The University of Georgia

Office of the Senior Vice President for Academic Affairs and Provost

May 25, 2011

Dr. Linda Noble
Associate Vice Chancellor for Faculty Affairs
University System of Georgia
270 Washington Street, SW
Atlanta, Georgia 30334-1450

Dear Dr. Noble and Members of the Regents Excellence Awards Committee:

I am pleased to nominate Sybilla Beckmann, Professor of Mathematics, for the USG BOR Faculty/Staff Teaching Excellence Award, research universities' sector. At all levels, Professor Beckmann has shown extraordinary leadership in enhancing the teaching and learning of mathematics. She has been a strong advocate for effective educational environments, particularly for those studying to be teachers. She has, within the Department of Mathematics and across many other departments and colleges, fostered a community of scholars dedicated to thinking seriously about how to improve teachers' knowledge of mathematics. She has been a catalyst for learning by her undergraduate students, graduate students, and colleagues, as the University recognized recently through the award of the Meigs Distinguished Teaching Professorship, our highest teaching award.

Professor Beckmann has a unique background, as she taught mathematics daily during the 2005-06 school year to a class of sixth graders making her the only serious research mathematician in the country who actually spent significant time in primary schools. Her concern for teaching the teachers is evident in new courses she designed for early childhood majors at UGA – which resulted in the *only* program recognized by the National Council on Teacher Quality as exemplary. Her leading textbook, *Mathematics for Elementary Teachers*, is nationally recognized. According to Francis Fennell, Past President of the National Council of Teachers of Mathematics, Professor Beckmann has made "a significant impact on how teachers teach and students learn mathematics," and epitomizes an exceedingly wished-for breed of "mathematicians who care deeply about teaching and nurturing the development of preservice and inservice teachers."

If you have the time, there is a video that accompanies her Meigs award, and it is available at ctl.uga.edu/Beckmann. The video allows you to hear her address what needs to change in elementary math, why her classes are writing intensive, how she prepares for class, how she keeps students motivated, and other topics. I am pleased to provide enthusiastic support of Professor Sybilla Beckmann's nomination for the Faculty Teaching Excellence Award.

Respectfully,

Jere W. Morehead
Senior Vice President for Academic Affairs and Provost

203 Administration Bldg. • Athens, Georgia 30602-1651 • Telephone 706-542-5806 • Fax 706-583-0746

The University of Georgia

Department of Mathematics

May 25, 2011

Dear Dr. Noble and Members of the Regents' Excellence Awards Committee,

With great pleasure I endorse the nomination of Sybilla Beckmann for the Regents' Teaching Excellence Award. Sybilla's devotion and contribution to revolutionizing the mathematical education of young minds is nothing short of astounding. Her innovative approach to preparing future teachers of elementary mathematics is groundbreaking. This work has led to her involvement in Mathematics Education reform in a broad and meaningful way, ranging from membership on national mathematical education advisory committees, to her nationally acclaimed textbook, to her involvement in the local school system.

What stands out in my mind most about Sybilla as an educator is the number of people's lives she has touched. In her classes, she manages to convey the joy of understanding that mathematics, even at the elementary level, is not a random compilation of arcane manipulations of numbers, but, in fact, makes simple, common sense. She teaches this understanding and appreciation to future and practicing teachers, and more recently she has extended her instruction to future teachers of teachers. Each one of these disciples then takes up the charge of conveying this joy to his/her students and colleagues. These teachers are laying the foundation in the young minds of their students for future success in mathematics and science.

It only takes a glance at the letters from past students, and comments on anonymous evaluations of her classes, to see that Sybilla's instruction is profoundly life-changing. Phrases such as *" ... Dr. Beckmann has been a true inspiration as to the teacher I would love to become," "... She shows such passion for mathematics and relays that passion in a way that makes others want to be passionate too,"* and, *"I feel like I will be a much better teacher for taking this course,"* abound in her evaluations. Sybilla is clearly a powerful role model for her students.

The Mathematics Department is extremely proud to have Sybilla amongst their number and we are proud to support this nomination for the Regents' Teaching Excellence Award.

Sincerely,

Malcolm R. Adams
Head, Department of Mathematics

Boyd Graduate Studies Research Center • Athens, Georgia 30602-7403 • Tel. 706-542-2211 • Fax 706-542-2573

The University of Georgia

Department of Mathematics and Science Education
105 Aderhold Hall
Athens GA 30602-7124

May 23, 2011

Dear Members of the Regents' Teaching Excellence Award Committee:

It is my pleasure to write a letter supporting the nomination of Dr. Sybilla Beckmann for the Regents' Teaching Excellence Award. Sybilla and I have worked together in a number of contexts across the last 16 years, all of them having to do with improving the mathematical preparation of teachers.

As part of our work together Sybilla and I have frequently observed each other's classes. I have observed Sybilla engage a class of students in deep and thoughtful work on a mathematics problem for the better part of a class period. Sybilla selects problems that challenge her students and that extend and deepen their thinking. She provides support and encouragement as they work together to solve the problem, but she is careful not to be the sole source of mathematical authority in the classroom. She pushes students to rely on their own reasoning and that of their peers to determine if an answer is correct. Sybilla is very reflective about her own teaching, and she actively seeks feedback on her lessons from peers. She is the first to admit that teaching is a subtle yet complex endeavor and one for which she does not have all of the answers. She grapples daily with issues related to assessment, classroom dynamics, group work, and problem-posing in order to improve her teaching. She has opened her classroom as a "laboratory" to faculty and graduate students in mathematics and in mathematics education, many of whom have taken advantage of her open-door policy and her willingness to reflect on and talk about her teaching.

At all levels of education, Sybilla has shown leadership in enhancing the teaching and learning of mathematics. She has been a strong advocate for effective educational environments, particularly for those studying to be teachers. She has fostered a community of scholars dedicated to thinking seriously about how to improve teachers' knowledge of mathematics within the Department of Mathematics and across departments and colleges. She has definitely been a catalyst for learning by her undergraduate students, graduate students, and colleagues. Sybilla is an excellent educator in all respects, and I consider myself fortunate to be her colleague. I hold Sybilla in the highest regard as a teacher and strongly endorse her nomination for the Regents' Excellence in Teaching Award.

Sincerely,

Denise A. Spangler

Denise A. Spangler
Professor of Mathematics Education and Department Head

Sybilla Beckmann
full name: Sybilla Beckmann Kazez
Josiah Meigs Distinguished Teaching Professor of Mathematics
University of Georgia, Athens, Georgia 30602
706-542-2548 sybilla@math.uga.edu

Education:
1976-1980 Sc.B., Mathematics, Brown University
1980-1986 Ph.D., Mathematics, University of Pennsylvania

Academic positions:

2011– Josiah Meigs Distinguished Teaching Professor, University of Georgia

2005– Professor, University of Georgia

1993–2005 Associate Professor, University of Georgia

1988–1993 Assistant Professor, University of Georgia

1986–1988 J.W. Gibbs Instructor, Yale University

Selected books:

Karen C. Fuson and Sybilla Beckmann. (in press). *Math Expressions*, Grade 6. Houghton Mifflin Harcourt.

Karen C. Fuson, Douglas H. Clements, and Sybilla Beckmann. (2011). *Focus in Grade 2: Teaching with Curriculum Focal Points.* Reston, VA: National Council of Teachers of Mathematics.

Sybilla Beckmann (2011). *Mathematics for Elementary Teachers*, third edition, Addison-Wesley, 885 pages. Accompanying activities manual, 681 pages. Accompanying Instructor's Resource Guide, 435 pages. Second edition: 2008. First edition: 2005.

Karen Fuson, Douglas Clements, and Sybilla Beckmann (2010). *Focus in Kindergarten: Teaching with Curriculum Focal Points.* Reston, VA: National Council of Teachers of Mathematics.

Thomas J. Cooney, Sybilla Beckmann, and Gwendolyn Lloyd. (2010). *Developing Essential Understanding of Functions for Teaching Mathematics in Grades 9 – 12.* Reston, VA: National Council of Teachers of Mathematics. Invited.

Sybilla Beckmann, Editor (2009) *Focus in Grade 5: Teaching with Curriculum Focal Points.* National Council of Teachers of Mathematics. Invited.

Selected articles:

Sybilla Beckmann. (2011). From the Common Core to a Community of all Math Teachers. *The Mathematics Educator.* Volume 20, Number 2, pages 3 – 9. Invited guest editorial.

Sybilla Beckmann. (2011). The Community of Math Teachers, From Elementary School to Graduate School. *Notices of the American Mathematical Society.* Volume 58, Number 3, pages 368 – 371. Invited.

Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). *Assisting students struggling with mathematics: Response to Intervention (RtI) for elementary and middle schools* (NCEE 2009–4060). Washington, DC: National Center

for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

Sybilla Beckmann and Karen C. Fuson (2008). Focal Points: Grades 5 and 6. *Teaching Children Mathematics*. Volume 14, issue 9, May, pages 508 – 517. Invited paper.

Sybilla Beckmann (2004). What mathematicians should know about teaching math for elementary teachers, *Mathematicians and Education Reform Newsletter*, Vol 16, No. 2, pp. 1, 4, 5, 11. Invited paper.

Sybilla Beckmann (2002). Mathematics for Elementary Teachers: Making Sense by "Explaining Why," in *Proceedings of the Second International Conference on the Teaching of Mathematics at the Undergraduate Level*. J. Wiley & Sons, Inc.

Selected membership on national committees:

Member of the writing team to produce *Progressions for the Common Core Standards for Mathematics*, 2010 –

Member, Mathematics Writing/Work Team, Common Core State Standards Initiative, 2009 – 2010, which wrote the *Common Core State Standards for Mathematics*.

Member, Committee to revise the *Mathematical Education of Teachers* document that is published jointly by the Mathematical Association of America and the American Mathematical Society. 2010 – .

Panel member for the development of an Institute of Education Sciences (U.S. Department of Education) Practice Guide on Word Problems, 2009 – 2011.

Member, National Research Council Committee on Early Childhood Mathematics, 2007 – 2009, which wrote the report, *Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity*.

National Council of Teachers of Mathematics *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics*, 2006. Beckmann was an invited member of the 9 person writing team that produced this document, which was reviewed by over 60 experts.

Selected expert advising and committee membership:

Current and past advisory board member or expert consultant on a number of research projects funded by the National Science Foundation and the Institute of Education Sciences of the US Department of Education.

Current and past expert consultant for children's TV shows "Curious George," "Sesame Street," "The Electric Company," "Cyberchase," and "Peep and the Big Wide World."

September 2010 – May 2011: Chair, organizing committee for the Mathematical Sciences Research Institute workshop, *The Mathematical Education of Teachers*, in the *Critical Issues in Education* series.

2009 – : Member, US National Commission on Math Instruction, The National Academies

August 2008 – : Member, Mathematics Sciences Research Institute (MSRI) Education Advisory Committee.

Selected presentations:

April 2011: "Do Models Play Different Roles in Integer Arithmetic and Fraction Arithmetic?" in the symposium session on Models in Elementary Mathematics Teaching and Learning, American Educational Research Association annual meeting, New Orleans, LA.

March 2011: with John Ewing and William G. McCallum, "Common Core State Standards – Math," featured speaker panel at the Celebration of Teaching and Learning conference, New York, NY.

January 2011: with Jim Lewis, "The Mathematical Education of Teachers 2," invited presentation to the Association of Mathematics Teacher Educators annual meeting, Irvine, CA.

October 2010: "Response to Intervention (RtI) for Elementary and Middle School Mathematics" keynote presentation to the Algebra Forum presession. San Jose, CA.

May 2010: "Common Core K – 12 Math Standards and Teacher Education," colloquium, Michigan State University, East Lansing, MI.

March 2010: "What is the role of math departments in PreK – Grade 8 teacher preparation?" Mathematics Sciences Research Institute Academic Sponsor's Day, Berkeley, CA.

February 2010: "Report of the Committee on Early Childhood Mathematics," STEM Summit 2010: Early Childhood Through Higher Education, Irvine, CA.

December 2008: Keynote address on the preparation of elementary teachers at the conference, "Developing Working Knowledge of the National Mathematics Panel Report," sponsored by the Center on Instruction, Long Beach, CA.

June 2008: Discussant of research findings on algebra in elementary school and its relevance to learning algebra in later grades, Pathways to Algebra Conference, Relais du Gue de Selle, Evron-Mezangers, Mayenne, France.

April 2008: Keynote address on the preparation of elementary teachers, conference on elementary teacher preparation, Framingham State College, Massachusetts.

October 2007: "NCTM's Curriculum Focal Points: Ideas and Activities to Focus on in Class," keynote address at the South Carolina Conference of Teachers of Mathematics. Greenville, SC.

May 2005: "A Research Mathematician Teaches 6th Grade Math" one hour keynote address at the 2005 Green Lake Conference of the Wisconsin Mathematics Council. Green Lake, Wisconsin.

March 2005: "Mathematics content courses for prospective elementary and middle school teachers", a one hour plenary talk at the symposium "Excellence in Teaching Mathematics and Science: Research and Practice" at Northwestern University, Chicago, Illinois.

September 2004: "Mathematics materials for prospective elementary school teachers", a one hour keynote address at a national conference focusing on the mathematical preparation of middle school teachers, sponsored by the NSF project, "Connecting Middle School and College Mathematics", St. Louis, Missouri.

Thoughts on Teaching

By Sybilla Beckmann,
Department of Mathematics, University of Georgia

It is an honor to be considered for a Regents Teaching Award. It has been my privilege to teach at the University of Georgia for the past 23 years and to be a part of nurturing the many bright young minds that come here to us. It has also been my privilege to work at the local, state, and national level towards improving mathematics education in early childhood, elementary school, middle school, high school, and college. I am deeply grateful for the opportunity to do this work that is so meaningful to me and now to take time to reflect on it.

The human side of teaching

Teaching, like research, is a surprising mix of the deeply intellectual with the deeply human. Why is a subject worthy of our interest, what makes people interested in that particular subject, and where does the desire to pursue knowledge and understanding in the subject come from? What are the ideas of a subject, how are they connected and related, what are their roots and origins and where are they headed? How can we develop a deeper understanding of the subject? These are questions for every teacher and every researcher.

Years ago, when I was new to the University of Georgia, I had a flash of insight that the human, social aspect of teaching was more important than I had appreciated. I was teaching a graduate course when I realized that even mathematics graduate students, who were already committed to learning mathematics for its own sake, required something more than the course material. Simply showing the students the ideas, no matter how carefully analyzed and presented, wasn't enough. They needed engagement, they needed to feel the excitement and thrill of the chase, they needed reasons to be enthusiastic about the topics, and they needed stimulating and validating exchanges with their peers and with me; when they felt these things, they were with me, but when they didn't, they weren't. Teaching, I realized, required not only a detailed analysis and organization of the material, but also required a human element. I now think of this "human element" as taking the perspective of the students, engaging with the students' ideas and building from them, sharing the excitement of the subject and one's enthusiasm for it, and turning a class of students into a community of learners who come to own the material for themselves. I aspire to this, but it is hard stuff!

Teaching math, the dreaded subject

To me, math is the coolest thing around. Yet for many people, math is a dreaded subject, a barrier to overcome and leave behind as quickly as possible. At every level, I find math to be full of surprising intricacies and deep beauty. For example, the Pythagorean theorem tells us in one simple, beautiful equation how the side lengths in a right triangle are related. But how do we know that this relationship holds true?

It is amazing that even though there are *infinitely* many right triangles, we can prove that the relationship holds for *every single one of them*! Not only that, but there are many different ways to prove the theorem, and these ways often involve a surprising puzzle-like process in which shapes just happen to fit perfectly together. Surely this theorem reflects some harmony or perfection in the universe. So why has math become such a dreaded subject? I think because, sadly, it is often not taught very well.

My mission has become to improve math teaching. When my children were young and just starting school, I had another moment of insight when I realized just how important the mathematical preparation of teachers is. Like many other math departments, we taught courses for future elementary school teachers, courses I had not thought much about until that moment. I decided then that I needed to start teaching these courses and thinking about how to improve them. This has become my passion and has resulted in a fundamental shift in my career. I went from being an ordinary research mathematician to one focusing on the mathematical education of teachers. I wound up redesigning our courses for elementary teachers, writing a book for use in such courses, and getting involved in improving mathematics education at the local, state, and national levels.

Math shouldn't be a dreaded subject, especially not for teachers. Everyone can learn math and appreciate its power and beauty. Learning math is not a matter of having math genes or some special abilities reserved for a select few. To be sure, math isn't easy and it does require a willingness to stretch one's thinking and to accept the challenge to think in new ways. Teachers, in particular, need to know all this about math. They need to know the math they will teach, including its intricacies and subtleties. They should know that math is about ideas and logical lines of reasoning, not just "turn the crank" calculations. They should know how engaging and interesting even elementary school math is, and they must know how to bring the depth and excitement of math to their own students. This is what I try to impart to all the prospective elementary and middle grades teachers I teach, and what I want them to take to their own future teaching.

Learning to teach

Teaching, like research, is not a skill we are born with. We must develop it, and its development is hard fought and ongoing. Recently, I discovered the research literature on expertise, which shows that expertise is not at all a matter of initial talent or promise but rather is a matter of deliberate practice over a long period of time. Expertise develops by working continually to improve areas of weakness; teaching is no exception. Good teaching takes cycles of tinkering, trying, adjusting, and revising. It takes confronting the inevitable frustrations and failures and figuring out how to improve based on them. But those "aha! moments," when the ideas suddenly make sense to students, and those moments when I read students' well-written work and realize just how much they have learned, those are what make teaching exhilarating for me and are the rewards for the hard work.

When I first started teaching (nearly 30 years ago!), I thought of teaching as a matter of explaining the material clearly and telling the students what I wanted them to know. I thought the students' job was to listen carefully and absorb what I told them. Of course clear explanations are an important part of teaching, but I have since recognized that to learn, students cannot just passively receive the material but must actively engage with it. Students must process and grapple with the ideas in order to make sense of them. I now see a teacher's job as guiding this process of engagement by setting tasks and facilitating discussions that help students build on what they know and confront what they don't know. This way of teaching is harder than just lecturing! And, although a few students resist active engagement, the vast majority of students find active learning more interesting, fulfilling, and effective.

Teaching is something we can help each other learn. Like all learning, it is most powerful and effective when we learn together and from each other in a community. In recent years I have been helping the next generation of mathematicians—graduate students and postdoctoral fellows—learn to teach courses for elementary and middle grades teachers. First, I have these new mathematicians observe one of my courses for prospective teachers. They also write weekly summaries, participate in online discussions about their observations, and do some reading in key documents related to K-12 mathematics and teacher preparation. Then, if they are ready, they teach a similar course. I meet weekly with all instructors of a given course so we can plan together and discuss any rough patches we encounter. I aim to treat all these instructors as my colleagues and find I learn many good ideas about teaching and about the course material from them in the same way that I learn many good ideas from my undergraduate students. To me, teaching and learning are inseparable. In both cases, learning with and from each other is a source for inspiration.

Teaching teachers and teaching the field about elementary math

People often wonder about college level courses on elementary school math. Why would a college student need such a course? Although college students know the "how" of elementary math, they rarely know the "why." For example, they know how to multiply decimals, but what is the logic behind why we put the decimal point where we do? To multiply fractions we multiply the numerators and the denominators, so why can't we add fractions by just adding the numerators and adding the denominators? These are the kinds of questions that elementary teachers should explore before they teach.

In teaching mathematics for elementary teachers, I see my role not only as a teacher of teachers but also as a teacher of the field at large. I give many presentations to groups of K-12 teachers and to college-level mathematicians and mathematics educators and I have participated in many national efforts aimed at improving mathematics education. All of these efforts have required explaining to a broader audience how deep the ideas of elementary math really are. For example, following

my membership on the writing team for the Common Core State Standards for Mathematics (which have been adopted by about 44 states, including Georgia), I am a member of the Progressions Project writing team, which is explaining the mathematical ideas within those standards in greater detail. Also, I was on the National Research Council Committee on Early Childhood Mathematics, and our report included a discussion of the mathematical ideas of very young children. We explained how even counting is more complex than one might think. For example, if a child can count, "one two three four," will the child necessarily be able to determine that there are 4 bears in a collection? Maybe not! The child might not make a one-to-one correspondence between the bears and the number words, and even she does, she may not know that the last number word she says, "four," also tells her how many bears there are in all.

To improve mathematics education, the broader education community must recognize just how much there is to know about school mathematics and that teachers deserve the opportunity to study this mathematics in depth.

Professionalizing the mathematics teaching community

In this essay, I have several times compared teaching with research. Yet teaching, unlike research, does not have a sustaining and validating framework that spurs us on to do better and better work. Research communities communicate, share, and scrutinize findings, so that members can gain each other's admiration by doing good work as appraised and validated by peers. This arrangement fosters motivation to work deliberately towards expertise and has led to a stunningly successful and vibrant mathematics research community. Teaching, however, is currently not set up this way, at either the K-12 or at the college level, and I think it suffers because of it. Worse yet, many current efforts to improve teaching are pushing teaching in an unproductive direction because they are based on evaluation and strictures imposed from outside the teaching community. This approach will only sap motivation according to research on motivation conducted over many decades and in many different fields. An unmotivated teaching community is not likely to improve in the long run, or to become vibrant and engaged, or to attract and keep talented individuals.

Instead, we need to push all teaching communities towards the active sharing and validation of teaching knowledge. In this way, we will be motivated to compete for each other's admiration, we will spur each other on to do better and better work, and we will build on each other's ideas to create a vibrant intellectual environment for teaching. This is my vision, my hope, and my deepest desire for the future of mathematics teaching—a community of mathematics teachers from the elementary grades through the college level who work together towards excellence for the sake of all of our students.

May 24. 2011

Dear Members of the Regents' Teaching Excellence Awards Committee,

I strongly support Dr. Beckmann Kazez's nomination for the University System of Georgia Regents' Teaching Excellence Award. During the time I have spent as a graduate student in the mathematics department, I have had the privilege of observing Dr. Beckmann Kazez in her roles as teacher and teaching mentor.

As you may already know, Dr. Beckmann Kazez developed, wrote the textbook for, and regularly teaches mathematics content courses for future elementary and middle grades teachers. I was Dr. Beckmann Kazez's teaching assistant during the 2007-2008 academic year and as such regularly attended her classes. In each class meeting, Dr. Beckmann Kazez's students were engaged in the ongoing mathematics lesson. Dr. Beckmann Kazez designed activities to illuminate the underlying foundations of mathematics, and through those activities, she gave her students the ability to take an active role in learning mathematics. Moreover, throughout my time in her classroom, her students genuinely seemed to enjoy being in her class and learning mathematics.

Dr. Beckmann Kazez was very supportive of me as her teaching assistant. Because these courses have a writing component along with a mathematical basis, it was initially difficult for me to assess student performance. Dr. Beckmann Kazez helped me learn how to assess student work fairly, with the help of a rubric she developed and with her advice; she also helped me learn how to use my assessments to improve students' abilities to explain mathematical ideas clearly and concretely.

During the 2009-2010 academic year, Dr. Beckmann Kazez mentored me as I taught three mathematics courses for elementary teachers. Throughout the year, I had weekly meetings with Dr. Beckmann Kazez and the other instructors who were teaching the same course. Each week Dr. Beckmann Kazez advised us on how to plan for the next week: which topics were most relevant to the students' future teaching, which concepts students would likely have difficulty with, how to pace the class meetings, etc. She also listened as we expressed any concerns or special challenges we had, and she provided helpful feedback on how to address those issues. Often she had read research related to our concerns and she referred to that research in her advice.

In addition to serving as a great mentor, Dr. Beckmann Kazez has also influenced my intended career path. When she found out I really enjoyed teaching, she encouraged me to learn more about teacher education. Because of her encouragement, I completed extensive training in teacher education and found I really enjoy teaching math to future teachers. I plan to be involved in teacher education throughout my professional career.

I am so honored to have been able to learn about teaching and teacher education from Dr. Beckmann Kazez. It is my great pleasure to wholeheartedly recommend her for the Regents' Teaching Excellence Award.

Sincerely,

Jennifer Belton

Jennifer Belton

Northeastern
Illinois
University

May 25, 2011

Dear Members of the Regents' Teaching Excellence Awards Committee:

This letter is in support of Professor Beckmann Kazez's nomination for the University System of Georgia Regents' Teaching Excellence Award. I have known Dr. Beckmann Kazez for many years and in three different contexts. As a graduate student in mathematics at the University of Georgia, I had the honor of working for her as an assistant in her Mathematics for Elementary School Teachers class. While I completed a post-doc in mathematics education at the University of Georgia's College of Education, I continued to be aware of and admire her ongoing mathematics education projects and collaborations with mathematics education faculty. In both of these contexts, I had the pleasure of observing Dr. Beckmann in instructional settings with students. She is a captivating lecturer with a unique perspective on education who is easily able to engage students in stimulating mathematical discussions.

Currently, as an associate professor of mathematics at a state university in Chicago, I continue to encounter Dr. Beckmann Kazez's contributions to the field of mathematics education. Her work, such as her involvement in the Common Core State Standards Initiative, has an impact on large, diverse school systems such as those in the Chicago area.

I consider Dr. Beckmann Kazez to be a role model. As a mathematician working in education, I know the importance of collaborative work with educators on issues concerning the mathematical education of school teachers. It is clear that reasonable reform will only come as the result of both communities working together. Dr. Beckmann Kazez is a leader in this growing community of education-minded mathematicians. An award such as Regents' Teaching Excellence Award would indicate the University System of Georgia's recognition of Dr. Beckmann Kazez's contributions to the national effort to improve the mathematical preparation of school teachers.

Please contact me if I can be of further assistance.

Sincerely,

Tanya Cofer, Ph.D.
Associate Professor of Mathematics
Northeastern Illinois University
T-Cofer@neiu.edu
(773) 442-5758

Orientation to attached documents

1) Representative comments from student evaluations on Beckmann's teaching methods and how her courses prepare future teachers for their own teaching.

2) A 3-page excerpt from a typical syllabus from one of Beckmann's courses for prospective teachers. Beckmann explains to students why their attitudes about math and about learning are important and explains why and how her *math* courses emphasize writing. Beckmann posts all her recent syllabi online at http://www.math.uga.edu/~sybilla/Courses.html so that others who teach similar courses can have access to them.

3) Remarks about Beckmann's textbook, *Mathematics for Elementary Teachers,* to demonstrate the quality of the book and why it is important for the mathematical education of teachers. The book is used widely across the country (and has been noticed internationally, e.g., http://refip-mat2011.cmm.uchile.cl/).

Beckmann views her book as an extension of her own classroom teaching and a means for collaborating with other teachers of teachers. A number of instructors who use her book created an "Insider's Guide" and collaborated on a DVD, both of which were published with the third edition and are made available to instructors. See http://www.pearsonhighered.com/beckmann3einfo/ and http://www.pearsonhighered.com/educator/product/Insiders-Guide-for-Mathematics-for-Elementary-Teachers-3E/9780321653505.page

4) The first page of "The Community of Math Teachers, from Elementary School to Graduate School," published in the March 2011 issue of the *Notices of the American Mathematical Society* is presented to demonstrate Beckmann's advocacy and leadership for improving mathematics teaching at all levels. This March issue was devoted to the special theme of mathematics education. Virtually all mathematicians read the *Notices*. Beckmann's article was the first one after the introduction to the special theme. The full article is available at:

http://www.ams.org/notices/201103/index.html
http://www.ams.org/notices/201103/rtx110300368p.pdf

In another invited commentary, "From the Common Core to a Community of all Mathematics Teachers," published in 2011 in the *The Mathematics Educator*, a journal for mathematics education researchers and other professionals, Beckmann again presents the case for mathematicians, mathematics education leaders, and K-12 teachers to collaborate to improve mathematics teaching at all levels.

http://math.coe.uga.edu/tme/Issues/v20n2/v20n2.html
http://math.coe.uga.edu/tme/Issues/v20n2/v20n2_Beckmann.pdf

Representative anonymous student evaluation comments

Students repeatedly comment that Beckmann's courses stretch their thinking about math:

- I loved everything about this course! It definitely challenged me to think differently about ways to teach math. (MATH 2002, Spring 2011)
- Dr. Beckmann has opened my eyes to the underlying meaning to simple mathematics. (MATH 5020/7020, Fall 2009)
- Dr. Beckmann is an outstanding teacher who always challenged us to think for ourselves and develop our own understanding. This is true learning. (MATH 5020/7020, Fall 2009)
- For the first time, I truly understand mathematical concepts and the "whys" behind mathematical formulas.... (MATH 5030, Spring 2008)
- She posed challenging questions that really made us think and reflect. (MATH 5030, Spring 2009)
- Dr. Beckmann has a genuine love of mathematics. You can tell it still fascinates her, which is really awesome to watch. I definitely have a new appreciation for math because of her class. She really encourages you to 'wrap your brain around' your work. She has always been ready and eager to help, and sees each student as an individual. (MATH 5020, Fall 2007)
- She used multiple methods to teach material and made us see perspectives I hadn't before. (MATH 5030, Spring 2004)

Students appreciate the peer discussions and hands-on activities in Beckmann's classes:

- Her novel approach to teaching— reflection, discussion, feedback— was refreshing and excellent. Dr. B. demonstrates a genuine passion for teaching math teachers, and the methods she has developed were effective at re-defining complex ideas for non-mathematicians. (MATH 7005, Fall 06)
- I really like that Dr. B. allowed everyone to share their answers.... I never felt afraid to share my opinion or answers.(MATH 5003, Spring 2006)
- Dr. Beckmann is an excellent teacher! She has so many different methods of teaching that encompass all types of learners and I love how she allows us to work in pairs in class to discuss ideas. This helps us to learn from her as well as eachother. (MATH 5030, Spring 2010)
- Methods of Instruction: Dr. Beckmann not only teaches us the material she gets us to look at it on a middle school level. She gives us great activities to model in our classrooms. She is truly an exceptional teacher and I feel lucky to have studied under her. (MATH 5030, Spring 2010)

Students feel well-prepared and inspired to teach from Beckmann's classes:

- Best teacher I have had at UGA! This class is preparing me so much for teaching. Dr. Beckmann not only knows how to teach the material she also inspires me to want to teach the material. I feel so lucky to have her as my teacher. (MATH 5030, Spring 2010)
- Dr. Beckmann has such amazing enthusiasm for the subject that she teaches. She definitely inspires her students to have the same love of math that she does. She makes her students want to be amazing teachers in the same way that she is. ... (MATH 5030, Spring 2010)
- Because of Dr. B., I feel confident in my future teaching of mathematics to middle school students. She has prepared me more than any other professor I have had. (MATH 5035, Fall 2006)
- I loved all of the hands on activities that we got to do everyday. None of my other teachers take that into consideration any more and they are great ideas for when I become a teacher! (MATH 5030, Spring 06)
- ...always there for extra help! Prepared us extremely well for the Praxis II exam we have to take! (MATH 5035, Fall 05)

Excerpts from a typical syllabus (MATH 2002, Spring 2011)
See http://www.math.uga.edu/~sybilla/Courses.html for links to all recent syllabi of Beckmann's courses for teachers.

Course objectives: To strengthen and deepen knowledge and understanding of numbers and the decimal system, fractions, decimals, and percents, elementary number theory and algebra, and elementary data analysis, and how they are used to solve a wide variety of problems. In particular, to strengthen the understanding of and the ability to explain why various procedures and formulas in mathematics work. To strengthen the ability to communicate clearly about mathematics, both orally and in writing. To promote the exploration and explanation of mathematical phenomena. To show that many problems can be solved in a variety of ways. To learn to pose and modify mathematical problems.

Preparation for your teaching: This course is part of your preparation to teach math in Prekindergarten through grade 5. We will focus on some of the topics in number, algebra, and statistics that children learn up through grade 5. We will also study how some of these topics develop a few grades beyond grade 5 because when you teach you need a bigger picture view to guide your students toward "where the math goes next." We will go more deeply into the mathematical ideas than you could with students in in the elementary grades so that you will have a more comprehensive understanding of the concepts than you could expect of your students.

Teachers are so important! We know that teacher quality a major factor in student achievement. You really can make a difference in your students' lives! In this course we want to put you on a path toward becoming a good math teacher. To be a good math teacher you will need to do much more that just demonstrate how to solve math problems. Good teachers help their students understand mathematical ideas by asking questions, by orchestrating discussions, and by expecting students to reason about and make sense of math. To engage your students in high quality instructional conversations you will have to know the math you teach well. The importance of understanding the math you will teach well cannot be overstated.

As a teacher, your own attitudes about math and about learning and the ways you approach math and learning are important. Therefore, in this course we aim to foster the following dispositions, practices, and understandings:

A "growth mindset" – Intelligence is not fixed but is something that can be improved by working at it. "[A] proven intervention is to tell junior-high-school students that I.Q. is expandable, and that their intelligence is something they can help shape. Students exposed to that idea work harder and get better grades. That's particularly true of girls and math, apparently because some girls assume that they are genetically disadvantaged at numbers; deprived of an excuse for failure, they excel." (From the NY Times 4/16/2009 article *How to Raise our I.Q.* by Nicholas Kristof.) And: "People who believe in the power of talent tend not to fulfill their potential because they're so concerned with looking smart and not making mistakes. But people who believe that talent can be developed are the ones who really push, stretch, confront their own mistakes and learn

from them."(Dr. Carol Dweck, as quoted in the NY Times 7/6/2008, If You're Open to Growth You Tend to Grow)

Engagement – Engage in mathematical ideas: grapple with ideas, think about ideas in new ways, think critically about ideas, discuss ideas with others, and work towards expressing ideas with greater precision. Look for interesting connections to other ideas and look for things that are surprising or neat. Make productive use of class time.

Perseverance – Keep trying to understand an idea or solve a problem even when you don't "get it" right away. Persistence and commitment to continued learning are vital to success in the long run, much more so than being talented or "quick."

Responsibility – Take responsibility for your learning. Monitor your understanding and look for ways to extend and improve it. Seek help when you need it. Look for your own optimal level of challenge.

Learning community – Learn with and from your classmates. Listen carefully to their ideas, explanations, and problem-solving approaches. Think critically about what you hear. Listening to others can be difficult and confusing at times, but it's an especially important skill for teachers. As a teacher you will need to listen closely to your students to determine how they are thinking about mathematical ideas so that you can build on what your students know. Recognize that in class we are working together to make sense of ideas, which will involve some false starts and errors. Even answers that ultimately prove to be incorrect can provide invaluable learning opportunities when we determine where the flaws lie. Be comfortable agreeing or disagreeing (you may feel more comfortable saying you "respectfully disagree"). Support each other's learning. Nudge each other towards greater participation and engagement.

Mathematical ideas – Understand that lines of reasoning, explanations, and making sense of concepts and ideas are just as important in math as skills and procedures. At its core, math is about ideas.

Writing Intensive Program: This section of MATH 2002 is part of the Writing Intensive Program. The Writing Intensive Program is designed to help courses teach the writing process within various disciplines. Although you have taken English courses on writing, and although these courses will help you with all your writing, mathematical writing has its own special features. In mathematics, we seek coherent, *logical* explanations, in which the desired conclusion is deduced from starting assumptions.

Our graduate teaching assistant, Theresa Brons, has been trained by the Writing Intensive Program to help you learn to write good mathematical explanations. Theresa will give you feedback to help you improve your explanations over the course of the semester.

Why are we emphasizing writing in this course? To be an effective teacher of mathematics, you need to understand the mathematical ideas you will teach well and

beyond the level at which you will discuss them with your students. By writing your initial thoughts and then revising your writing to produce clear, thorough, well thought out explanations, you will have a chance to develop and refine your understanding of the ideas you will teach. Because of the benefits of writing, we think that the writing intensive format is a perfect fit for this course.

Types of assignments: All assignments will be posted on the Assignments page, which is linked to the main course webpage. The journal writing assignments require that you access E-Learning Commons. You should expect to spend at least 2 to 3 hours outside of class for each hour in class.

Written homework assignments to turn in: Expect to have a written assignment due at least once a week and sometimes more often. These **assignments must be typed**. You may write by hand any equations, pictures, diagrams, or the like. Pictures and diagrams can be inserted either within the body of the text or they can be labeled and placed at the end of the document (and in this case you should refer to them by their label within the text). Your written assignments will generally be fairly short, but we expect your work to be highly polished. Turn in only well thought out second or third (or fourth ...) drafts. Mathematics requires precise language, so attend closely to the way you express your ideas. When you teach, you will also need to take care to use correct and precise language, but we will hold you to an even higher standard of expression than would be realistic all the time in a classroom with children. In grading your work we will be looking for the extent to which it meets the following criteria:

- The work is factually correct, or nearly so, with only minor, inconsequential flaws.
- The work addresses the specific question or problem that was posed. It is focused, detailed, and precise. Key points are emphasized. There are no irrelevant or distracting points.
- The work could be used to teach a student: either a child or another college student, whichever is most appropriate.
- The work is clear, convincing, and logical. An explanation should be convincing to a skeptic and should not require the reader to make a leap of faith.
- Clear, complete sentences are used. Mathematical terms and symbols are used correctly. If applicable, supporting pictures, diagrams, and/or equations are used appropriately and as needed.
- The work is coherent.

Remarks about Beckmann's textbook, *Mathematics for Elementary Teachers*

"Her textbook on mathematics for elementary classroom teachers is **THE** textbook in the field (I am, of course, biased – I use this book and love it)." – Dr. Frances (Skip) Fennell, Past President, National Council of Teachers of Mathematics

The 2008 report of the National Council on Teacher Quality, *No Common Denominator, The Preparation of Elementary Teachers in Mathematics by America's Education Schools*, was generally critical of preparation programs and math books for teachers, http://www.nctq.org/p/publications/docs/nctq_ttmath_fullreport_20080626115953.pdf . On page 32, UGA's elementary teacher preparation program is singled out as the only one that is exemplary in math. On pages 35, 36: Beckmann's textbook is rated top, but most other textbooks for elementary teachers are found to be inadequate.

On pages 92 and 93, Beckmann's treatment of material is highlighted as strong and contrasted with treatments in other books.

From page 92:

> What can elementary content courses and textbooks do well? First, they can deal with the building blocks of the subject. Looking at *Mathematics for Elementary Teachers* by Beckmann, the textbook earning the highest marks for textbooks with a "stand-alone" algebra section of textbooks in our sample, we see four and one-half pages devoted to a discussion of "mathematical expressions, formulas, and equations." Only two of the thirteen algebra textbooks used in general audience courses in our library — which contains most of the textbooks used in general audience algebra courses found in institutions in our sample — discuss these basics at all. One devoted three pages to these topics (*Intermediate Algebra: Concepts and Applications*, Bittinger and Ellenbogen) and another, two and one-half pages (*Intermediate Algebra*, Tussy and Gustafson). Clearly the majority of writers of textbooks intended for use at the secondary or collegiate level do not think their readers need any reinforcement of basic concepts, yet these are precisely the concepts that an elementary teacher will using to frame pre-algebra instruction in the classroom.

From page 93:

> Elementary content textbooks can also deal with the nuances of even the simplest mathematical concepts in a way that both reinforces understanding and assists the prospective teacher to understand children's mathematical thinking. This sample from page 596 of the Beckmann text demonstrates this; no comparable discussion is found in the Bittinger or Tussy texts:
>
> > *One source of difficulty in solving equations is understanding that the equals sign does not mean "calculate the answer." For example, when children are asked to fill in the box to make the equation*
> >
> > $5 + 3 = \square + 2$
> >
> > *true, many will fill in the number 8 because 5 + 3 = 8.*
>
> Another excerpt from Beckmann demonstrates how elementary content textbooks can convey a deep understanding with a clarity that allows prospective teachers to perceive and retain the core concepts that will frame their own instruction. The one and one-half page section (pages 640-641) from Beckmann below precedes her statement that every linear function has a formula of the form $f(x) = mx + b$.
>
> > *Consider a linear function. By definition, its graph is a line. We can use this line to form many different right triangles that have a horizontal and a vertical side, as shown in Figure 13.45. Because the horizontal lines are all parallel, the*

The Community of Math Teachers, from Elementary School to Graduate School

Sybilla Beckmann

Why should mathematicians be interested and involved in pre-K–12 mathematics education? What are the benefits of mathematicians working with school teachers and mathematics educators?[1] I will answer these questions from my perspective of research mathematician who became interested in mathematics education, wrote a book for prospective elementary teachers, and taught sixth-grade math a few years ago. I think my answers may surprise you because they would have surprised me not long ago.

It's Interesting!

If you had told me twenty-five years ago, when I was in graduate school studying arithmetic geometry, that my work would shift toward improving pre-K–12 mathematics education, I would have told you that you were crazy. Sure, I would have said, that is important work, it's probably hard, and somebody needs to do it, but it doesn't sound very interesting. Much to my surprise, this is the work I am now fully engaged in. It's hard, and I believe what I'm doing is useful to improving education, but most surprising of all is how interesting the work is.

Yes, I find it interesting to work on improving pre-K–12 math! And in retrospect, it's easy to see how it could be interesting. Math at every level is beautiful and has a wonderful mixture of intricacy, big truths, and surprising connections. Even preschool math is no exception.

Consider this connection between preschool math and number theory. Young children play with pattern tile sets that consist of the shapes shown in Figure 1. Playing with these shapes,

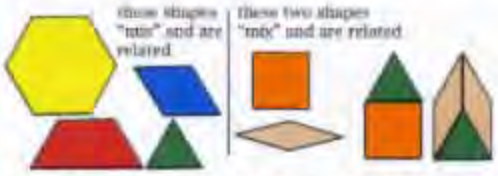

Figure 1. Pattern tiles that young children play with.

children discover that some of them can be put together to make others (e.g., three triangles fit together to make the trapezoid) but that the squares and thin rhombuses are different. In fact, shapes that are made without the squares and thin rhombuses, such as the shape in Figure 2, can never be made in a different way using the squares or thin rhombuses. Why not? Because the square root of three is irrational! The square and thin rhombus have rational area (in terms of square inches), but the other shapes' areas are rational multiples of the square root of three.

Sybilla Beckmann is professor of mathematics at the University of Georgia. Her email address is sybilla@math.uga.edu.

[1] *A note on terminology: By "mathematician" I mean individuals in mathematics departments at colleges and universities who teach mathematics courses and who have done research in math. By "teacher" I mean individuals who teach within pre-kindergarten through grade 12. By "mathematics educator" I mean individuals who teach mathematics methods courses, professional development seminars, or workshops or who supervise or coordinate math teaching or curricula in schools and who have done research in mathematics education. I acknowledge that these categories are neither exhaustive among mathematics professionals nor mutually exclusive, that the descriptions of these categories should be viewed as somewhat fuzzy and approximate, and that the names of these categories are not fully descriptive.*

The Mathematics Educator
2011, Vol. 20, No. 2, 3–9

Guest Editorial...

From the Common Core to a Community of All Mathematics Teachers

Sybilla Beckmann

As I write now, early in 2011, over 40 states have adopted the Common Core State Standards in Mathematics (National Governors Association Center for Best Practices and the Council of Chief State School Officers, 2010). This is a strong, coherent set of standards that asks students to understand and explain mathematical ideas and lines of reasoning. These standards should act as a framework to support vibrant teaching and learning of mathematics, in which students actively make sense of mathematics, discuss their reasoning, explore and develop ideas, solve problems, and develop fluency with important skills.

Calls for vibrant mathematics teaching and learning and improved student proficiency in mathematics have been steady for a number of years (e.g., National Commission on Excellence in Education, 1983; National Council of Teachers of Mathematics [NCTM], 2000; National Commission on Mathematics and Science Teaching for the 21st Century [NCMST], 2000; National Mathematics Advisory Panel [NMAP], 2008). This new set of standards is one of many initiatives and projects that answer this call. But as strong as the Common Core standards are, they cannot improve students' understanding of mathematics on their own—the standards will not teach themselves. Teachers are certainly key to enacting the standards as they are intended. They need to know the mathematics well, and they need to how to teach it in engaging and effective ways.

Thinking about how to improve mathematics teaching and learning has led me to consider the larger environment in which this teaching and learning takes place. This, in turn, has led me to think about several interconnected groups and communities that are related to PreK-12 mathematics: the group of all mathematics teachers from pre-kindergarten through the college level; the community of mathematics researchers; and the community of mathematics educators, which includes teacher educators and mathematics education researchers. I am a member of all three groups and as I write I am drawing on my own experience as a mathematics researcher and member of a mathematics department; my experience teaching a variety of college-level mathematics courses, in particular, courses for prospective teachers; and my one year of teaching sixth grade mathematics.

In this editorial, I want to make the case for the group of *all* mathematics teachers—from early childhood, to the elementary, middle, and high school grades, through the college and graduate levels, and including mathematics educators who teach teachers—to form a cohesive community that works together with the common goal of improving mathematics teaching at all levels. Although all parts of this community work individually towards improvement, I believe this community should take collective responsibility for improving the quality of all mathematics teaching. In making the case for the community of all mathematics teachers, I will draw on my knowledge of the mathematics research community and how it is set up to work towards excellence in mathematics research. I will also contrast research in mathematics and teaching of college-level mathematics, much of which is done by the same group of people.

What Can Mathematics Research Tell Us About Mathematics Teaching?

Why is it that at no level of mathematics teaching—from elementary school, to middle and high school, to the college level—do we have widespread excellence in mathematics teaching in this country? Of course, there are many examples of outstanding mathematics teaching and mathematics teachers, but, on the whole, there is cause for concern. At the K-12 level, mathematics teaching in the US is widely regarded as needing improvement (NCTM, 2000; NCMST, 2000; NMAP, 2008). Nor does it compare favorably with teaching in other countries, such as in Japan, where students perform well on international

Sybilla Beckmann is a Professor of Mathematics at The University of Georgia. She is the author of a textbook for preservice elementary school teachers on mathematics, and her research interests are in the mathematical education of teachers and arithmetic geometry/algebraic number theory.