Pre-Calculus
three communities; one goal
June 6-9, 2012 on the Iowa State University campus
## Program Schedule

### All rooms in Carver Hall

#### Thursday, June 7

<table>
<thead>
<tr>
<th>Time</th>
<th>Room</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 - 8:30</td>
<td>305</td>
<td>Pick up folder</td>
</tr>
<tr>
<td>8:30 - 9:30</td>
<td>305</td>
<td><strong>Developing precalculus-level students’ mathematical meanings and practices: The role of curriculum, teachers and instruction</strong>&lt;br&gt;-Marilyn Carlson-</td>
</tr>
<tr>
<td>9:30 - 10:00</td>
<td>305</td>
<td>Discussion</td>
</tr>
<tr>
<td>10:00 - 10:15</td>
<td>400</td>
<td>Break</td>
</tr>
<tr>
<td>10:20 - 10:50</td>
<td>305</td>
<td><strong>Precalculus: What’s so important?</strong>&lt;br&gt;-Tim McNicholl-</td>
</tr>
<tr>
<td>10:50 - 11:50</td>
<td>305</td>
<td>Panel: ISU, UI, UNI</td>
</tr>
<tr>
<td>11:50 - 12:20</td>
<td>305</td>
<td>Questions, Discussion</td>
</tr>
<tr>
<td>12:25 - 1:25</td>
<td>305</td>
<td>Lunch at UDM</td>
</tr>
<tr>
<td>1:30 - 2:10</td>
<td>018</td>
<td><strong>Success across three education systems: A longitudinal study of mathematics and statistics transitions</strong>&lt;br&gt;-Wolfgang Kliemann-</td>
</tr>
<tr>
<td>2:15 - 2:55</td>
<td>018</td>
<td><strong>Data fitting in the precalculus classroom</strong>&lt;br&gt;-Heather Bolles-</td>
</tr>
<tr>
<td>2:55 - 3:25</td>
<td>400</td>
<td>Break</td>
</tr>
<tr>
<td>3:25 - 4:05</td>
<td>018</td>
<td><strong>Project ideas for trigonometry</strong></td>
</tr>
<tr>
<td>4:10 - 4:50</td>
<td>018</td>
<td><strong>Stretching sinusoidal data into more than sine and cosine</strong>&lt;br&gt;-Heather Bolles-</td>
</tr>
</tbody>
</table>

#### Noon - 1:25

<table>
<thead>
<tr>
<th>Time</th>
<th>Room</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:35 - 11:15</td>
<td>268</td>
<td><strong>Supporting the development of student learning in precalculus level mathematics</strong>&lt;br&gt;-Marilyn Carlson-</td>
</tr>
</tbody>
</table>

#### Friday, June 8

<table>
<thead>
<tr>
<th>Time</th>
<th>Room</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 - 9:30</td>
<td>305</td>
<td><strong>Calculus in high school: Too much of a good thing?</strong>&lt;br&gt;-David Bressoud-</td>
</tr>
<tr>
<td>9:30 - 10:00</td>
<td>305</td>
<td>Discussion</td>
</tr>
<tr>
<td>10:00 - 10:30</td>
<td>400</td>
<td>Break</td>
</tr>
</tbody>
</table>

#### Saturday, June 9

<table>
<thead>
<tr>
<th>Time</th>
<th>Room</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 - 8:30</td>
<td>400</td>
<td>Continental breakfast at Carver</td>
</tr>
<tr>
<td>8:30 - 9:30</td>
<td>001</td>
<td><strong>Additional high school standards in Iowa Core Mathematics (also known as “the additional 15%” or “the Iowa standards”</strong>&lt;br&gt;-Eric Hart with Megan Balong &amp; Judith Spitzli-</td>
</tr>
<tr>
<td>9:30 - 10:00</td>
<td>001</td>
<td>Discussion</td>
</tr>
<tr>
<td>10:00 - 10:30</td>
<td>400</td>
<td>Break</td>
</tr>
<tr>
<td>10:35 - 11:15</td>
<td>001</td>
<td><strong>Engaging visualizations for precalculus and calculus</strong>&lt;br&gt;-Eric Schulz-</td>
</tr>
<tr>
<td>11:20 - Noon</td>
<td>150</td>
<td><strong>Web sites as resources to supplement the textbook and instruction</strong>&lt;br&gt;-Virginia Swenson-</td>
</tr>
<tr>
<td>12:25 - 1:25</td>
<td>400</td>
<td>Lunch at UDM</td>
</tr>
<tr>
<td>1:30 - 2:10</td>
<td>150</td>
<td><strong>Methods of discourse</strong>&lt;br&gt;-Jeffrey Marks-</td>
</tr>
<tr>
<td>2:15 - 2:55</td>
<td>001</td>
<td><strong>Closing session: Where do we go from here?</strong></td>
</tr>
</tbody>
</table>
Developing precalculus level students' mathematical meanings and practices: The role of curriculum, teachers, and instruction

Marilyn Carlson
Arizona State University School of Mathematical and Statistical Sciences
marilyn.carlson@asu.edu

I will share results from a series of investigations that examined expert problem solving abilities, and student learning of key ideas of precalculus and beginning calculus. This will be followed by a description of how that knowledge was leveraged to inform the development of student tasks and teacher tools for teaching precalculus. Studies were then conducted to investigate the impact of these tools on precalculus teachers' knowledge and on their instruction. These studies revealed that these teachers' content knowledge for teaching precalculus and their instructional practices advanced significantly towards greater focus on students' mathematical thinking and meanings. Much of teachers' advancement happened in the context of perturbing advanced both students' and teachers' schemes of mathematical meanings. Further investigations are revealing that the continued refinement of teachers’ schemes of meanings and the quality of their interactions with students happen when they are perturbed by their students’ thinking and by their own struggles to understand specific content. Assessments of student learning in these studies revealed significant gains in precalculus students’ understanding of key ideas of precalculus that are foundational for calculus.

Pre-calculus: What’s so important?

Timothy McNicholl
ISU Department of Mathematics
mcnichol@iastate.edu

Based on my experiences as a pre-calculus student and as an instructor of pre-calculus and calculus, I will discuss topics that appear to be crucial for success in Calculus and how we might best teach them. While not much needs to be learned, it must be learned very deeply. In particular, an understanding based on principles rather than procedures is essential.

Precalculus Panel

Panel participants will respond to Timothy McNicholl's statements and address multiple questions about precalculus and calculus at their institutions.

Elgin Johnston, Director
Center for Excellence in Undergraduate Mathematics Education
ISU Department of Mathematics
ehjohnst@iastate.edu

Oguz Durumeric, Undergraduate Director
UI Department of Mathematics
Oguz-Durumeric@uiowa.edu

Douglas Mupasiri
UNI Department of Mathematics
mupasiri@math.uni.edu

Moderator: Chris Schultz
ISU Department of Mathematics
cschultz@iastate.edu

Student success across three education systems: A longitudinal study of mathematics and statistics transitions

Wolfgang Kliemann, Chair
ISU Department of Mathematics
kliemann@iastate.edu

Student success in post-secondary education often depends on an individual’s passing of one or many mathematics and/or statistics courses. This is certainly true for students in STEM fields, but also for humanists, architects, animal breeders, veterinarians, and others. Indeed, basically all majors at the three public universities in Iowa require at least one mathematics and/or statistics course. Helping and guiding students to acquire the necessary knowledge in these courses is high schools, community colleges, and four year institutions. Student experiences and accomplishments in one education system become prerequisites for continuation in another system, and often parallel courses are offered in all three kinds of institutions. Obviously, this situation could create a huge variety of transition issues – and it does!

This presentation describes the attempt of an NSF-funded research group at Iowa State University to identify successful and less successful roads through mathematics/statistics courses to a college degree. We try to identify:
• Course sequences that work, and those that need alignment and coordination
• Gender issues related to mathematics/statistics courses that complicate completing a STEM degree

Obtaining data to answer many of these questions does not seem so difficult: institutions have student data bases, departments have instructor data bases, and student attitudes can be explored via surveys. We will report on the data and methodological setup of this study, on administrative difficulties, and on some preliminary results. We expect that continuing work on this project will lead to intensified collaboration across educational systems in the state.

Data fitting in the precalculus classroom

Heather Bolles
ISU Department of Mathematics
hbolles@iastate.edu

Learn how data can be gathered and examined to identify linear, quadratic, and rational functions. Students are involved in making conjectures, collecting data, and analyzing the data. See rich mathematics that makes sense and evolves from a context.
Supporting the development of student learning in precalculus level mathematics

Marilyn P. Carlson
Arizona State University
marilyn.carlson@asu.edu

The Pathways Professional Development Model and student curriculum are being successfully implemented in more than twenty schools and colleges in the US. Workshop participants will engage with the Pathways Precalculus Curriculum that includes in-class tasks designed to support student development of mathematical practices and key understandings that are foundational for calculus. Teacher support tools, including dynamic applets, videos and written notes of essential student thinking will also be examined and discussed. Investigations of student learning in this context reveal that students in this setting are developing proficiency in solving novel word problems and understanding key ideas of precalculus that are foundational for calculus. This data will be discussed, as will data that challenge the effectiveness of conventional precalculus and calculus curriculum and instruction.

Project ideas for trigonometry

What projects have been used in teaching trigonometry? Come share your projects and gain ideas from others.

Assessing students’ understanding of calculus

Elgin Johnston
ISU Department of Mathematics
ehjohnst@iastate.edu

Gain years worth of calculus exams as well as insight into how to write exam questions that assess the desired topics. Also plan to share your ideas for calculus projects and other means to assess calculus students – both formative and summative.

The Big Ideas of Calculus

Adrian Jenkins
ISU Department of Mathematics
ajenkins@iastate.edu

What are the big ideas of calculus? How do we best teach and facilitate the learning of the big ideas of calculus? I hope to lead a discussion where we come to some consensus on what we are trying to accomplish in calculus, and what a student should take away from a calculus course.

Stretching sinusoidal data into more than sine and cosine

Heather Bolles
ISU Department of Mathematics
hbolles@iastate.edu

See how sinusoidal data generated from a weight on a spring can be used to develop equations for more than just trigonometric functions.
Calculus in high school: Too much of a good thing?
David Bressoud
Macalester College
bressoud@macalester.edu

Over the past quarter century, high school enrollment in calculus has tripled, from 200,000 to 600,000. Over the same period, the number taking the AP calculus exam has grown from 50,000 to almost 350,000 and continues to grow at 6% per year. We have passed the cross-over point where each year more students study first semester calculus in US high schools than in all 2- and 4-year colleges and universities in the United States. In theory, this should be an indication that students are preparing for science, engineering, and mathematics. In fact, it is having the opposite effect. This talk will present an overview of the history of AP Calculus program, data on its effectiveness and the effects of this growth, and a description of the responses that are needed within our high schools and universities.

Supporting the development of student learning in precalculus level mathematics
Marilyn P. Carlson
Arizona State University
marilyn.carlson@asu.edu
(See Thursday’s description)

Hands-on conic sections
Gail Johnston
ISU Department of Mathematics
gjohnsto@iastate.edu

We will discuss ways to motivate ellipses, hyperbolas and parabolas. I will share an activity in which students use the definition of a hyperbola to draw a hyperbola. We will also discuss applications of the hyperbola and share an activity which uses laser pointers and definitions of trigonometric functions to find the height of a room.

Inquiry in mathematics
Timothy McNicholl
ISU Department of Mathematics
mcnichol@iastate.edu

What does Inquiry Based Learning and Problem-Based Instruction look like in a precalculus or calculus course?

Assessment horizon: The next generation
Tom Deeter
Iowa Department of Education
Tom.Deeter@iowa.gov

This session will describe how the Common Core State Standards (CCSS), incorporated into the Iowa Core by the Iowa State Board of Education, reflect constructs that relate to student learning expectations in higher level mathematics courses, and how the Iowa End-of-course Assessments (IEOC), in mathematics relate to student preparation for higher level math courses.

The ALEKS Mathematics Assessment at Iowa State University
Elgin Johnston
ISU Department of Mathematics
ehjohnst@iastate.edu

All students entering Iowa State University in Fall of 2012 will be required to take the ALEKS Mathematics Assessment for placement in a Mathematics class. This talk discusses the nature of the exam, what students can expect, and how Iowa high schools can help facilitate the process.

GAISE-ing at the Iowa Math Core: Everything you need to know about statistics
Bob Stephenson
ISU Department of Statistics
wrstephe@iastate.edu

In 2005, Guidelines for Assessment and Instruction in Statistics Education (GAISE) were published by the American Statistical Association. The Pre-K to 12 report provides a framework for presenting statistical material within the mathematics taught Pre-K to 12. Although the Pre-K to 12 report has its foundation in the NCTM Principles and Standards for School Mathematics (2000) the framework matches very well with the core curriculum in mathematics. In this presentation I will discuss the GAISE framework for teaching statistics within the Pre-K to 12 mathematics core curriculum. Special attention will be given to the middle grades (6th to 8th) through high school.

The Iowa Core Curriculum & Precalculus
Heather Bolles
ISU Department of Mathematics
hbolles@iastate.edu

Examine the (+) items of the Iowa Core Curriculum from the perspective of teaching a precalculus course. What does it look like?

Test journals in AP calculus
Allysen Lovstuen
Decorah High School
allysen.lovstuen@decorah.k12.ia.us

The story of how I have used Test Journals to increase student learning and metacognition.

Career opportunities in mathematics
Wolfgang Kliemann
ISU Department of Mathematics
kliemann@iastate.edu

For which jobs are math majors prepared? What are the career opportunities available for those in mathematics? It goes beyond teaching.

Rewindable Learning
David Gisch
Des Moines Area Community College
dgisch@dmacc.edu

Ever watch a math tutorial online and wonder, “How can I do that for my students?” Now you can find out. We will use Smartpens and tablet PC’s to demonstrate how to record math tutorials.
The Additional High School Standards in Iowa Core Mathematics (also known as “the additional 15%” or “the IA standards”) over the past eight years. They will provide detailed and practical information and lead a discussion related to the mathematical content of the additional standards, how to teach and assess the standards, and implementation issues.

Engaging visualizations for precalculus and calculus

Eric Schulz
Walla Walla Community College
eric.schulz@wwcc.edu

With so many technology options available to us today, what choices can we make that improve our teaching of mathematics, help students see and understand concepts better, and plant the mathematical seeds that grow into memories lasting beyond the next test? Engaging interactive visualizations open the doors to a more dynamic and conceptually focused experience for both the teacher in the classroom and the student trying to master content. Several interactive figures will be presented from a large collection created by the presenter for the interactive eBooks of Calculus, by Briggs, Cochran, Gillett, and Schulz, and an in-development Precalculus project.

Web sites as resources to supplement the textbook and instruction

Virginia Swenson
Des Moines Area Community College
vsswenson@dmacc.edu

Help students find help when it’s midnight, you are not available, and the textbook seems to be useless to them. Websites can supplement instruction and textbooks and can help students become more independent learners. Find out about free websites that are useful for your students’ learning and your lesson planning.

Yikes!!! My math class at the university is ONLINE!!

Chris Schultz
ISU Department of Mathematics
cschultz@iastate.edu

Online learning appears in many formats at ISU and working with MyMathLab will most likely happen with students coming for a 100 level math course. Strategies for succeeding in online classes will be discussed and the components of MyMathLab will be shared.

Methods of discourse in a mathematics classroom

Jeffrey Marks
Roosevelt High School, Des Moines, IA
jeffrey.marks@dmschools.org

Learn key steps in having your students learn mathematics through discourse. I participated in a 5-year project and examined my mathematics teaching through the perspective of discourse.

Updating the Mathematics Transition Guide

Justin Peters
ISU Department of Mathematics
peters@iastate.edu

Megan Balong
UNI Price Lab School
megan.balong@gmail.com

Five years ago the Mathematics Transition Guide was developed to identify skills and competencies needed by students to help ease the transition from the study of mathematics at the high school to the study of mathematics at the community college and university levels. Is the Transition Guide a useful tool? Where does it now fit in relation to the Iowa Core Curriculum, the end-of-course exams, and the mathematics placement exams? Does the document need to be changed? Come be a part of the discussion process.
Our warmest thanks to supporters of this conference:

Iowa State University
www.iastate.edu

Pearson, PLC
www.pearson.com

ISU Department of Mathematics
www.math.iastate.edu