth to speak mathematically and to apply a structural set to all their work. So it was decreed and so it was. All of the subjects of the kingdom began to speak mathematical words and to apply mathematical structures throughout their daily activities, whether in the castle or in the fields (real and otherwise).

> Surely by teaching his Ss this new math, their understanding would increase significantly.

As a reward for making the subjects understand mathematics, the king laid tributes of all varieties before the beberman and the begle: riches of gold, and oil, and land. Statues were erected in their honor. The kingdom was now happy and content. Cheerful sounds of mathematics could be heard throughout: "Say, what numerals are the hands on the clock pointing to? It's either nine and three or, equivalently, three and nine."

All seemed understandably happy until the day , the king heard Morris proclaim, "Your subjects cannot add." The king was overwrought. "My subjects cannot add!"

(Continued on page 4.)

AMTE 2006 Annual Conference News

Make your plans now to attend the 2006 AMTE Annual Conference in Tampa, Florida on January 26-28, 2006. Program chair Gladis Kersaint reports that she has received more than 150 proposals, which are currently being reviewed.

The conference site is the Renaissance Tampa Hotel International Plaza. The hotel room rate is $139 for a single or double room. The deadline for reservations is January 6, 2006 or when the room block is full. If the room block is filled prior to the deadline, the hotel will accept reservations at the hotel's prevailing rate and only on a space-available basis.

Tampa's January weather ranges from an average low of 52º F to a high of 70º F with an average precipitation of 2.27 inches. Tampa's population of 300,000 makes it Florida's third most populous city. Some of Tampa's features include Busch Gardens, a streetcar system, the Florida Aquarium, and "glistening waterways and sandy shorelines." For more information, you may want to vist the Tampa Convention and Visitors' Bureau's web site at http://www.visittampabay.com.

More information on registration and details about hotel reservations and conference activities can be found on the AMTE website. We hope to see you in Tampa!

New Policy on AMTE Preconference Sessions

Groups or persons interested in conducting a preconference session at the AMTE Annual Conference need to submit a request to the AMTE Board for review. The request should be sent to the Executive Director and should describe the following:

Title and goals of the session
Target audience
Anticipated attendance

Review of applications will begin on July 1. Proposals will be reviewed based on their benefit to AMTE members and alignment with the mission of AMTE.

Once their session is approved, each group will advertise and conduct registration for their session, though AMTE will announce the sessions in its conference materials. In addition, each group must pay for all expenses related to their session, including media and food costs (if any). Groups are expected to compensate AMTE for the space used. Groups can submit a request to waive this fee along with a rationale. If groups intend to charge a registration fee, this should be stated in the proposal along with a rationale.

The AMTE Conference Coordinator will work with each group regarding room set-up needs, such as room arrangement, media needs, and food selection (if any). The Conference Coordinator will serve as the liaison to the hotel for all arrangements for the sessions. Individual groups should not directly contact the hotel.

Nominations for Upcoming Election

The AMTE Nominations Committee is ***seeking nominations for candidates for President-Elect by July 31, 2005.*** Please review the job description below. To nominate a candidate, send the individual's name, professional affiliation and position, email address, and one to three sentences describing his or her qualifications for the position to the chair of the nominations committee, Denise Mewborn (dmewborn@uga.edu). Self-nominations are permitted. (Before listing any candidate on the election slate, the Nominations Committee will verify his or her willingness to serve.)

After reviewing all nominations submitted by the July 31 deadline, the Nominations Committee will produce a slate of two candidates for the election, taking into consideration both professional qualifications and diversity (e.g., years of experience; racial or ethnic background; size of institution; professional affiliation within their institution: Mathematics Department, College or School of Education, or other affiliation). The individual elected will assume the office of President-Elect at the annual meeting in Tampa in January of 2006.

Send nominations to: Denise Mewborn (dmewborn@uga.edu)
Deadline: July 31, 2005

Job Descriptions: President-Elect, President, Past President
Term: Four-Year Commitment
(One year as President-Elect, two years as President, one year as Immediate Past President)

Duties

President-Elect: The President-Elect shall serve as assistant to the President and assume the office of President in the year following her/his election. The President-Elect, with the consent of the Board of Directors, shall assume the Presidency during his or her term of office upon the incapacity or unavailability of the President.

President: The duties of the president include planning and overseeing committees and bringing the Board members together. The president is responsible for making and responding to outside contacts, such as with other professional organizations. The president is also charged with thinking about the future direction of the organization and making supporting contacts. AMTE is an affiliate of NCTM; thus the President is charged with helping AMTE become the main voice of mathematics teacher educators within NCTM. Note that a separate Conference Committee is charged with overseeing the annual meeting, so the President is expected only to preside at the meeting.

Past President: The Immediate Past President shall serve as a resource to the President during the year following the Immediate Past President's term of office as President of AMTE. The Immediate Past President, with the consent of the Board of Directors, shall reassume the Presidency during the year following her or his term as President upon the incapacity or unavailability of the President.

Travel: Two Board meetings per year (each year), Two CBMS meetings per year (only while president)

Two AMTE Board Meetings Per Year

AMTE holds two board meetings each year; one is held the day before the AMTE annual conference in January or February, and one is held at the NCTM annual meeting during the NCTM Research Presession or the NCSM meeting, usually on Monday. For each of these meetings, AMTE will pay one additional day for hotel accommodations and meals. Travel expenses are not reimbursed.

Two CBMS Meetings, Washington, DC

AMTE is a member of CBMS, and the president attends two CBMS meetings a year, one in May and the other in December, both in Washington, DC. All travel expenses are paid.

Nominating Committee Members: Dave Coffey, Grand Valley State University; DeAnn Huinker, University of Wisconsin-Milwaukee; Karen Karp, University of Louisville, Board Liaison; Denise Mewborn, University of Georgia, Chair; and Blake Peterson, Brigham Young University.

AMTE's Nominations Committee is seeking nominations for candidates for President-Elect by July 31, 2005.

President's Column

(*Continued from page 1.*)

he cried. "They do not truly understand!" In an outrage, the king decreed that henceforth no subjects were to speak of new mathematics. Over the statues of the beberman and the begle was shroud a cloak of basic black. All tributes of gold and oil and land that had been given to the hounds were seized back by the king. The king decreed that the gold and oil were to be buried in the land and that this tributive property was to remain hidden until all could truly understand mathematics. So it was decreed and so it was.

Throughout the dark ages of "black" to basics, few came forward to claim the prize. Then suddenly, as if history would repeat itself, the kingdom came under siege by the Saxons. In a military style, the Saxons drilled the subjects with a gradual procession that did indeed lead to some positive results. The subjects could now add, but they had no idea of when or why they'd ever want to. They still did not understand.

As if on cue, when things seemed their darkest, an age of renaissance began to form. The issue of "why and when" led to an emphasis on the applications of mathematics. Under the assumption that it is the real world use of mathematics that makes it meaningful, they challenged the topics of mathematics that did not fit their "uses" criteria. Only those topics that could be taught through their applications were deemed appropriate. The family of followers of this criteria have come to be called the "uses kins."

For others, the age of renaissance was founded on the changing technology. At first this group explored ways to teach mathematics better, but with time their energies returned to the challenge of teaching better mathematics. Fearful of the negative connotations that new math carried with it, this group described their efforts as "mu math." As time passed, so did the technology as if aging from 81 to 82 to 83 to 84 and on into its silver years. Technology became the pad on which the subjects could sketch their mathematical understanding.

For others, the age of renaissance was founded on the changing technology. At first this group explored ways to teach mathematics better, but with time their energies returned to the challenge of teaching better mathematics.

Once again the kingdom seemed at peace. Throughout the nation, the nature of mathematical understanding appeared to once more become standardized. The course for the subjects to follow seemed set. Rather than a linear path to understanding, with compass in hand, it appeared possible for each subject to construct their own arc that would guide their route to understanding. Throughout the kingdom, every day the youngest subjects blazed trails as they investigated mathematics. Older subjects could show you and me a mathscape, in context that was connected thematically. Still older subjects saw mathematics at its core as integrated and interactive. To add to this core, it enabled the subjects to model their world.

On the surface, all was in harmony. Yet beneath this bed of tranquility laid the tiniest grain of discontent, scarcely more than a miligram. As daylight waned into dusk and fuzziness fell across the land, a bishop placed the king's quest for understanding in check claiming that true understanding can only come if subjects learn to travel one mathematically correct path. A new battle cry was shouted. "Your subjects cannot divide."

The king was once more troubled. Though his subjects may know when and why to divide, they could not divide. In an effort to find a route through the increasing darkness, the king called out for a new look at the standards for the teaching and learning of mathematics and for the creation of guiding principles that all could agree upon. The king sent emissaries thoughout the land. But whether he sent fish or fowl, even the most talented bass was unable to woo the factions to a common vision—once again they deKleined to find a common ground. Try as he

President's Column

may, the mathematically sane were never seen as correct and the mathematically correct were never seen as sane. The kingdom was at war.

From the days of the beberman and the begle to the days of the mathematically correct and mathematically sane, the prize has yet to be claimed. The hidden wealth of "dis" tributive property still awaits those who truly understand mathematics.

> Moral — Before the subjects will understand, we must first understand the subjects:
> We must understand what one who understands understands,
> We must understand what one who does not understand understands,
> We must understand what one who teaches one who does not understand to understand understands,
> We must understand what curriculum will lead one who does not understand to understand, and
> We must understand what curriculum will lead one who does not teach for understanding to teach for understanding.

Nominations Sought for AMTE's First Teaching Award

The AMTE Awards Committee is seeking nominations for the first Award for Excellence in Teaching in Mathematics Teacher Education. Nominations are due September 1, 2005. The Award recipient will be announced at the annual meeting of AMTE.

The Excellence in Teaching Award is intended to recognize a colleague for a unique contribution to the pedagogy of mathematics teacher education. We invite nominations that highlight an individual's innovative practices in teaching. Examples of eligible nominees would be those who have implemented effective and innovative teaching practices, demonstrated innovative teaching methods (e.g., publications, materials, videos), or received awards in teaching. The documentation required for the nomination includes the following:

a. Letter of nomination highlighting the innovative practices of nominee (no self nominations will be considered)
b. Vita (highlighting teaching publications and presentations)
c. Documentation of innovative practice (e.g. publication, materials, video are some examples)
d. Documentation of effectiveness of innovative practice (e.g. evidence that pre-service or in-service teachers apply ideas when teaching)
e. Three letters of support from former students – addressing how the innovative teaching impacted their learning about mathematics teaching
f. One letter of support from a peer who has witnessed the individual's teaching or has had former students of the nominee in their own classes and noted the impact of the nominee's teaching on those students.

See http://www.amte.net for more details on how and where to submit materials.

The Excellence in Teaching Award is intended to recognize a colleague for a unique contribution to the pedagogy of mathematics teacher education.

Exchange of Ideas:

"Proof" in Mathematics: How Can You Be Sure and What Difference Does It Make for Teachers?

LouAnn Lovin, Judy Kidd, and Laurie Cavey
James Madison University

The last 10 times you went to the grocery store at 5:00 PM you stood in the check-out line for 45 minutes. You are going to the grocery store again today. It is 5:00 PM. You have brought those papers to grade, a book to read, or your bills to pay because you expect to stand in line for 45 minutes. Is standing in line at this time of day a given? Can you guarantee that this will always be the case?

People have a tendency to look for patterns in their world and to use those patterns to make sense of that world. Discerning a pattern across several observations is a kind of reasoning that we all use in everyday life. We are not necessarily surprised if what we expect to happen does not happen. That's life. Inductive reasoning works well enough to get us through life (at least most of the time!); however, the world of mathematics offers a way of reasoning, deductive reasoning, that provides certainty of a particular outcome. Formal mathematical proofs, based on deductive reasoning, are considered by many to be the foundation, or the heart, of mathematics. If this is so, is it important for prospective teachers to understand and use deductive reasoning? We might all agree that it is important for prospective high school teachers, but how about prospective PreK-8 teachers?

Consequently, it can be a challenge for prospective teachers to understand the signficance of deductive reasoning in mathematics.

We have all heard the argument that teachers need to know more than they will be expected to teach. Some people believe knowing more mathematics means prospective PreK-8 teachers should learn how to use logic tables and write formal proofs. Some people assert that such experiences will provide teachers with the "real" picture of mathematics and a better understanding of mathematics. But simply including logic tables, deductive reasoning, and writing formal proofs because it makes the mathematics courses more "mathematical" or more "rigorous" is not enough. Many mathematics textbooks for elementary teachers address the differences between inductive and deductive reasoning, but in a cursory fashion. Consequently, it can be a challenge for prospective teachers to understand the *signficance* of deductive reasoning in mathematics. Formal proof becomes one more thing that "those math types" expect them to do without really understanding or appreciating what they are doing. In addition, none of these texts attend to how an understanding of these different kinds of reasoning might be informative for a teacher's work—that is, *how* it can help teachers in their work with students. Here, we share strategies that we believe are effective in moving prospective teachers toward an understanding and appreciation of the difference and interplay between inductive and deductive reasoning and how such knowledge can be helpful in their work as teachers.

Fallibility of Inductive Reasoning

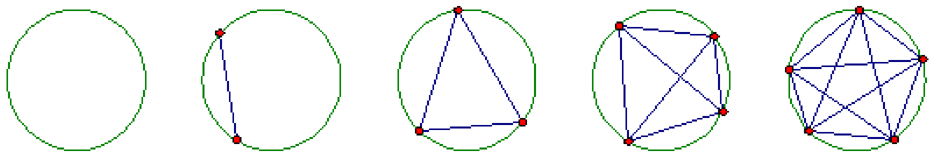
Becoming aware of the fallibility of inductive reasoning is a first step. Because people spend so much time making predictions about their world by using inductive reasoning, it can be difficult for prospective teachers to understand why this does not *prove* that something is true and why it might be beneficial to know with certainty that something is true for all cases. The following problem is an example of a task that provides opportunities to examine the weakness of drawing conclusions based on inductive reasoning.

Dissecting a Circle (The Mathematical Association, 2001)

The task is to choose points on a circle and connect each point on the circle to every other point to create distinct, non-overlapping regions. Start with one point, then two points, and so forth. Create a table to record the number of points on the circle and the number of regions created.

Students typically use the values in the table to identify the pattern that, with each new additional point on the circle, the number of regions doubles. Most can generate an equation such as $R = 2^{n-1}$. When asked to draw the circle with six points and count the number of regions formed, they believe that they have just not counted correctly and will count several times until they realize that something is not quite right. This situation creates a perturbation for them because they believe that since they have found a way to write the relationship between the number of points and the number of regions in a generalized way that this somehow "proves" that the number of regions will always double.

Tasks such as this one provide an opportunity to discuss the notion of inductive reasoning, but also provide an occasion to address a common



N	1	2	3	4	5	6	. . .	10	. . .
R	1	2	4	8	16				

misconception that a generalization (i.e., a "formula") somehow constitutes a proof.

Interplay between Inductive and Deductive Reasoning

Before beginning work on proving an idea using deductive reasoning, we find that it is more productive for prospective teachers to consider how inductive reasoning plays into deductive reasoning. We think of inductive reasoning as part of the discovery process that provides purpose and insight for our deductive work.

Familiar Ideas

Starting with a familiar context can advance prospective teachers' understanding of the difference and interplay between inductive and deductive reasoning. For example, most prospective teachers know that the sum of the angles in a triangle is 180 degrees but many are not able to explain *why* this always holds (in Euclidean geometry). Using a dynamic geometry program, they can "create" several different triangles, noticing what happens to the sum of the angles (i.e., the sum does not change). We want students to realize that based on several examples it *appears* that the sum of the angles is always 180 degrees, but that they do not know this with absolute certainty because they cannot check every possible triangle. That is, they cannot be sure that the pattern will not break as it has in previous tasks. Since checking every possible triangle is impossible, there is a need to look for other ways to be *certain* that this outcome holds for all cases. At this point, we encourage students to develop a deductive argument using ideas that they know are true (e.g., alternate interior angles are equivalent; supplemental angles are 180^{o}). Together, we logically deduce the outcome as a consequence of these ideas.

Connecting to Teachers' Work

Students in mathematics classes frequently ask, "When will I ever use this?" Even in mathematics courses for prospective teachers, they want to know how what they are learning has relevance for them as teachers. Below we briefly describe how we can help prospective teachers see the relevance of inductive and deductive reasoning to their work as teachers.

Waring (2000) suggests a developmental sequence that progresses from inductive to deductive approaches to characterize the ways in which people convince themselves about the truth of a mathematical statement,. For the beginning inductive thinker, checking a few cases seems to be sufficient *proof.* The more advanced inductive thinker however, is aware that checking a few cases is not sufficient evidence, but may be satisfied with merely checking more varied examples. At higher stages, students are aware of the need for a deductive argument, but are not always able to produce one. Eventually, students are able to understand, appreciate, and generate formal proofs. Engaging prospective teachers in discussions about how this framework can inform their work with students is imperative.

Considering the developmental sequence described above from a pedagogical viewpoint, teachers who understand the developmental path for convincing oneself of the truth of a statement can use the framework to inform their instruction. The teacher whose students are satisfied with using a few examples to check for the validity of a situation can prod students to check more varied examples, challenging students with "How can I be sure this is true for *all* cases?" Let's consider a third grader who notices that the product of two odd numbers is another odd number. She states, "See, when you multiply 3 times 3 you get 9, an odd number; or when you multiply 3 times 11 you get 33, another odd number." Another student might offer the observation that when you multiply 5 by 7 the result is an odd number, 35. Many students may be convinced at this point that this will always occur.

(Continued on page 15.)

Before proving an idea via deductive reasoning ,it is productive for prospective teachers to consider how inductive reasoning plays into deductive reasoning.

Theory & Practice Question:

Using Video to Support Teacher Learning

Although reviewing video of their teaching is a traditional assignment for student teachers, additional research on teacher development with video, as well as changing technologies, provide opportunities to deepen teacher reflection and learning from video. How can video support inservice and preservice teacher learning?

Response by Alison Castro, *University of Michigan*

Mathematics educators and researchers are taking an increased interest in the use of video as a site for learning about teaching. Because preservice teachers often have very limited views of teaching that are informed by their own experience as students, they also have a limited understanding of the conflicts and uncertainties that often arise in teaching. Using video of classroom teaching in mathematics methods and content courses can potentially help preservice teachers gain a greater understanding of the complexities of teaching (Lampert & Ball, 1998). Video creates a window into practice, and can provide opportunities for preservice teachers to investigate and discuss various aspects of teaching, which can help prepare them for their future work as teachers.

In this way, video becomes the curriculum in which preservice teachers grapple with the complexities of teaching.

There are at least two potential benefits to using this method of inquiry into practice with preservice teachers. First, video of classroom teaching provides opportunities for preservice teachers to discuss aspects of practice that are safely distanced from their own teaching (Cohen & Ball, 1999). Because video allows them to critically examine *other* people's teaching, preservice teachers are afforded greater opportunities to critique, raise concerns about, and even disagree with certain aspects of instruction. These activities are arguably more difficult for preservice teachers when they examine their own practice. Second, using video presents the tasks and problems of teaching at the forefront of the discussion, which centers preservice teachers' learning in practice. In this way, video becomes the *curriculum* in which preservice teachers grapple with the complexities of teaching (Lampert & Ball, 1998).

Yet, as there are potential benefits, there are also challenges to using video with preservice teachers. Learning how to observe teaching, knowing what to look for and what to focus on, and knowing how to talk about what one sees are important skills to be learned. If preservice teachers do not possess these skills, video cannot be an effective tool. However, because video has such great potential to help preservice teachers learn about teaching, my colleagues and I have designed activities to overcome this particular challenge. Currently, I am a member of a team of graduate students and faculty members who design and teach both mathematics content and methods courses for preservice elementary teachers. As part of our work, we carefully design activities that help preservice teachers gain the skills they need to effectively observe others' teaching.

To help our students develop these skills, we provide scaffolds throughout the semester that guide them in their observation and discussion of teaching practice. For example, we provide students with a particular viewing lens for watching video by asking them to focus on what the teacher or students are doing or saying, or on the mathematical ideas that are being discussed in a particular video clip. Following the video, we discuss what students paid attention to or found particularly surprising in the video, within the constraints of the viewing lens. Similar to proving a mathematical conjecture, we ask students to provide evidence and details for claims they make about the teachers or students, pointing to places in the video transcript to help other students in the class follow the discussion. After some discussion, we have students watch the same video clip again, using the same viewing lens and the previous discussion to help guide their observations. As when one reads a novel for the second or third time, students tend to notice things they missed in the first viewing, or they realize they have insufficient evidence for their claim about what they think the teacher or students are doing.

Much of the work done in helping our students develop skills of observation and investigation takes place during these discussions. By asking students to provide evidence and details to support their ideas, to think about the context in which a particular class takes place, or to listen for the mathematical ideas being discussed, our students can begin to understand important aspects of instruction. In particular, the use of video can facilitate a better understanding of the critical relationship between teacher moves and decisions, students' mathematical work, and the mathematical content.

To give you a better sense of how these activities work in our courses, I will provide an example of how we use video in the mathematics content course to discuss different interpretations of fractions, an important concept in elementary mathematics. The particular video clip we use shows fifth-grade students talking about fractions and trying to understand what different fractions mean, such as 2/3 or 7/5. We ask our students to identify what the fifth-grade students do and do not understand about fractions, as well as to identify any misconceptions or confusions the students may have about improper fractions. Because our preservice teachers are in a mathematics content course, the viewing lens is to focus on particular aspects of the mathematics at work in the video. Following the video, our students discuss several important mathematical ideas. In past discussions, our students have mentioned that the fifth graders do not understand the part-to-whole relationship and hypothesize that this misunderstanding lies at the root of misconceptions involving improper fractions. Still, others of our students mention that the fifth graders know how to represent different fractions and claim that this level of understanding of fractions is sufficient for fifth-grade students. After this discussion and the second viewing of the video clip, we discuss how identifying and understanding students' misconceptions about mathematical ideas is an important part of the work of teaching mathematics.

Although there has been little empirical inquiry into the impact of video on preservice teachers' thinking or on their subsequent entry into the classroom, it does seem that our students have more carefully thought out and nuanced things to say about teaching practice as the semester unfolds. Thus, my purpose here was to not only provide anecdotal evidence of how video can support preservice teachers' learning about practice; my purpose is also to draw attention to the need for preservice teachers to develop the skills necessary to use video effectively. If preservice teachers gain these skills, video of classroom teaching can become a valuable tool for learning about practice in ways that can inform their future work as teachers.

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Response by Karen Clark, University of Colorado at Denver, and Jennifer Jacobs, University of Colorado at Boulder

Video is one tool that can be used to situate professional development in the practice of teaching (Ball & Cohen, 1999). We have found video to be especially powerful when teachers identify specific pedagogical domains that they wish to analyze, improve upon, and discuss with colleagues. Video enables teachers to have rich and complex records of their own classrooms and to reflect upon their teaching practices–individually and collectively–with particular goals in mind (Brophy, 2004; Sherin, 2004; Tochon, 1999).

Video enables teachers to have rich and complex records of their own classrooms and to reflect upon their teaching practices with particular goals in mind.

Teachers who participate in our two-year professional development program[1] for middle school mathematics teachers, Supporting the Transition from Arithmetic to Algebraic Reasoning (STAAR), have their classrooms videotaped on a regular basis, and then share these videotapes in monthly workshops. The workshops are intended to create a professional learning community in which the participating teachers critically examine their own teaching practices, with an emphasis in the teaching of algebra. The primary objective of the STAAR project is helping teachers to learn about algebraic content and pedagogy, and we frequently use video as a tool in our workshops.

The videotapes of the teachers' classrooms are used in a variety of ways in the STAAR workshops. As one example, we invite the participating teachers to identify relevant pedagogical goals for themselves and to generate ideas for meeting those goals. The videotapes help teachers to spot areas

(Continued on the next page.)

The Fall Issue's Theory & Practice Question:

Bridging the Potential Divide between Theory and Practice

A common complaint about university courses or professional development is that they are too theoretical and do not provide immediately applicable activities for the classroom. In what ways do you attempt to get teachers (preservice or inservice) to bridge the potential divide between theory and practice?

AMTE members are encouraged to respond to this question with an essay of 600-1000 words. Submit your response to *Connections* Editor Lynn Stallings (lstalling@kennesaw.edu) by September 1 to ensure consideration for the October issue.

Theory & Practice Question:

Using Video to Support Teacher Learning

Response by Clark and Jacobs

(Continued from previous page.)

that they feel need improvement, and watching videotapes of their colleagues sometimes helps point to new strategies. Teachers are able to analyze their video independently before the workshop and then collectively during the workshop. Studying their own video provides an opportunity for teachers to directly reflect on their own classroom practices. Watching other teachers' videos with a specific purpose or goal in mind provides an opportunity for teachers to glean insight into pedagogical alternatives (Hiebert & Stigler, 2004). We have seen the ways in which this use of video can serve as a powerful medium to promote change, particularly in teachers' self-identified goals. Collecting and analyzing videos throughout the school year encouraged teachers to shift their goals as they started to see changes in their practice.

One participant, Celia (a pseudonym) identified her initial goal as improving group dynamics at the beginning of the school year. After making some important changes in her classroom, such as rearranging the desks and asking students to work together more often in mixed-ability groups, her goal began to shift. She decided to focus on encouraging more student talk throughout the classroom. To foster more frequent and productive discussions, Celia led several conversations about norms and expectations for talking and listening to peers. Together they developed a list of "rules for group work" which Celia posted on a wall in the classroom. Celia also began having students present their ideas and solution strategies to the whole class. Celia developed many of these new pedagogical strategies through conversations with her fellow teachers during STAAR professional development workshops, as they viewed and analyzed video from her lessons together.

As they generate and act on self-selected goals, teachers determine their own starting point for reform and work towards instructional change in areas that are personally relevant for them.

As the school year progressed and Celia continued watching and reflecting on her videos, she began to feel that her students were working well collaboratively and having more extended mathematical discussions. Celia's goal then evolved to become deeper questions of her students. Celia noticed that her natural inclination, particularly during small group work, was to tell students if they were right, for example by saying "good job," without any additional probes or questions that might encourage more justification and reasoning. As that school year was drawing to a close, Celia's goal shifted once again to having students ask deeper questions of each other. As she carefully analyzed her video by herself and with colleagues, Celia became keenly aware of her pedagogical moves as well as the abilities of her students, and decided that she could push them to engage in the same type of higher level questioning that she was now using.

Now in its second year, the STAAR program has recently added a new online component. Selected video clips of the teachers' lessons are shared through an online environment so that conversations can continue between workshop sessions. Streaming video clips are posted on a secure internet site and the teachers are encouraged to write about their thoughts and suggestions.

By centering our professional development around video, we have provided a forum in which all of the teachers can progress on individually selected paths. As they generate and act on self-selected goals, teachers determine their own starting point for reform and work towards instructional change in areas that are personally relevant for them. Sharing their goals along with their videotapes helps the teachers to bring their colleagues into the conversation, and, in the right environment, fosters a focused and supportive community.

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Response by Karen B. Givvin, LessonLab Research Institute, Santa Monica, CA

Knowledge required for competent teaching is broad in range and diverse: content and pedagogical knowledge (and their combination), classroom management skills, knowledge of child development, learning, and motivation, as well as a grasp of the special needs of different student populations, to name a few of the most important areas. Preservice programs mostly provide introductory courses in these areas. Once in the classroom and with inservice teacher learning programs the primary source of continuing education, time to focus on these topics becomes even more limited. Add in all the other demands on teachers' learning time and professional development activity has stiff competition. So if choosing from among of wide array of possible programs to facilitate teacher learning, why select one that includes video? What can it uniquely offer?

Video offers inservice and preservice teachers two powerful learning opportunities. The first is related to the cultural nature of teaching. The second is related to the doors video-based reflection opens to increasing pedagogical content knowledge.

Teaching is a cultural activity because unrecognized (and often unquestioned) rules about how lessons are conducted determine how teachers and students interact in the classroom (Gallimore, 1996; Lortie, 1975; Stigler & Hiebert, 1999). Cultural rules are so deeply engrained in our minds that we think about them only when they are violated or directly pointed out. Why would that matter when it comes to improving teaching? Actions taken habitually and without thinking constrain learning. The challenge is bringing these cultural activities to the fore and placing them open for discussion. Video–especially when it includes images or views from outside one's own culture–enables us to "see" practices normally taken for granted. Reasons (or the lack thereof) behind cultural routines can be examined and discussed. Alternatives can be presented for consideration. Reflection on video allows for cultural routines that underlie teaching to be more easily made explicit, evaluated, and changed.

Video-enabled teacher reflection also provides specific teacher learning opportunities. Among the most critical is the increasing of teachers' pedagogical content knowledge (PCK), that unique blend of content and pedagogy that constitutes the professional knowledge of accomplished teachers (Ball & Cohen, 1999; Ball, 2000; Hiebert, Gallimore, & Stigler, 2002; Ma, 1999). Shulman (1986) included in pedagogical content knowledge "the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, demonstrations–in a word, the ways of representing and formulating the subject that make it comprehensible to others" (Shulman, 1986, p. 9).

The nature and complexity of PCK makes it challenging to learn. The most effective context for learning PCK is through extended opportunities to collaborate with and observe accomplished practitioners. One way to increase and extend such opportunities is through the vivid images that videos can provide. With video, teachers have the chance to observe, study, and integrate subject matter and pedagogical knowledge to solve problems of practice. Teachers rarely have this opportunity otherwise (Hiebert et al., 2002).

The caveat: The potential of video to improve teaching cannot be reached with videos alone. Simply providing teachers with recordings of their own or others' teaching to watch and reflect on accomplishes little if they are left to work in isolation and without a guiding analytical framework. Left to their own devices, novice video viewers often focus on superficial matters such as teacher and student characteristics, fleeting classroom management issues, and global judgments of lesson effectiveness. Without an analytic framework and explicit tasks, teachers watching lesson videos rarely address subject matter content and, almost by definition, rarely see the invisible qualities of teaching as a cultural phenomenon. However, learning sophisticated analysis-of-practice skills helps teachers to more skillfully "see" the subject matter in lessons, discriminate ways that learners comprehend subject matter, identify problematic features, assess student responses, detect, diagnose, and develop instructional responses to student errors, and generally become more successful practitioners (Berthoff, 1987; Burnaford, Fischer, & Hobson, 1996; Cochran-Smith & Lytle, 1993, 1999). Furthermore, guidance that illuminates the hidden culture of teaching can bring to light pedagogical alternatives available to teachers.

(Continued on the next page.)

So if choosing from among of wide array of possible programs to facilitate teacher learning, why select one that includes video? What can it uniquely offer?

Response by Givvin

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InterMath: A Web Resource for Middle Grades Math

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The InterMath website (http://www.intermath-uga.gatech.edu) is a free resource that houses over 500 technology-enhanced explorations of mathematics (TEEMs) that were designed or adapted to engage middle grades teachers in mathematical thinking and dialogue. These TEEMs are sorted according to mathematical strand, and all can be solved with technology tools. The website also includes a dictionary written for middle grades students, a constructionary to support teachers in learning how to construct objects using Geometer's Sketchpad, and lesson plans written by InterMath participants using the Backward Design model from Wiggins and McTighe's *Understanding by Design*. A number of additional resources are available to support workshops, such as matrices organizing the investigations and syllabi for six different InterMath courses. All materials on the InterMath website are available for anyone who would like to use them.

This rich web resource resulted from the InterMath professional development program funded by the National Science Foundation. InterMath's model of professional development includes two major pieces: a series of face-to-face workshops and an extensive website to support teacher professional development. The professional development workshops are designed to enhance middle grade teachers' content knowledge, proficiency with technology, and comfort in working with open-ended mathematical investigations.

Newly Released NCTM Position Statement:

Calculators, Computation, Common Sense

Question: Is there a place for both computation and for calculators in the math classroom?

School mathematics programs should provide students with a range of knowledge, skills, and tools. Students need an understanding of number and operations, including the use of computational procedures, estimation, mental mathematics, and the appropriate use of the calculator. A balanced mathematics program develops students' confidence and understanding of when and how to use these skills and tools. Students need to develop their basic mathematical understandings to solve problems in and out of school.

Technology pervades the world outside school. There is no question that students will be expected to use calculators in other settings; this technology is now part of our culture. More importantly, when calculators are used well in the classroom, they can enhance students' understanding and use of numbers and operations. Teachers can capitalize on the appropriate use of this technology to expand students' mathematical understanding, not to replace it.

Written mathematical procedures—computational procedures in the elementary grades and more symbolic algebraic procedures as students move into the secondary level—continue to be an important focus of school math programs. All students should develop proficiency in performing efficient and accurate pencil-and-paper procedures. At the same time, students no longer have the same need to perform these procedures with large numbers or lengthy expressions as they might have had in the past without ready access to technology. Furthermore, computation should not exist in isolation. Measurement, geometry, and analyzing data represent important mathematical content and provide useful contexts as students develop their numerical abilities.

Even more important than performing computational procedures or using calculators, students need greater facility with estimation and mental math than ever before. These skills are essential both for understanding numbers and because of their usefulness outside school. Students should have a solid understanding of what addition, subtraction, multiplication, and division mean and how they work so that they can identify what operation(s) can help them solve a problem they encounter in math class, in another subject, or outside school. As they develop number sense, students acquire abilities to estimate and perform mental calculations quickly and proficiently. Students should become proficient at using mental math shortcuts, performing basic computations mentally, and generating reasonable estimates for situations involving size, distance, and magnitude.

A skillful teacher knows how to help students develop these abilities in a balanced program that focuses on mathematical understanding, proficiency, and thinking. The teacher should help students learn when to use a calculator and when not to, when to use a pencil and paper, and when to do something in their heads. Students should become fluent in making decisions about which approach to use for different situations and proficient in using their chosen method to solve a wide range of problems.

A skillful teacher knows how to help students develop these abilities in a balanced program that focuses on mathematical understanding, proficiency, and thinking.

Newly Released NCTM Position Statement:

Closing the Achievement Gap

Question: How can we close the achievement gap in mathematics education?

To close the achievement gap, all students need the opportunity to learn challenging mathematics from a well-qualified teacher who will make connections to the background, needs, and cultures of all learners.

The achievement gap indicates disparities among groups of students usually identified (accurately or not) by racial, ethnic, linguistic, or socioeconomic status with respect to a variety of measures, including attrition and enrollment rates, alienation from school and society, attitudes toward mathematics, and test scores. The achievement gap is not a result of inclusion in any demographic group, but rather of disparities in the way that learners are treated on the basis of racial, class, and language differences. These disparities can be conscious or unconscious, blatant or subtle, personal or institutionalized. Students internalize others' perceptions of the group to which they belong. The feelings and anxieties that students harbor as a result of negative messages can and do affect their performance on tests (Croizet & Claire, 1998; Shih, Pittinsky, & Ambady, 1999; Steele & Aronson, 1995). Teachers' expectations and belief systems also affect students' mathematics achievement (Strutchens, 2000).

Every student should have equitable and optimal opportunities to learn, free from any bias on the part of schools, communities, and teachers. Every student should be taught by teachers in schools where expectations are high, regardless of the community where the school is located. The teachers should be mathematically competent and pedagogically proficient. They should use curricula that are culturally relevant and methods of instruction that are culturally sensitive. Ideally, all children who are not proficient in English should receive mathematics instruction in their first language as they work to acquire English proficiency. Alternative and authentic assessment practices should be used, and the federal mandate for achievement, insofar as it is based on inadequate and inequitable standardized assessments, should be challenged.

Convincing evidence suggests that teachers can play a significant role in closing the achievement gap. Unfortunately, students who have the greatest needs often have the least qualified teachers. Key decision makers in government, industry, community leadership, and education must fully understand the issues related to equity in mathematics education so that they can carry a strong, consistent message. Finally, educators at the local, state, and federal levels should be knowledgeable about equity issues and communicate with their legislative representatives about the current inequities in education.

NCTM Position

Every student should have equitable and optimal opportunities to learn mathematics free from bias—intentional or unintentional—based on race, gender, socioeconomic status, or language. In order to close the achievement gap, all students need the opportunity to learn challenging mathematics from a well-qualified teacher who will make connections to the background, needs, and cultures of all learners.

NCTM President's Online Chat:

Untapped Potential

Tuesday, July 26th, 3:00 PM

Cathy Seeley
NCTM President, 2004-2006

Each month the NCTM president chats live online with members, students, and others who want to ask the president a question. This program is part of the president's outreach and offers the public a way to keep current on the issues and concerns of mathematics teachers. Cathy Seeley's next online chat will begin at 3:00 PM EDT on Tuesday, July 26. The topic is "Untapped Potential."Read each month's President's Message in the *NCTM NewsBulletin* and regularly visit NCTM's home page, where the time and date of each month's chat is posted.To view the transcript of the most recent chat, transcripts from past online chats, or to submit a question to future chats, visit http://www.nctm.org/news/chat.htm.

Exchange of Ideas:

"Proof" in Mathematics

(Continued from page 7.)

The teacher can ask appropriate questions, such as what if you multiplied a very large odd number and a small odd number? Would you get an odd number? How many examples do you need to check? How do we know we have checked enough to know for sure? A teacher who believes that using a couple of examples is enough to "prove" that something is always true, may not see the opportunity or the need to pose appropriate tasks and questions to students that could extend their mathematical reasoning.

Why Do Teachers Need to Know "This"?

Students often use a couple of examples to convince themselves that a situation will always occur. Teachers should be aware of the fallibility of this way of thinking. This is not to say that teachers need to teach first graders to use formal deductive reasoning, as if they could. But knowing the relationship between inductive and deductive reasoning and the fallibility of inductive reasoning can inform teachers about how they might interact with students grappling with mathematical ideas.

As we teach mathematics content courses for prospective PreK-8 teachers, we struggle with the tensions between being true to the discipline of mathematics and enhancing our prospective teachers' mathematical knowledge for teaching. As we select and teach the big ideas of these courses, we find ourselves wrestling with the question of how this idea or that idea will help our students be better mathematics teachers. As we challenge our students to unpack mathematical ideas to understand how children might be reasoning or to develop their own reasoning skills, we also challenge ourselves to unpack our knowledge of teaching mathematics in an attempt to understand how various ideas can be useful in the work of teachers. We want to be able to answer the proverbial question "When will I ever use this?"

We struggle with the tensions between being true to the discipline of mathematics and enhancing our prospective teachers' mathematical knowledge for teaching

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Affiliate Corner

AMTE currently has five state-level affiliates: California, Connecticut, Florida, Illinois, and Utah. In 2003, AMTE formalized its process for affiliation and officially named Illinois and Utah as affiliates. The Florida group affiliated in 2004; California and Connecticut both affiliated in 2005.

California

Officers: President Carol Fry Bohlin, President-Elect Nadine Bezuk, Secretary Kathy Morris, Treasurer Shuhua An, Members-at-Large: Joan Commons, Michael Lutz, and Dale Oliver.

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Officers: President Hari Koirala, Vice President Jill Shahverdian, Secretary-Treasurer Maria Mitchell, Executive Board members: Maria Diamantis and Elaine Dinto.

Florida

Web address: http://reach.ucf.edu/%7Emae5318/FAMTE.html

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Illinois

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Utah

Web address: http://uamte.math.byu.edu/

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Upcoming Conferences

Online at
http://www.amte.net

Membership/Renewal Forms

Position Papers

Position Listings

Resources

Forum for Members

Other Opportunities

2005

August 4-6	MAA MathFest	Albuquerque, New Mexico
October 6-8	NCTM Regional	Hartford, Connecticut
October 20-22	NCTM Regional	Birmingham, Alabama
October 20-23	PME-NA	Roanoke, Virginia
November 10-12	SSMA	Fort Worth, Texas
November 10-12	NCTM Regional	Denver, Colorado

2006

January 12-15	MAA-AMS Joint Meeting	San Antonio, Texas
January 26-28	AMTE	Tampa, Florida
April 8-12	AERA	San Francisco, California
April 24-26	NCTM Research Presession	St. Louis, Missouri
April 24-26	NCSM	St. Louis, Missouri
April 26-29	NCTM	St. Louis, Missouri

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