Technology changes mathematics instruction

The Department of Mathematics has used technology wisely to improve instruction for many years. Our attitude toward technology is that we want to use it to involve students actively in the material. We don’t want to be using technology just for the sake of giving the administration something to brag about.

Indeed, since people using technology to teach may find themselves required to write newsletter articles about it, the faculty are careful only to use technology when they see a real gain for the students.

The beginning
The computer classroom-laboratory opened in 1990 and has seen heavy use. Some classes meet solely in the lab. In these classes students are expected to work regularly with computers throughout the class. The one regular course that uses this approach is Elementary Numerical Analysis. Rather than just hearing lectures about how to implement different numerical methods, the students are continually carrying out methods themselves.

Other courses meet regularly for weekly lab sessions. Labs in Elementary Differential Equations and Applied Matrix Theory give students a chance to see complicated graphical representations and to apply the mathematics in various situations.

The lab is also used occasionally by courses that just need to meet once or twice in the lab when dealing with a particular unit.

Unfortunately, the lab has several limitations. Since it only accommodates 30 students at a time, larger classes must split into groups. No additional large classes beyond those already scheduled can fit into the lab these days. And students occasionally complain that because the lab is so heavily scheduled, it is difficult for them to find open times to finish off assignments.

So we have been looking at other technologies where the students don’t have to come to a particular location. These technologies include graphing calculators and the Internet.

New directions
Graphing calculators are currently required for students in College Algebra. Using the calculator makes it possible to tackle interesting questions that were previously put off until later courses. For example, a typical algebra problem might be to write down a function for the distance between two ships moving in a particular fashion. College Algebra students rarely understand the power of being able to write a function, if all they ever do is write down the function and turn it in.

It isn’t until they reach Calculus and are able to minimize the function to see where the ships are closest that they recognize how being able to write the situation as a function is useful. But since most College Algebra students never take Calculus, most students never make that connection.

With a graphing calculator, students can graph the function and find the minimum right away by looking at the graph. And since the students can carry their calculators with them, they always have them available and aren’t required to head to the lab for their homework.

Of course, calculators also have implications for teaching Calculus. This is especially true for the newer calculators that do symbolic calculation. It is now possible to buy a $150

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Remembering Gary Thomas, 1943–1999

Gary Thomas, our 1997 distinguished alumnus and cofounder of the Gary and Janet Thomas lecture series in our department, died suddenly on February 21.

Gary came from a family with a long association to K-State: his father Keith “Kite” Thomas was a star athlete who later owned and ran a popular bar and grill in Aggieville and his brother earned a Ph.D. in biochemistry at K-State. Gary earned a B.S. in mathematics here.

He later earned a Ph.D in mathematics from the University of Arizona and taught for two years at the University of Nebraska, Lincoln. But while a graduate student he had become interested in investing, so after a few years of teaching he embarked on a career in banking and investments. After positions in banks and investment firms in Manhattan, Topeka, Westwood, and Wichita, his most recent position was as president of Prestwick Associates, Inc., of Wichita.

In addition to his professional accomplishments, he served in various capacities for the Wichita Police and Fire retirement system, Kansas Commission for the Humanities, Ft. Larned Old Guard, and the Kansas Historical Society. He was a member of Leadership Kansas and a member of Rotary. His avocations included history, travel, running, and golf.

The inaugural Gary and Janet Thomas lecture was given in 1996. This series has brought several internationally prominent mathematicians to lecture on our campus. In establishing this series, Thomas remarked that he was impressed with “Kansas State’s increasingly good reputation in science and especially in mathematics” and that he “saw this [the new lecture series] as a way to build on existing strengths.”

He and his wife, Janet (an artist), saw the series as a way to share their mutual interest in “the creative process as expressed through science and mathematics.”

Gary Thomas is survived by his wife, Janet; daughter Emily Thomas; stepdaughter Casey Clampitt; and brother Kent Thomas, all of Wichita.
calculator that will differentiate $x^3 + 3x + 1$ and get the answer $3x^2 + 3$. We don’t know exactly how best to handle this in our classes (and neither does any other math department), but we are considering how best to use this technology to be sure our students learn more, and not less.

The other hot new technology is the Internet. Of course, one advantage of the Internet is that it makes it easy to publish material for the students. Many of the large courses make the course syllabus available over the Internet for students who want to look up their assignments. Some courses, such as Introduction to Algebraic Systems, have put up class notes on the Internet as well.

But while it may be convenient for students to be able to look up assignments over the net while visiting their families, these applications don’t really add much to the courses beyond what was already possible with the copy machine. A more interesting use for the Internet is to design web pages where the students are actively involved, rather than just reading text.

The computer labs for Elementary Differential Equations have been ported to Java and are now available over the Internet as well as in the computer lab. This has proven very popular with the students since they can finish off their homework wherever they can find a computer, rather than having to come into our lab.

We are now looking at other ways to use the Internet to involve the students. This fall we will start experimenting with letting students turn in some homework over the web in Trigonometry. This will let students do as many drill problems as they need, and should free up our graders to concentrate on more interesting problems. You can go to the mathematics department home page at http://www.ksu.edu/math/ and follow the links to see for yourself.

Our focus
The mathematics department is keeping up with modern technologies, but we aren’t trying to get ahead of them. We are careful that our focus is always on teaching better, so we wait for the technologies to stabilize and then examine how they fit into our mission of preparing students before we use them in the classroom.

But with technology changing so quickly, we are moving fairly quickly ourselves to see that our students get the best education we can provide.

1998 Undergraduate Lecture Series in Mathematics

Lectures by two distinguished visiting mathematicians, seven alumni, and business and government representatives were the highlights of our Undergraduate Lecture Series in 1998.

Denny Gullick, an emeritus mathematician from the University of Maryland, visited K-State in the spring and gave a mini-course entitled “Basic Examples and Concepts in Chaos.” Dr. Gullick gave many interesting properties of the famous tent function and the renowned quadratic functions. He also introduced the concept of bifurcations and gave applications of chaos to the real world.

In the fall, Judith Grabiner, a distinguished mathematician from Pitzer College, gave a mini-course on “Mathematics and the World: Historical Perspectives.” Professor Grabiner discussed why mathematics is the language of science, how people came to recognize that physical space is best modeled in a non-Euclidean way, what made scientists apply statistics to nature, how Descartes pioneered a new approach to solving problems, and different ways of thinking about mathematics. Among her many awards, Dr. Grabiner received the 1997 Lester R. Ford award for her expository paper “Was Newton’s Calculus a Dead End? The Continental Influence of Maclaurin’s ‘Treatise of Fluxions.’” These two mini-courses were well received, attracting visitors from Lawrence, Topeka, and Wichita.

Judith Grabiner

Rick Un, a 1994 K-State mathematics alumnus, gave a talk describing his experiences as a math major starting a computer consulting company. Rick is a systems specialist for SP Consolidated in Euness, Texas.

Eric Farmer, a 1997 K-State mathematics alumnus, spoke on the mathematics of card shuffling, research experiences for undergraduates, and graduate school. Eric is a graduate student in mathematics at the University of Illinois at Urbana-Champaign.

Nathan Geier, a 1997 K-State alumnus, discussed the importance of mathematics in the life of a geophysicist. Nathan is a graduate student in geophysics at the University of Kansas.

Marilyn McCord, a 1961 K-State alumna, described how mathematics gave her “A Ticket to Ride” in her various careers. Marilyn is head of Associated Consultants in Bayfield, Colorado.

Foster Dieckhoff, a 1972 K-State alumnus, gave a talk entitled “Mathematics: The Durable Discipline.” Foster is manager of administration and engineering for Kansas City Water Services.

Clair Manson, a 1950 K-State alumnus, described the actuarial profession. Clair is a life actuary for Unified Life Insurance Company in Kansas City. He recently donated a large collection of actuarial journals to the department of mathematics.

Mark Lesperance, a 1991 K-State alumnus, described the actuarial exams and profession. Mark is a casualty actuary for Farm Bureau Insurance in Manhattan. He and Dr. Charles Moore teach our actuarial mathematics course.

Mark Koehn, representing Cessna Aircraft in Wichita, discussed work opportunities in the business world.

John Sedlock, representing the United States Navy, described navy programs for mathematicians.
Lecture series bring experts to campus

This year’s annual Friends of Mathematics lecture was delivered by Karen Smith, of the University of Michigan. Professor Smith presented a very simple, number-theoretic “trick,” with a view toward explaining how she began her journey as a mathematician back in her elementary school days, and toward bridging the gap between the notion of explaining a trick and “providing a proof” of a deep theorem.

In another vein entirely, this year’s Harry E. Valentine lecture was given by Ciprian Foias of the University of Indiana. He received his Ph.D. in 1962 in Romania, and he is now one of the elder statesmen (and a perennially youthful source of new ideas) in the world of functional analysis and dynamical systems. His talk, entitled “Parametrization of Finite Fractal Aets in Hilbert Space,” concerned the frontiers of current research in an area of dynamical systems that has applications, for example, in the science of turbulence.

Alexandre Volberg

Returning to number theory, the Isidore and Hilda Dressler lecture was given by Peter Sarnak, of Princeton University. It has been recognized for at least 100 years that the most important (and probably the most difficult) problem in number theory is that of determining the behavior of the zeroes of the so-called Riemann zeta-function. This function is one of the classical functions of a complex variable $z=x+iy$, and the problem is to show that all of its roots (its “zeros”) have real part equal to $\frac{1}{2}$. Professor Sarnak’s talk, “Zeros of Zeta-Functions, and Symmetry,” concerned generalizations of the classical Riemann function.

The Karl Stromberg memorial lecture was given this year by Alexandre Volberg of Michigan State University and the Steklov Institute (in Saint Petersburg, Russia). Professor Volberg was the 1988 winner of the prestigious Salem Prize in harmonic analysis. This is the area of mathematics that begins with trigonometric series and which is today witnessing one of its periodic resurgences, with the theory of “wavelets.”

It is also the area in which Karl Stromberg became a brilliant expositor, and in which, through his leadership, Kansas State University became a nationally recognized center of research. Professor Volberg spoke on “Weighted Estimates of Singular Integral Operators,” in which the “weights” are, in contrast to the classical set-up, matrices rather than numbers.

Finally, in our endowed series of lectures this year, the Gary and Janet Thomas lecture was given by Judith Grabner of Pitzer College. Professor Grabner is a historian of mathematicians, and her lecture took us to the year 1735 and to the work of Scottish mathematician Colin MacLaurin. In that year MacLaurin (whose name is familiar to all second-semester calculus students through the study of Taylor series and MacLaurin series) wrote a 94-page memoir for the Scottish Excise Commission. The purpose of the paper was to explain how to calculate the precise volume of a molasses barrel, molasses being then an integral part of the economy of Scotland, through the manufacture of rum.

Professor Grabner’s talk concerned a nice piece of eighteenth-century mathematics, and it concerned taxes, riots, strong drink, the making of the British state, slavery and European prosperity, and the relationship between science and society in the time of the European Enlightenment.

Alumni notes

Francis Fung. B.S. 1992, is a computer scientist in Ithaca, New York. He recently had a paper accepted to the IEEE symposium on security and privacy in Oakland, California. Last year he adopted a girl from Bulgaria named Darsi, and on April 11 his wife, Maria, gave birth to a baby boy named Zlatomir Yung Chi Fung. Pictures of both can be seen at http://math.cornell.edu/~mfung.

Marilyn McCord. B.S. 1961, is working as a freelance computer instructor in industry. Her work has been for such places as IBM, Los Alamos National Lab, and Storage Tek. She received her M.S. in C and L in 1978, and another M.S. in CS in 1980. She has spoken in K-State’s Undergraduate Lecture Series and later gave the same presentation at Ft. Leur’s College in Durango, where she previously served as a staff member.

Foster Dieckhoff. M.S. 1972, is a manager of administration and engineering in the Kansas City area. He manages a $3.5 million operating budget and a $30 million capital improvement budget for the Kansas City, Mo., Regional Water Authority.

Richard D. Latas. B.S. 1969, has been working as the director and CIO of Eli Lilly in Japan for the past three years.

Gaylene Shank. M.S. 1978, is a high school math teacher in Goodland. She received the Sherman County High School Alumni Association Outstanding Educator Award for the 1997–1998 school year.

Susan Arnolds Babcock. B.S. 1984, is a statistician and lives in Littleton, Colorado. In 1993 she received her M.S. in biometrics from the University of Colorado Health Sciences Center. She has been a consulting statistician for several industries in the last five years, including environmental, biotechnology, and pharmaceutical industries. Currently she is contracting with Eli Lilly and Company analyzing clinical trial data.

Gordon E. Huggins. B.S. 1949, celebrated his 50th wedding anniversary on September 5, 1998. He is retired after working for 30 years as an elementary school principal. Before that he worked for seven years as a math teacher. His granddaughter from Overland Park, Stacy Huggins, attends K-State. Stacy’s father, Howard M. Huggins, also attended K-State.

John L. Goin. B.S. 1969, is a specialty chemical consultant at Principal-Lake View Associates. He retired from the Stanford Research Institute after eight years in April 1996.
Hale, but not hearty: update on the KSU Libraries

In the last Friends of Mathematics newsletter you might have seen the article by Bob Burckel concerning the dire state of KSU Libraries. Two years ago the greatly-expanded main library building on campus was dedicated and renamed—from Farrell to Hale.

Shortly thereafter, massive cuts were ordered in the scholarly journals to which the library subscribes. (In just one year, the number of subscriptions fell from 8847 to 6150.) Since journals comprise the main research tool of mathematicians, the burden of such massive cuts fell especially hard on our department.

So the Department of Mathematics made vociferous protests both collectively and individually. We, together with others, also began a small campaign to educate various segments of the university about the importance of the library and the decades-long period of underfunding that it has had to endure.

Progress
During the past year, this situation has begun to turn around.

- Two members of our department were appointed to the 15-member university library committee and one of us was elected to chair the committee.

- Members of the library committee and Faculty Senate leaders met with President Weidick, Provost Coffman, and KSU Foundation officials to try to see what could be done to reverse the negative trends.

- More than $1 million was raised for the university libraries endowment this year and the KSU Foundation hired a specialist who will spend half-time on raising funds for the libraries.

- The K-State students passed a resolution to increase their fees by $1 per student credit hour, with the funds generated to be directed to the libraries.

- The Kansas legislature made a special appropriation to increase the base budget of KSU Libraries.

- After a heated discussion, the library committee decided to set a long-range goal of K-State membership in the Association of Research Libraries.

- As one of its last acts in the spring 1999 semester the Faculty Senate endorsed the goal of K-State obtaining ARL membership.

What ARL status means
Let me digress a moment to explain the ARL. In the NCAA, Division IA consists of the 113 top football programs. Some 15 to 20 years ago K-State was in danger of losing its Division IA status because its football program was so poor.

There is a close equivalent to Division IA in the world of scholarship and research. The Association of Research Libraries is an association of 110 of the best university libraries in North America, together with a handful of other top libraries (such as the Library of Congress) that aren’t connected with universities. The universities that belong to the ARL are considered to be the top-level research institutions on this continent. As ARL members they enjoy many important benefits, not the least of which is being able to attract and keep top students and faculty and the research dollars that usually accompany them.

However, K-State isn’t in this prestigious group. Just who is?

All of the public universities of the Big 12—except us—are ARL members. (Baylor is private and doesn’t belong to ARL.) K-State has a list of five peer universities that we consider to be very similar to us: Colorado State, Iowa State, North Carolina State, Oklahoma State, and Oregon State. All of these except Oregon State are ARL members, and last year Oregon State set an official goal of achieving ARL status.

Why are we excluded from this top group? The reason is that just as Division IA has membership requirements so does ARL. According to these requirements, Hale Library does not measure up.

ARL’s membership standards include items such as doctoral degrees, expenditures for library services and materials, staffing levels, the number of books and journals held, the number and quality of journal subscriptions, the quality of collections, and, in general, evidence of sustained institutional support.

Incidentally, KU has been an ARL member since 1932, and in virtually every statistic that ARL uses it has us beat by a factor of two or more. For example, it has five times as many current journal subscriptions as we do.

What’s next?
So today our library situation is similar to (and perhaps a bit worse than) our football program in the mid 1980s. We are not the perennial doormat—we aren’t even in “the league!”

However, as you can see from the positive developments listed above, the library situation seems to be improving. We need to keep attention focussed there and to try to get the recent journal cuts reversed. In this endeavor the drive to achieve ARL membership is our friend.

George Strecker
Chair, University Library Committee

K-State hosts MAA conference

On March 26 and 27, more than 60 mathematicians gathered in our department for the annual meeting of the Kansas section of the Mathematical Association of America.

The conference opened with a keynote address by Deborah Hughes-Hallett, the co-chair of the Calculus Consortium at Harvard, who is a well-known advocate for “calculus reform” and a co-author of essentially the original “reform” calculus text, which stresses problem solving over rote memorization of algorithms.

In her lecture, “Understanding Students: Mathematics from Another Angle,” Professor Hughes-Hallett spoke on how she believes students have changed, how they arrive with goals and backgrounds that differ from those of their teachers, and how we might respond to this.

In another keynote address the next day, “The Role of Symbolic Manipulation,” she asked what changes we might make in our algebra classes now that so much of the symbolic manipulation can be done with simple hand-held calculators.

Throughout the remainder of the conference there were several parallel sessions with 20-minute lectures on topics in mathematical research and the teaching of mathematics. These included, among others, a special session on the teaching of algebra, a special session for graduate student talks, and a special session for undergraduate talks.

The local organizer of the conference was Professor Andrew Bennett, who is the president of the Kansas section of the MAA.
Bernard McDonald named distinguished alumnus

This year’s distinguished alumnus is Bernard McDonald, who accepted this honor at the annual Friends of Mathematics banquet on April 29.

Dr. McDonald was raised in Kansas City, Kansas, and received a B.A. from Park College in Parkville, Missouri. He attended K-State from 1962 to 1964 and obtained an M.A. in mathematics with a minor in physics. He received a Ph.D. from Michigan State University in 1968.

From 1968 until 1984 he was a mathematics professor at the University of Oklahoma and served as department chair for several of these years. He has also held visiting positions at the University of California, Santa Barbara; Queen’s University in Canada; and at Pennsylvania State University.

Since 1983 he has held various positions in the Division of Mathematical Sciences and at the National Science Foundation (NSF) in Washington, D.C. He has served as program director for the algebra and number theory program, program director of the Office of Special Projects and later as head of that office, and currently holds the title of executive officer of the Division of Mathematical Sciences. The division oversees a budget of $104 million and is responsible for more than half of the federal support of the mathematical sciences. He has also served in the office of the director of the founding.

During his years at the NSF he has received 14 outstanding performance ratings, two special recognition awards, the NSF Director’s Meritorious Service Award, and a Senior Executive Service Performance Award. He recently received the Director’s Distinguished Service Award from the National Science Foundation for helping shape science policy and training NSF program staff. This is the highest honorary award conferred by the NSF on its employees.

In his address, “Yesterday and Today,” he offered his insights and observations on the current status and future prospects for mathematics and science and the formation of national science policy. He noted that there are three major drivers of U.S. science policy: the need for national security, health and the environment, and the economy and jobs.

Regarding national security, he observed that without security, the nation can have nothing else. He told of a recent site visit he had made to the Army Research Office where, in the “Army After Next,” mathematical researchers were developing visualization and inverse imaging algorithms to see through smoke, forests, fog, and darkness. He told how the army is modeling equipment that will be “invisible” to others and how the army researchers envision the future “electronic battlefield.”

In the area of manufacturing, he cited as an example the fact that automobile makers no longer crash test their cars using crash-test dummies. Crash-test dummies make good television commercials, but more accurate and reliable information can be obtained from mathematical simulations in the high-tech design of automobiles.

Regarding jobs and the economy, McDonald remarked that “it is not jobs, but high-tech jobs that will drive the future.” Health, biology, and the global environment cannot advance without new mathematical modeling, prediction, and simulation.

McDonald noted that all of these examples are dependent on the mathematical sciences as are each of these three driving forces in general. We are “seeing a rebirth of mathematics as a key player and partner in the sciences,” he states. “There are strong indicators that the 21st century will be a century for mathematics rather than the alleged ‘century of biology.’”

Although these three areas do drive policy, and consequently the direction science takes, he noted that curiosity and adventure are still important as a driving human force. This certainly encourages mathematical discovery, and can be best seen in the federal investment in optical, radio, and gravitational telescopes.

But not all of his lecture was on these areas of his expertise; he did include a few reminiscences of his days spent here as a graduate student.

He recalled the days when the university had about 10,000 students, when the mathematics department was housed in Holtz Hall, and graduate students played “hearts” during their lunch hour. K-State basketball, not football, was the big game in town.

He recalled writing his master’s thesis under the direction of Leonard Fuller, and how Professor Fuller and other good teachers had made a difference in his life. K-State had no Ph.D. program then, so he had to go elsewhere, but he recalled the happy coincidence that occurred when his Ph.D. research ultimately led him back to some of the research of Fuller.

Students match wits in math contests

Math olympiad
For the third year in a row, the K-State math department hosted a mathematics olympiad for regional students in grades 5 through 12. The contest was modeled after the U.S. Math Olympiad, the International Math Olympiad, and similar competitions in eastern European countries.

The contestants were organized in three groups, representing grades 5 and 6, grades 7 and 8, and grades 9 through 12. Each group was given four problems to solve, and the solution of at least one problem out of the four was required to achieve a result of “honorable mention.”

Parker competition
Twenty-one K-State freshmen and sophomores matched their mathematical skills in the first annual S. Thomas Parker mathematical competition on April 17.

The competition consisted of four problems to be solved in a three-hour period. These were not typical problems that one encounters in College Algebra or Calculus, yet they all could be solved just using the ideas from these courses.

The winner was Ali Mohammad from Manhattan, who received $300; second place went to Trevor Fast from Hutchinson, who received $200; and third place went to Peter Pauzauskie from Topeka, who received $100. A $20 honorable mention award was given to Jesus V. Hernandez from Garden City.

The competition was established in honor of the late S. Thomas Parker, who served on our faculty from 1947 until his retirement in 1982. After his death in 1990 a fund was established in his honor to support scholarships and this competition.

Want to try your hand at some problems from the exam? Visit http://www.math.ksu.edu/~clint/mathcomp.html on the web.
An interview with Karen Smith

Professor Karen Smith of the University of Michigan gave the 17th annual Friends of Mathematics lecture on April 29.

Professor Smith received her Ph.D. from the University of Michigan in 1993. Among her many honors and awards, she has received an Alfred P. Sloan Research Fellowship, a National Science Foundation Career Grant, a National Science Foundation Postdoctoral Fellowship, and a U.S. Department of Education Fellowship.

Professor Smith is a member of the National Research Council Bureau of Mathematical Sciences, the American Mathematical Society's committee on committees and committee on the profession, and has served on the federal policy subcommittee of the American Mathematical Society committee on science policy. She has given invited lectures all over the world, has written numerous papers, coauthored a book, and helped translate a book from the Finnish language.

During her visit, Professor Smith was interviewed by K-State professor (and fellow Michigan alum) David Aucky. Here are some excerpts of that interview.

David Aucky: I notice that you were one of the few people who have won a National Science Foundation Career Award in mathematics. That's a fairly large grant, so what have you done with it?

Karen Smith: The grant has enabled me to support a lot of graduate students. I've got a project this summer planned that's going to involve a graduate student and an undergraduate. I hope we'll be able to recruit another undergraduate to work on that research project. That's all being funded by the career grant.

It's also enabled me to travel. It's paid for some of my conference support, and for some graduate student travel as well.

There's one other aspect of the grant that I'm still planning on doing, although I'm having trouble recruiting people to do this: I'm planning to bring people from industry into the classroom—for instance, from IBM or from small computer firms, anyone who uses mathematics in their research—to give some sort of living demonstration of what they're doing. I've met with people and tried to recruit them to do this, and I've used their examples, but it has been tough to get people to actually come to campus. But I'm still hoping to be able to do that next year. I've got two people in the works.

KS: That's right. I'm very lucky that I have such a supportive husband who comes along. He also has a flexible schedule, being a math professor, so he can come along and help do some babysitting at these events. It wouldn't be possible without his support.

DA: I suppose it's worthwhile mentioning that your new baby, Sanelma, is one year old. And you've been together with your husband, Juha, for about...

KS: About 10 years now.

After some discussion of Professor Smith's career and the difficulty of couples finding academic employment at the same university, the interview continues.

DA: Maybe we can talk a little bit about some mathematics. Let's break the question into a couple of parts. If you were going to describe the mathematics that you do research in—first to a high school student, then to an undergraduate major, then to maybe a second-year graduate student, then to just a general member of the faculty in the math department—what would you say?

KS: Well, there are a lot of parts there so I'll start with the high school student. What I study is called, for a high school student, algebraic geometry. What we study is the geometric properties of things that are described by algebraic equations. High school students have seen things like parabolas and ellipses, and hyperbolas. Those are all examples of the kinds of things I study. Algebraic varieties.

We're interested in whether or not they have singularities. For example, you can draw pictures of these things that are given by algebraic equations, polynomials that have a crossing—that would be a singular point. We're interested in how you describe those singularities, how you can get rid of, or resolve, those singularities. That kind of stuff is one big branch of my research.

For college students, I would get more algebraic, because I am really more an algebraist and not so much an algebraic geometry. And if the college student had studied some algebra, meaning rings and groups and fields, I would talk about the coordinate ring of an algebraic variety.

Associated to every algebraic variety there is a ring, a ring of polynomial functions on that variety, and you can study its properties. And it turns out one of the really beautiful aspects of algebraic geometry is that, more or less, everything you'd like to know about that algebraic variety is reflected in the ring. So there's
sort of a perfect correspondence between the geometric properties of this set and the algebraic properties of this ring.

My research is focused more on the ring side of these things. I’m studying how you can tell what the singularities are like by looking at the ring, for example. How can you describe differential operators on the variety by looking at the ring? Those kinds of questions are some of the things I study. How can you embed the variety in a projective space or some other space in a natural way? What kind of properties do the rings have that reflect that? Those are the kinds of things I ask.

She continues answering the question with a detailed and technical explanation of how she would describe her research to graduate students and professors in mathematics. A further discussion of some other aspects of her research ensues. After this, the conversation continues:

DA: What about outside of mathematics? Do you have other hobbies or interests?

KS: Sure. Well, with a new baby, it’s hard to do very many of them. But one thing I like to do a lot is orienteering. I don’t know if you know about orienteering, but for the sake of everyone else I guess I should explain what it is.

What we do is we go in the woods with a topographical map, so it’s a very detailed map of the terrain. We have a compass and the person who has set the course up has gone out and put flags at various locations. The object is to find all the flags in the shortest time possible. All you’ve got is this map and a compass, so it’s a lot of fun.

This is something we can do with Sanelma. She rides in the backpack while I do the orienteering. I have to stay mostly on the trails. I can’t find the harder flags that are deep in the thickets of the forest, but it’s still a lot of fun.

DA: Are these orienteering meets all in Michigan?

KS: Well, recently we’ve done them only in Michigan. We belong to the Southern Michigan Orienteering Club. We’ve also done them when we lived in Boston, up in the whole New England area—Massachusetts and upstate New York. We’ve done one in Virginia, which was a U.S. championship, and Juha actually placed third in the country in his age group. We also traveled to Toronto once to participate in the international championships. So we’ve done a lot of orienteering around.

And in Finland, we’ve done it, too. It’s a very popular sport in Finland. It’s even on TV, the way we have football on TV. Well, maybe not as much as football, but the big meets are on the radio and on TV.

DA: Do you use any GPS? Or is that forbidden?

KS: No, global positioning systems would be forbidden. I think that would be cheating.

I don’t know, though. Maybe that would be a whole new branch of orienteering. It would be a competition of the machines: who could build the best GPS system? I don’t know how accurate they are.

DA: You would have to know how to use the machine. You still have to get from point A to point B.

KS: As quickly as possible. Well, part of the challenge of orienteering, really, is knowing where you are. When you are looking at a map and all you’ve got are the altitude lines telling you where you are, you have to decide, “Am I on this hill or that hill or in this valley?” That’s part of the challenge. If you had a system that told you exactly where you were, I think it would be a lot easier.

DA: It definitely would change. Maybe it is a technology-type issue that you might have with calculators in a classroom. When you teach class do you have your students use calculators?

KS: Well, I’m not a big fan of calculators. I do think it’s important that students know how to use a calculator. Especially now that we’ve got such great technology, they ought to be able to take advantage of it. At Michigan you have the reform calculus, which uses a lot of calculators and calculator work. I haven’t taught that yet, but I’m planning on teaching it next year. So I’ll have a more well-defined position on using the calculator in the classroom after I’ve taught that and seen how it goes.

For my theoretical classes, such as the linear algebra class I just taught, I do not permit calculator use, but there would have been no advantage to using a calculator in that class. I wrote the exams so that it wouldn’t matter. It wouldn’t help at all.

DA: Do you have any advice you could offer to graduate students in mathematics?

KS: I guess the only advice I can really give is that you have to work really hard, and you have to keep working even when you feel like you’re not getting anywhere. I think the hardest thing is when you’re stuck, and you feel like you haven’t gotten anywhere for weeks and weeks, sometimes months and months. You have to just keep working.

Seek advice from other people. Read new things. You can’t just stop and say you’re not getting anywhere because often the results come in a flash, all of a sudden. Somehow, that working hard for months and months lays the groundwork for a theorem to suddenly appear. And you never know when you’re about to approach that critical point, so you just have to keep going.

DA: I’m glad to hear you say that. It’s excellent advice. I seem to remember that you spent a lot of time at Michigan in the math department working.

KS: Right. I worked very hard as a graduate student. And I still do.

DA: What about for undergraduates. Would you have any advice for them?

KS: Well, that depends so much on what they’re studying. I don’t know if I have any general advice, because they all have such different goals. If it were an undergraduate who was planning to do a career in math or any kind of science, I would advise them to take as much math as possible. Even if they’re thinking about something like law school, which is almost like a science. To study all those books and understand all the laws, they really should take as much math as they can. It sharpens the mind.

DA: In your evening talk you are going to talk about your experiences as a female mathematician in our society. Are there any comments or previews you’d like to share now?

KS: Yeah. I don’t know. I have a lot of stuff planned that I’ll say so I don’t want to say everything. Basically, I think it’s a great career for women. That’s one thing I can say.

The flexibility it has given me in balancing my work and family life is tremendous. Now that I have a child, I can work when she’s asleep. I don’t have to be at the office from 9 to 5, so if she goes to bed at 7:30, I can have a couple of hours, maybe as much as 5 hours. I may have to give up a little bit of sleep here and there to work at night, and that’s real work time. Also, because I only have a few hours a day where I have to be in a specific place in front of a classroom, I can arrange to have a babysitter then. Other than that, when she’s awake, we can find a lot of time to play with her and still do my job.

So a really great thing about being a woman in math is this flexibility. [It’s true for] any academic career, I suppose.

DA: Well, we look forward to your talks this afternoon and at this evening’s banquet. I hope you can come back again someday.

KS: Thank you. Me, too.
Your support makes a difference

In the last 10 years, the mathematics department has been graced with substantial gifts from alumni and friends. These gifts have enabled us to establish scholarships for talented undergraduates (notably, the Hostinsky, Fuller, and Rector scholarships), and establish the S. Thomas Parker scholarship competition. We have also been able to establish four lecture series—the Dressler, Spencer, Valentine, and Thomas series—that bring the world's best mathematicians to our department to lecture.

The importance of these scholarships and lecture series for mathematics at K-State cannot be overemphasized. These, together with smaller, less visible gifts, have had a profound impact on both our undergraduate and graduate programs and have raised the reputation of the department locally and throughout the country.

In its most recent survey, the American Mathematical Society ranked K-State's mathematics graduate program 91st in the nation. There are hundreds of graduate programs in the U.S.; this ranking places us highest in Kansas and third in the Big Twelve (behind Texas and Nebraska). In the same survey, our undergraduate program was cited as one of the most improved since the last survey, 10 years before.

But our push for excellence is not confined to our graduate program. Recently our undergraduates have achieved success by winning many prestigious scholarships, securing coveted internships, and placing high in national mathematics competitions. K-Staters have won 35 Goldwater scholarships, second only to Princeton University. More than half of the K-State winners have been mathematics majors. Recently a mathematics major won a Rhodes scholarship.

We would like to be able to continue to provide scholarships to attract top students. We are, and would like to continue to be, recognized for our use of computers and technology in our courses and the important skills these provide. These represent pressing financial needs for our department.

We call on all our alumni and friends to continue to help us to attain our goal of becoming one of the top 50 mathematics departments in the United States and to allow us to continue to provide an excellent education for our students.

Alumni survey

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How did your experience at K-State provide you with sound mathematical knowledge—especially in algebra and analysis? ____________________________

How did your experience at K-State develop your ability to engage in rigorous mathematical reasoning and abstraction? ____________________________

How did your experience at K-State enable you to become an independent learner of mathematics and a successful problem solver? ____________________________

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