Please Form Groups of 2-4

• Each group should have:
  – A small whiteboard
  – Pen
  – Kleenex eraser

• Enjoy the pre-lecture videos:
  – PSSC:  https://www.youtube.com/watch?v=PhVy1WG_IKQ
  – BoxSand:  https://media.oregonstate.edu/media/t/0_ydxprosh
  – New Math:  https://www.youtube.com/watch?v=UIKGV2cTgqA
Catalyzing the Transformation of Science Learning

Corinne Manogue
April 5, 2018
Restaurants

Menu in Folder
• Sit down
• Order
• Eat with knife and fork
• Pay

Menu on Wall
• Order
• Pay
• Sit down
• Eat with hands
Restaurants

Menu in Folder
• Sit down
• Order
• Eat with knife and fork
• Pay

Menu on Wall
• Order
• Pay
• Sit down
• Eat with hands

No Menu
• Sit down
• Don’t order
• Eat with hands
• Don’t miss out on dessert
• Pay
Lecture vs. Activities

• The Instructor:
  – Paints big picture.
  – Inspires.
  – Covers lots fast.
  – Models speaking.
  – Models problem-solving.
  – Controls questions.
  – Makes connections.

• The Students:
  – Focus on subtleties.
  – Experience delight.
  – Slow, but in depth.
  – Practice speaking.
  – Practice problem-solving.
  – Control questions.
  – Make connections.
Purpose

• Discuss with your group: What is the purpose of education? Write 2-3 answers on your small whiteboard.
The Purpose of Education

“…the purpose of your education is your growth as an individual and the development of your capacity to contribute to the transformation of society.”

—FUNDAEC

Fundación para la Aplicación y Enseñanza de las Ciencias
Dean F. A. Gilfillan

- High School Teaching
- Junior Engineers’ and Scientists’ Summer Institute (JESSI)
- OMSI

From Harriet’s Photograph Collection, OSU Libraries Special Collections & Archives Research Center

4/5/2018 Gilfillan: Catalyzing Transformation
Early Influences

• New Math
• Great Books Group
• PSSC Physics Curriculum
• Modular Scheduling/Open Space School
• Open University Model in High School
• Calculus Reform
• Robert Little: Physical Science Curriculum
• Montessori
New Math

• Affect: I LOVED it!
• Agency: I got to teach the teachers
• Institutionalization: I watched it fail

• New Math video: https://www.youtube.com/watch?v=UIKGV2cTgqA
PSSC Physics

• New pedagogical strategies:
  – open-ended laboratories
  – small group activities,
  – Videos (eg. when you were arriving)

• Affect: Modern physics is fascinating

• Identity: Physicists are middle-aged white men in narrow ties smoking pipes
Modular Scheduling/
Open Space High School

• **Agency:** Students make some decisions regarding their use of time.

• **Encouragement/Change:** Teachers can try new approaches.

• **Spaces:** Subject-area resource centers/open laboratories replace study halls.

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Paradigms in Physics

- Restructured/rearranged UD curriculum
  - 1 and 2 hr blocks alternate
  - Rearrangement of content
Paradigms Features Activities

Small Whiteboard Questions

Small Group Activities

Computer Visualization

Compare & Contrast
Kinesthetic Activities
Density

• Make a linear charge density.
Kinesthetic Activities

• Keep students awake!
• Are fun and engaging.
• Allow the instructor to see who is understanding.
• Allow students to check their reasoning against others.
• Let students see that they are not the only ones in the class having trouble.
Representations

Physical Manipulatives
Paradigms Is Informed By:

• Our own education research
  – Role of types of activities
  – Transfer of math to physics
  – Expert understanding
  – Representations
  – Rich points

• Research of others
  – Diversity, inclusivity
  – Learning spaces
Roundy: How do experts/students use math in thermodynamics?

Van Zee: How do faculty learn how to investigate and enhance their own teaching?

Emigh: How do students think about holding variables constant when finding derivatives?

Alfson: How do students use tangible representations to understand equations in physics?

Lenz: Do students find sensemaking useful?

Peterson: What kinds of physics sense-making do students engage in?
Founds: What do students not understand about finding the slopes?

Dray: How do students transfer mathematical knowledge to physics?

Mulder: How do physics majors coordinatize physics problems?
Scales of DBER

Cognitive Elements

Individual Student or Instructor

Group of Students

Course, Program, Institution
Rich Points
Rich Points

Redish quoting:
M. Agar, Language Shock
(Perennial, 1994)
Learning Spaces
My Cultural Journey

• A child of privilege, particularly educational
  – HS: A wealthy public school in the mid-west
  – College: A liberal eastern women’s college renowned for educating women scientists
  – Grad: A large R1 university in Texas
  – Postdoc: An elite research institute
  – Faculty: The first woman in physics at OSU
  – Research abroad: England, India, Australia
  – Workshops: Colombia, India
Cultural Lessons

• The subtext of my education:
  – HS: I can do anything except physicists are men.
  – College: I can do physics??? if I am manly tough.
  – Grad: Women are only sort of welcome in physics.
  – Postdoc: Physics can be wildly competitive.
  – OSU: Women need special help to be in physics.
  – Teaching: Classrooms have cultures.
  – Sabbatical: Race is still a challenge
Courage in the Classroom

• It takes courage to be publicly wrong.
• Physics culture is to NEVER be publicly wrong.
• We need to/can change this.
• Our classrooms culture can model a new culture.
Power Poses
Identity—Then and Now

4/5/2018 Gilfillan: Catalyzing Transformation
My Coming Out

• I am a Bahá’í!
Bahá’ís in Iran

- Bahá’ís in Iran have not been allowed to attend university since the Iranian revolution in 1979
Wellbeing of Mankind

“The well-being of mankind, its peace and security are unattainable unless and until its unity is firmly established.”

Bahá’u’lláh

The World Order of Bahá’u’lláh, p. 203
False Dichotomies

Men

Science

White

Women

Religion

Everybody

Else
Normative Adversarialism

- Legal contests
- Economic contests
- Political contests
- Educational systems

Adversarialism  Mutualism

Inequality  Equality
Mutualism
Adversarialism
Inequality
Coercion/
Oppression
Good Marriage
Mutualism
Equality
Mutualism
Adversarialism
Coercion/Oppression
Good Marriage
Mutualism
Inequality
Equality

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Talk with your group:

Mutualism  Adversarialism

Equality  Good Marriage  Inequality

Coercion/Oppression  What goes here?  What goes here?
Mutualism

Political Gridlock

Adversarialism

Coercion/Oppression

Inequality

Equality

Good Sports

Good Marriage

Mentoring

Teaching

Gilfillan: Catalyzing Transformation
What’s Next at OSU?

• We have:
  – A small number of DBER faculty
  – A LARGE number of faculty engaging
  – Many Centers/Professional Faculty/Offices
  – A national support system
What’s Next at OSU?

• Needed—A new administrative structure framework that:
  – Encourages individual initiative & collaboration
  – Employs a mutualistic, consultative process
  – Utilizes reflective cycles of growth
  – Acknowledges that change is slow
  – Pushes forward on many fronts at once
  – Builds on/sustains/learns from previous efforts

• DBER faculty as catalyzers!!!
Support

• National Science Foundation
  DUE-9653250, 0231194, 0618877, 0942983
  DUE-1256606, 1323800
  DUE-0088901, 0231032, 0837829, 1023120
• Oregon State University
• Oregon Collaborative for Excellence
  in the Preparation of Teachers
• Grinnell College
• Mount Holyoke College
• Utah State University
The Big Picture

- Organic process of growth
- Personal growth leading to social change
- Role of individual/collaborative action
- The role of cycles of reflective practice
- Unity, diversity, culture, respect
- The long haul
- The possibilities of the next level at OSU
My Hope/Prayer

• My hope/prayer is that each of you will go home and take some time to reflect on your own personal journey. How has it affected who you are now? How has it enabled you to contribute to the transformation of society? What do you want to do next? How can you invite others to walk this path with you?