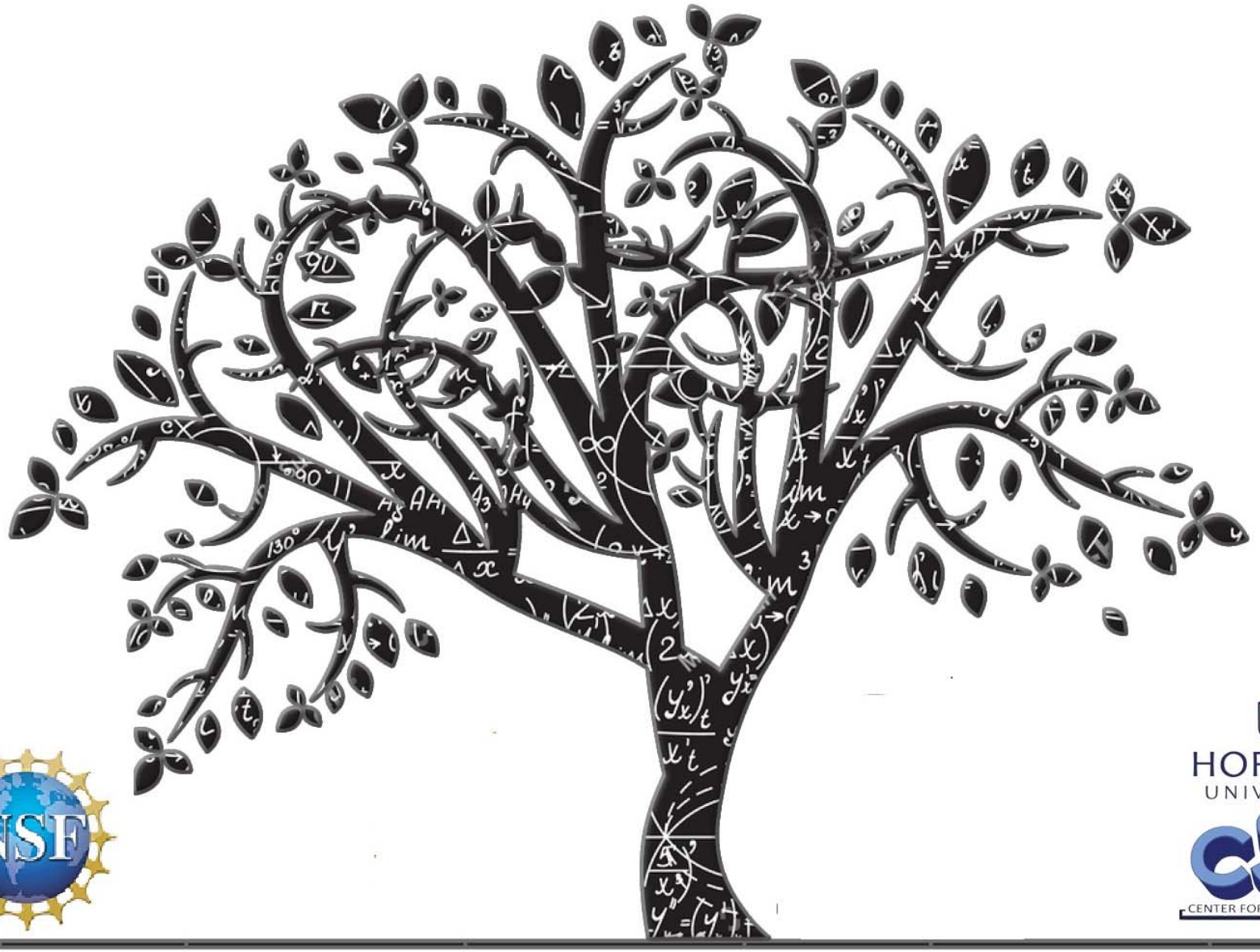


HOFSTRA UNIVERSITY

CSR CENTER FOR STEM RESEARCH

NEEDED MATH

FUNDED BY THE NATIONAL SCIENCE FOUNDATION, GRANT #1737946

WELCOME FRIENDS

MLK Weekend Needed Math Conference
January 12-14, 2018

www.neededmath.org

According to the reverend Dr. Martin Luther King, Jr., "*The function of education is to teach one to think intensively and to think critically. Intelligence plus character—that is the goal of true education*."

GREETINGS FROM NSF

Welcoming Remarks

Gerhard Salinger

ATE

- Technician Education at two year colleges
- Build a community
- Industry input --- directed

Celeste Carter's Concerns

- A useful and used report
- Subsequent Research
  - ✓ Could mathematics be taught in a just-in-time mode?
  - ✓ Does the use of context really deepen learning?
  - ✓ Do we lose competent technicians in disciplines by making them take Math XXX before entering the study of the discipline?

Outside Influences

- References on the Needed Mathematics Web site
- Swail: Job market NCEE: What Does It Really Mean to Be College and Work Ready?
- NSB: Task Force on Skilled Technical Workforce.

AGENDA

FRIDAY, JANUARY 12, 2018

5 PM: Conference Opening and Welcoming Remarks

- Steering Committee member introductions
- Charge to the Conference and Intended Conference outcomes
- Saturday and Sunday agenda overview and discussion groups
- Use of data collection worksheets
- Research and evaluation plans

6:15 PM: Keynote Address: *A Conference to End All Conferences*.
Dr. Solomon Garfunkel, Executive Director, Consortium for Mathematics and its Applications (COMAP).

7 PM: Dinner. Tables of 6-8. Individual introductions. Discuss and clarify intended conference outcomes and procedures.

STEERING COMMITTEE MEMBERS

- Marilyn Barger, Director, Florida ATE Center (FLATE), Hillsborough CC, FL.
- Rosemary Brester, President/CEO, Hobart Machined Products, Hobart, WA.
- Sol Garfunkel, Director of the Consortium for Mathematics and its Applications (COMAP), Bedford, MA.
- Michael Hacker, PI, Co-director, Ctr. for STEM Research, Hofstra Univ., NY.
- Deborah Hecht, Evaluator, CASE, CUNY Graduate Center, NY. (PI)
- Katherine Hughes, Research Lead, former CCRC Deputy Director, Wash., DC
- Paul Horwitz, Senior Scientist, Concord Consortium, Concord, MA. (Co-PI)
- Jennifer Lazare, Biotech Instructor, Anderson HS and Austin CC, TX.
- Lois Miceli, Project Administrative Assistant, Hofstra University, NY.
- Rodney Null, Math Professor, James A. Rhodes State College, Lima, OH.
- Gerhard Salinger, Retired NSF program officer and originator of the ATE program, Albuquerque, NM.
- Lisa Seidman, Former Program Director in Biotechnology, Madison Area Technical College, Madison, WI.
- Sue Siegal, Principal, "A Way With Words," NC. Proceedings Writer/Editor
- Gordon Snyder, Co-Principal Investigator, National ATE Center for Optics and Photonics Education, Waco, TX. (www.neededmath.org Webmaster)

Charge to the Conference

Our charge, and the major intended Conference outcome, is to begin to identify possible changes in curriculum and instruction that will reflect the mathematics needed by entry-level STEM technicians to be successful and productive employees.

What outcomes are we hoping for?

Paul Horwitz

Needed Math Conference

Baltimore, MD

January 12, 2018

Three kinds of math:

- **The math that's *taught***
  - **A fraction is a representation of a rational number as the quotient of two coprime integers.**
- **The math that's *learned***
  - **A fraction is a piece of something, represented by a number smaller than 1.**
  - **To add fractions you do something mysterious that I used to know.**
    - **(But I don't know why you would ever want to do that.)**
- **The math that's *needed* in the workplace**
  - **A joint of 1-inch diameter copper pipe is 21 feet long. We need 675 pieces of pipe. Each piece is 13 ¾ inches long. How many joints of pipe will we need?**

The three kinds of math are not the same! Why not? Some conjectures:

- **The math that's taught is the "wrong" math.**
  - **too abstract; perceived as irrelevant, geeky, scary**
- **The math that's tested is the "wrong" math.**
  - **Recall of algorithms rather than conceptual understanding**
- **The math that's learned is forgotten.**
- **Or maybe just…**

"Math class is tough!" – Barbie Doll, 1992

(Those dolls are worth over $500 today!)

What Do We Want to Accomplish Here?

- **Characterize the problem**
  - **Are STEM companies finding it difficult to recruit qualified applicants?**
  - **If so, to what extent can that be traced to deficient math skills?**
  - **What are those skills and are there commonalities across industrial sectors?**
- **Try to identify the cause(s) of the problem**
  - **Instructional modes**
  - **Standards mismatch**
  - **Gaps in the curriculum**
  - **Other?**
- **Report findings**
- **Recommend changes?**

What do we want to avoid?

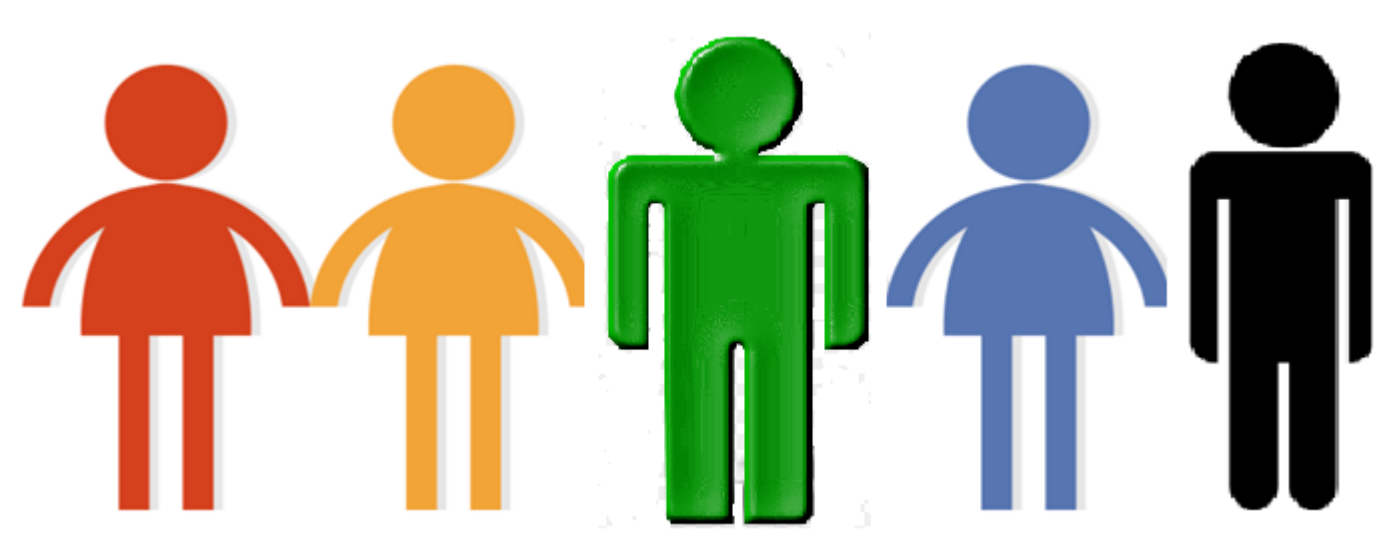
- **Pointing fingers.**
  - **This is not a "blame game"!**
- **Valuing math solely for its utility in the job market.**
  - **We don't use that standard for other academic subjects.**
- **Aiming too low…**
  - **Teaching to a specific task could be as harmful as teaching to the test.**
- **… or too high**
  - **"If they really understood rational numbers they'd be able to figure out how much pipe they need!"**

Expected Products

- Conference proceedings, to include:
  - Annotated example problems from the three industrial sectors
  - Math concepts and skills required to solve such problems
  - Which of those are taught and assessed
- Other publications aimed at
  - Math education researchers
  - Math teachers
  - State and federal policy makers
- Press
  - Trade: e.g., Education Week
  - General: e.g., Wall Street Journal
- Social media
  - e.g., blogs, listservs
- Proposals to
  - NSF, Other federal/state agencies, private foundations

Expected Outcome

Getting to know each other!



Saturday and Sunday Agenda Overview

Saturday Morning, January 13, 2018

Continental Breakfast 7:30-8:15 AM

8:15 AM: Employer Panel: Dr. Lisa Seidman, NSF Bio-Link Center, Moderator. Three employers will discuss employer needs (focused on needed math). Jo-Anne Hongo (Biotechnology); Jim Kiggens (ICT); Blake and Jana Wallace (Manufacturing); Kirk Adams (Using Math on the Job as an Employee Who Is Blind or Visually Impaired). Q&A.

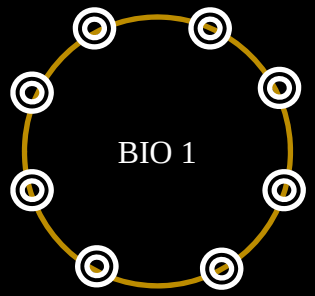
9:45 AM: Coffee Break.

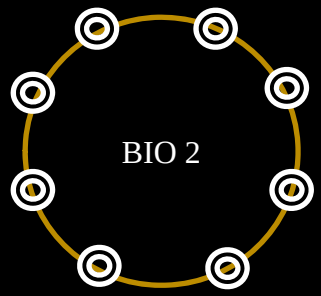
10:00 AM, Session 1: Small-group discussions (tables of five/six from the same domain) facilitated by steering committee members.
Goal. Use worksheet to begin to capture ideas that will be continually refined during the conference and presented by domain-based groups at Session 7 on Sunday 1:15 PM.

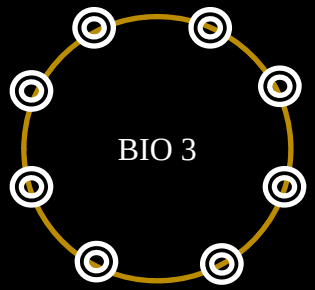
12:00-1:00 PM: Buffet lunch, outside meeting room.

Small Group Discussion Tables

Biotechnology







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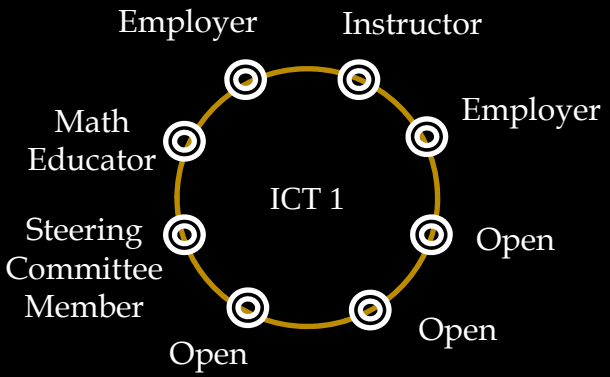
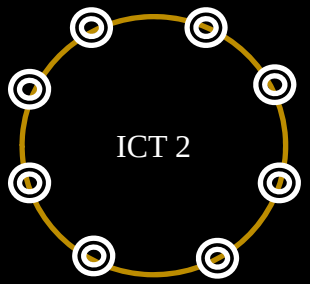
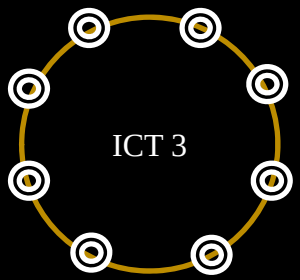
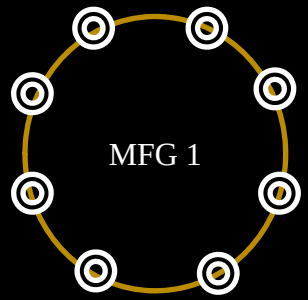
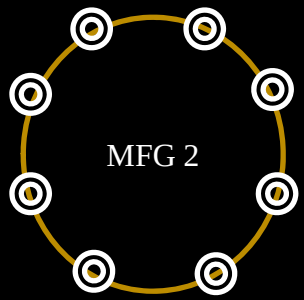


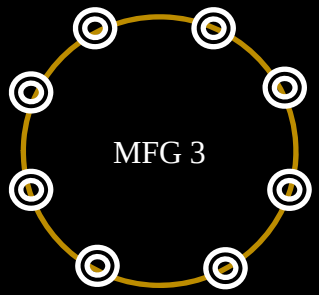




Manufacturing



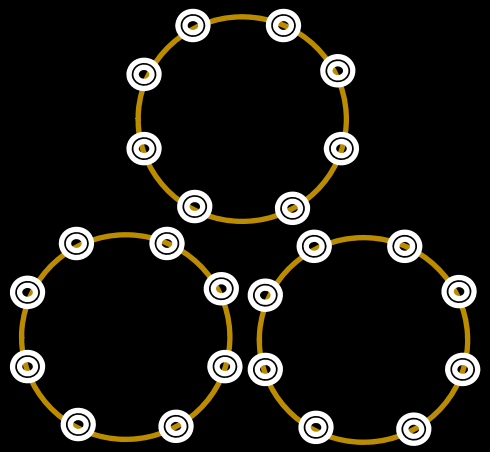




Domain-based Group Discussions
(Tables Moved Together Within Domains)

Biotechnology

Either in main Room or at long table just outside main room.



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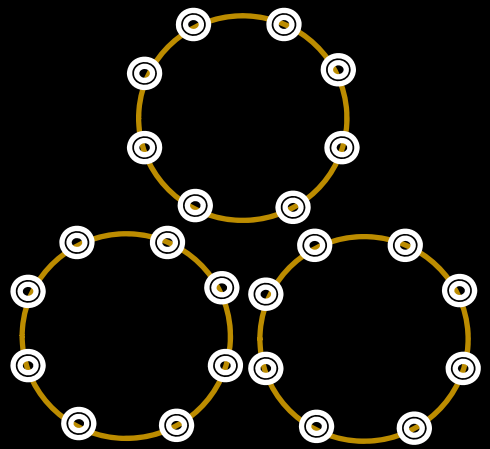
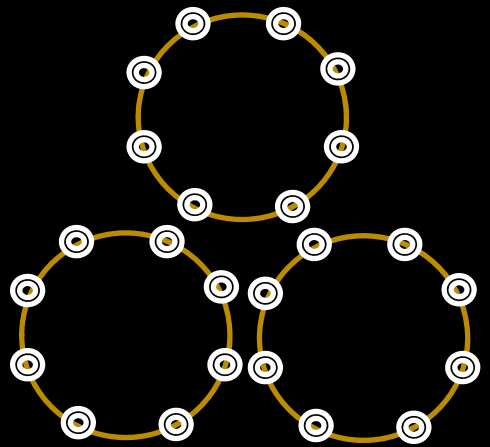


Either in main Room or meet in De Gaulle Room

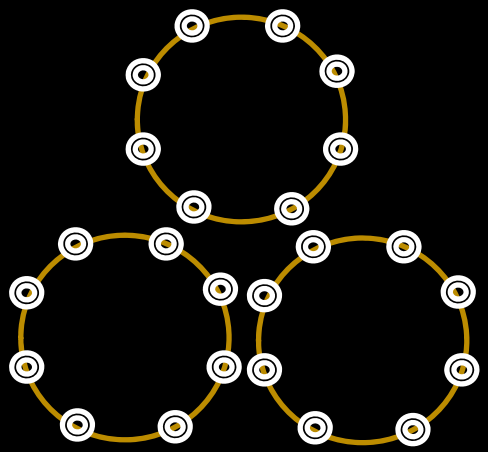
Manufacturing

Meet in Main Meeting Room



Domain-based Group Discussions

Biotechnology



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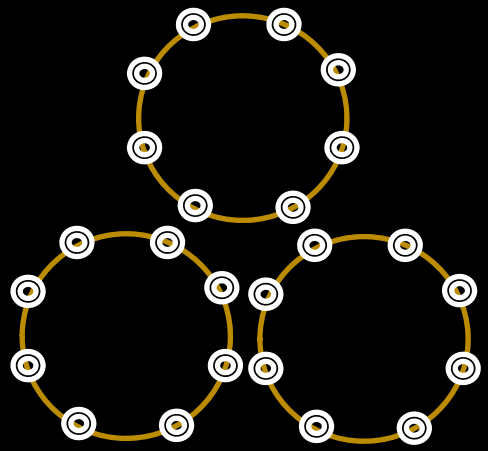

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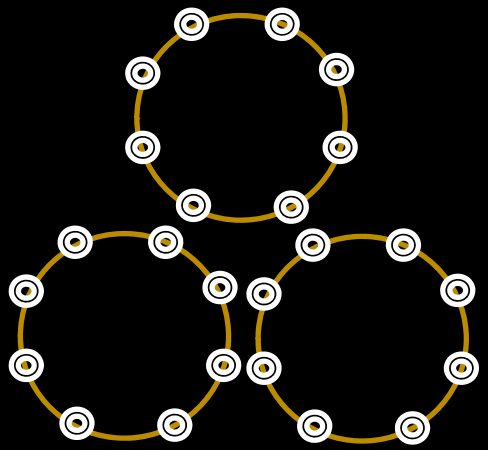

Saturday Afternoon Agenda – January 13, 2018

1:00 PM–3:15 PM, Session 2. Reconvene in larger groups (all domain participants or subgroups within a domain) to discuss/refine emerging recommendations. Begin to seek commonalities. SC members facilitate

3:15 PM: Break

Late PM Session: Dr. Gerhard Salinger, Moderator.

3:30 PM–4:30 PM, Session 3: Groups present Session 2 results (charts).

4:30 PM–5:00 PM, Session 3, cont'd. Whole group synthesis/discussion

5:00 PM: Pre-dinner break

6:00 PM: Dinner (to mix people from different domains). Tables of 8.

- Secondary school educators sit with Jen Lazare. Discuss implications of grades 6-12 implementation of needed math (report out during Session 5, Sunday, 9:45 AM)

7:00 PM: Concluding Discussion: Dr. Deborah Hecht, External Evaluator: What went right during the day. Review Sunday's agenda.

Sunday Morning, January 14, 2018, Bkfast, 7:30-8:30 AM, Bistro 1

8:30 AM-9:45 AM: Session 4. Submitting for reimbursements (Lois)

Affinity groups meet and address the following focus questions.

Employers: With what math do employees have difficulty, and why? What guidance can you give to educators? How is the field evolving and what are the implications for math requirements?

Instructors: Given the constraints of the present system, what would you change with regard to math in secondary school & CC programs?

Math educators: What needed math commonalties and differences (between domains) have emerged? Given that students have difficulty with math after years of study, what can and should we do?

9:45 AM-10: 30 AM: Session 5. Affinity groups (including secondary school instructors) report out (~10 minutes/group).

10: 30 AM: Coffee break

10:45 AM to 12: 15 PM: Session 6. Domain-based groups finalize work started on Saturday, factoring in what was learned from affinity groups.

12:15 PM: Buffet Lunch in meeting room

Agenda, Sunday Afternoon, January 14, 2018

1:15 PM – 2:15 PM: Session 7. Final flip-chart presentations from each domain (20 minutes each).

2:15 PM: Concluding Session.

- Potential areas for funding of new proposals.
- Large-group discussion and reflective comments. Framing next steps and further initiatives (suggestions, implications, and recommendations from conferees). Ask for participants' assistance with dissemination, email further suggestions.

3:00 PM: Conference ends.

Rod Null

Use of Data Collection Worksheets

(Flip-Chart Size)

DATA COLLECTION WORKSHEET

Conference Session #_____

Check the Conference Domain: Biotechnology ☐ ICT ☐ Manufacturing ☐ Other (describe) _____

To whom in the group should we address follow-up questions

Name _____ Email _____

SPECIFY THE PARTICULAR TECHNICAL PROBLEM TO SOLVE

IDENTIFY THE NEEDED MATH FOR THE PROBLEM ABOVE (What math do entry-level technicians need to be able to solve the problem. State what technicians need to do in *behavioral terms* (e.g., employees will model, calculate, estimate, evaluate, decide, analyze).

HOW WOULD THE PROBLEM BE SOLVED BY AN EMPLOYEE WHO IS ABLE TO DO THE MATH?

CLASSIFY THE NEEDED MATH BY DISCIPLINE, CONCEPT, PROCESS SKILL, AND SPECIFIC COMPETENCIES

- ***Mathematics Discipline*** *(please check):*

  Arithmetic ☐ Algebra ☐ Calculus ☐ Geometry ☐ Operations Research ☐

  Statistics and Probability ☐ Trigonometry ☐ Other _____

- ***Mathematics Concepts***:

- ***Process Skills***:

- ***Competencies Needed***:

At approximately what grade level(s) is this math taught? _____ ***Not Typically Taught*** ☐

For the example you have provided, briefly describe how the mathematics needed is (or is not) addressed within the grades 6-14 curriculum.

Please provide any suggestions to assist teachers in conveying the needed mathematics concept(s) in context (in the math classroom, the discipline-based classroom, or both).

Briefly describe training that companies might provide to assist employees to gain these skills.

Research and Evaluation Plans

Dr. Kathy Hughes

Dr. Deborah Hecht

RESEARCH QUESTIONS FOR THE CONFERENCE
Kathy Hughes

- What are the math concepts and skills that employers require for biotech, ICT, and advanced manufacturing entry-level technician positions?
- Is there a mis-match between the needed skills and the skills that are being taught in high school? in college?

THE QUESTION FOR THE COMMUNITY COLLEGE FIELD

- *To what extent should and could* math preparation for STEM-related technician positions be *differentiated*?

Ongoing Math Reforms in Community Colleges

- Charles A. Dana Center's Mathematics Pathways
  - Purpose: "Redesign courses" and "modernize content" because students are required to "pass courses that do not prepare them for their futures"
  - Technical assistance to states and institutions to implement math pathways
  - e.g., new statistics pathway for MD public colleges and universities; supported and evaluated with a First in the World grant
- Other reforms – e.g., in the California community colleges – also focus on creating statistics courses as an alternative to algebra requirements

Evaluation Plans

Debbie Hecht

Why evaluate this Conference?

To answer questions such as:

- To what extent does the Conference bring together key stakeholders?
- How effective is the structure and design of the Conference?
- To what extent are Conference goals achieved (identification of needed technician math, where taught, how to improve, etc.)?
- To what extent are Conference outcomes evident in Conference recommendations, proceedings, publications, and other materials?
- What are the perceived values of the conference for participants?
- What types of impacts does the conference have on policy and practice?

What Conference data are being examined?

- All planning materials
- Artifacts from the Conference (e.g., flip charts, notes, etc.)
- Surveys collected from participants and steering committee members
- Informal interviews with participants and steering committee members
- Review of proceedings and other documents resulting from Conference
- Any thing else that is relevant

How you will participate?

- You will be asked to answer brief feedback surveys throughout the Conference days and as a follow up to the Conference ends
- I may ask you questions or chat with you at different times during the Conference
- I may take pictures of your work (e.g., flip charts) or ask for copies of materials you share

When surveys will be distributed?

Day 1 –Before dinner

Day 2– Before lunch- A quick "check-in"

Day 2– At the end of the day

Day 3 –During coffee break – A quick "check-in"

Day 3 - At the end of the conference - before you leave

Six weeks later – A follow-up reflection emailed to you

The Logistics

- If you have your laptop – surveys can be emailed to your preferred email address
- Please confirm the email that will be used
- Otherwise, we have paper copies
- Surveys will be collected and summarized during the Conference
- Your responses are confidential and will be aggregated
- As appropriate, during the Conference feedback will be given to the Steering Committee, allowing for questions to be addressed and adjustments made
- The results will be summarized and become part of the Conference Evaluation Report

List of Materials in Packets to be Distributed On Site

Right side

- Welcome Packet (Welcome message & 3 domain overviews)
- Participant Agenda
- Using the Data Collection Worksheet
- Needed Math Examples from Employers
- Steering Committee Agenda (for SC only)

Left Side

- List of All Participants
- Participants' biographies
- Steering Committee Biographies
- Reimbursement forms

Data Collection Worksheets are available on the supplies table

Keynote Address

Dr. Solomon Garfunkel, Executive Director

Consortium for Mathematics and its Applications (COMAP)