



University of Pittsburgh

Why Active Learning? Take 2!

*I personally hate having
all the attention on me!*

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Make the lecture active...

- <http://www.youtube.com/watch?v=dxPVyieptwA&feature=related>

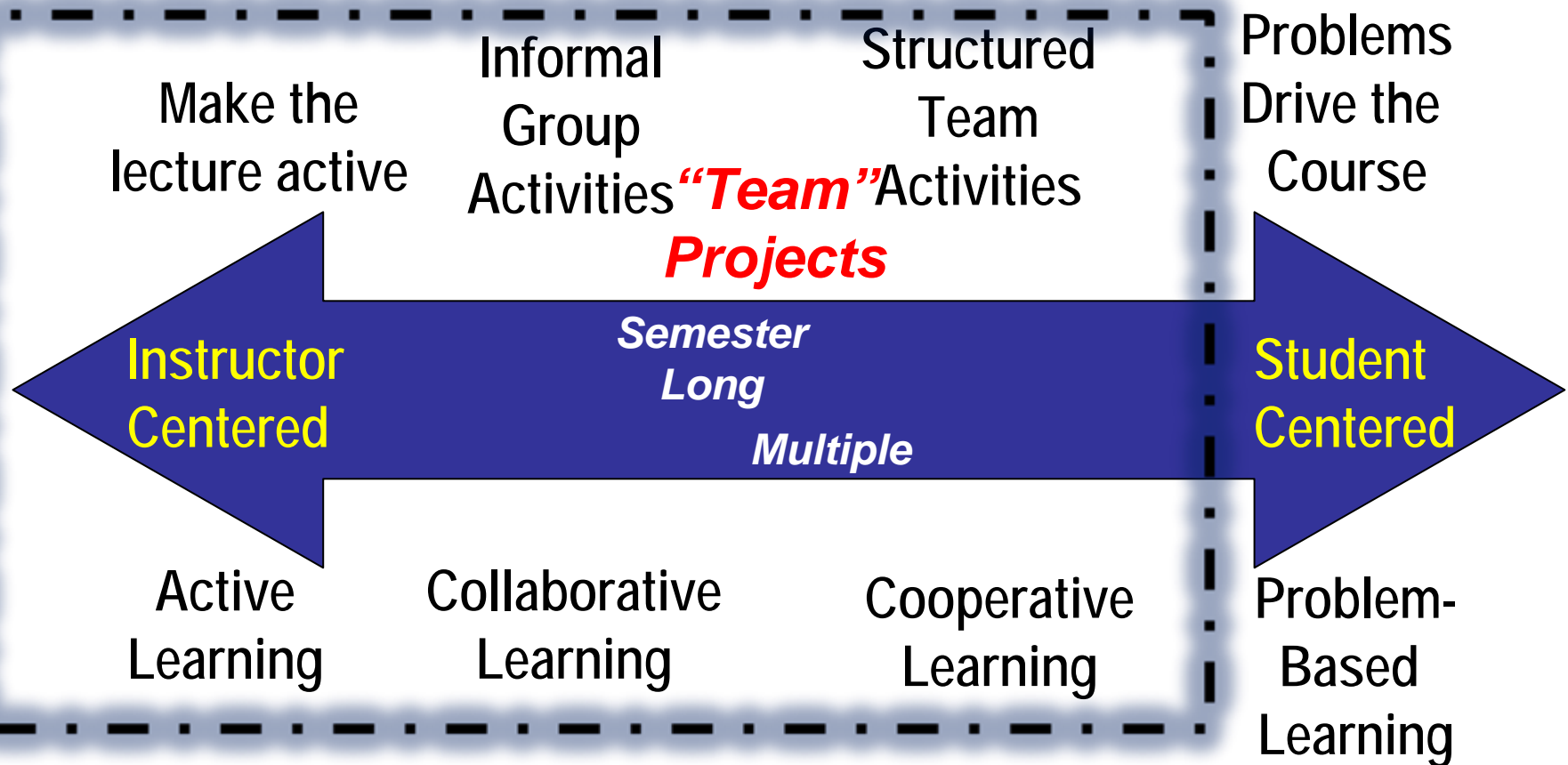
My biggest piece of advice...

- We, as faculty, hate having the room silent...
- Wait, wait, wait...
- Students will answer regardless if it is right or wrong!

**Where
am I?**

Scaffold notes
Wait for it...
Think-Pair-Share
"Your Turn"
"Kick the Tires"

MEAs



Think – Pair - Share

- What student learning outcomes do you want to achieve along this *active* → *collaborative* → *cooperative* → *problem based learning* continuum?

My student learning outcomes

- Conceptual understanding
- Teamwork abilities in problem solving
- Engineering modeling abilities **
- Professional issues
 - Working with “clients”
 - Ethical reasoning or at best awareness **
 - Current challenges in society

Model Eliciting Activities (MEAs)

...mini “Problem Based Learning”

- Originated in mathematics education
- Carefully built open-ended scenarios that simulate authentic, real-world problems
- Designed to develop systems thinking in modeling
- Teams to apply mathematical or other structural models
- Constructs
 - Model Construction
 - Reality
 - Self Assessment
 - Model Documentation
 - Generalizability
 - Effective Prototype

Semi structured problems

MEA protocol

- A news paper article or Utube video
 - Get the students in the ‘state space’
 - Individual task and/or questions
 - Next class period or following week
- Additional information and a memorandum from their “client”
 - Team based effort to solve the task
 - At least one week, sometimes more
 - Several iterations
- Formal feedback to students

SUV Rollover

- Students prepare design and submit plan
- Simulated data is returned to them based on their design
- Students make recommendations based on their results
- Feedback provided not only on the simulated study but on the Ford Firestone case



To: Thomas K. Richards
Richards Automotive Consulting (RAC)
From: John McCray
CountryWide Insurance Company (CWI)
Re: Tire accident analysis
Date: 2/3/10

Dear Tom:

We are requesting your expert opinion as automotive accident consultants with respect to a potentially serious situation that facing CountryWide. As you know, we are one of the largest automobile insurers in the U.S. Over the past several years we have received claims from more than 100 customers who have experienced vehicle rollover accidents that appear to be the result of tire separation. Too many of these claims have resulted in serious injury and a few have also resulted in death. Interestingly, the large majority of these claims involve a SUV.



Our claims investigators feel that we may be dealing with multiple problems. First, the SUV design may present a serious safety hazard. The National Highway Traffic Safety Administration (NHTSA) has pointed out that the high frame results in a high center of gravity, and, for certain SUVs can create an unstable design. Consequently, these SUVs may have a greater tendency to rollover. Combine this with a weak roof and inadequate crash protection, and a SUV rollover can be deadly. Consequently, NHTSA has estimated that while 22 percent of passenger car occupant fatalities are attributable to rollover, the number jumps to 61 percent for SUVs.

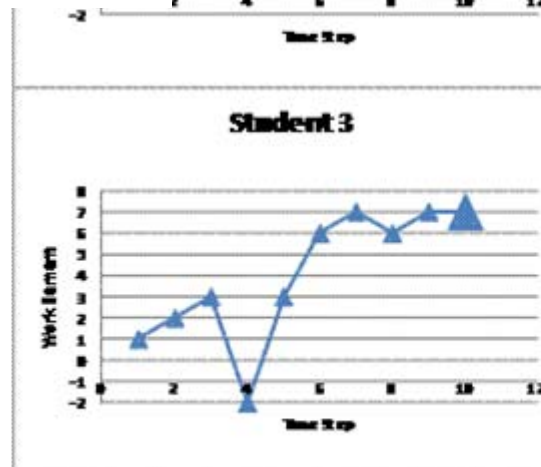
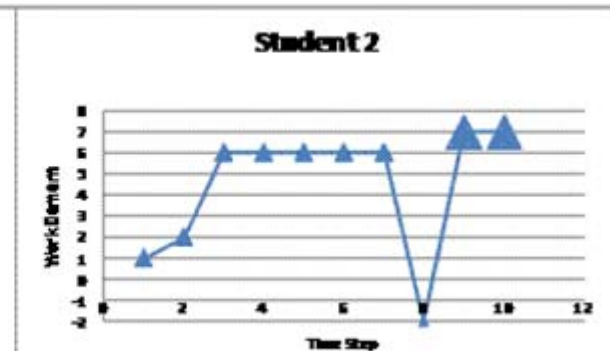
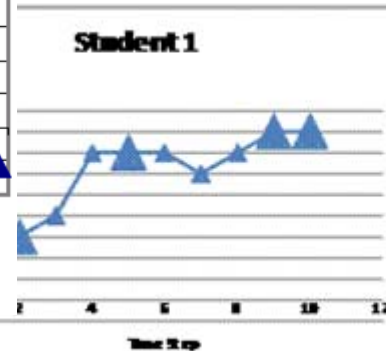
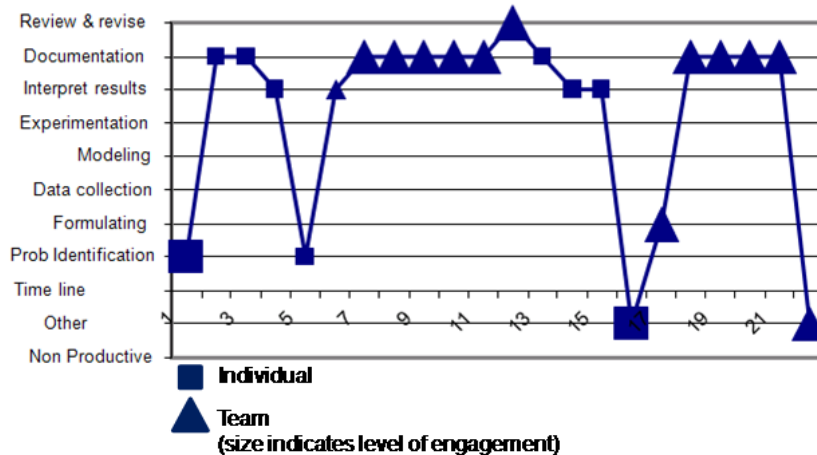
An estimated 7,000 people are killed or seriously injured annually when their vehicle rolls over and the roof collapses into the occupant survival space. The drawing below illustrates this problem:



What have we found...

Investigations of teamwork on problem solving

- Equipped students with PDAs and UMT software



- 1: Problem identification
- 2: Problem formulation
- 3: Data collection
- 4: Modeling
- 5: Experimentation
- 6: Interpreting results
- 7: Documentation
- 8: Reflecting/reviewing
- 1: Other
- 2: Non productive

What have we found...

Investigations of teamwork on problem solving

- Teams who work as “teams” and not as groups perform better on the MEA

Factor: Team or Individual Problem Solving	Individual problem solvers: Work delegated among individuals	Mixed problem solvers: Mixed delegation of tasks and group work	Team problem solvers: Complete teamwork on all tasks
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- No significant findings

Factor: Task sequence	Linear problem solvers: Team works on one task at a time; moves on to next task when completed	Iterative problem solvers: Team iterates between tasks, visiting the same tasks multiple times if needed
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- Teams who allocate their time to each phase perform better on the MEA

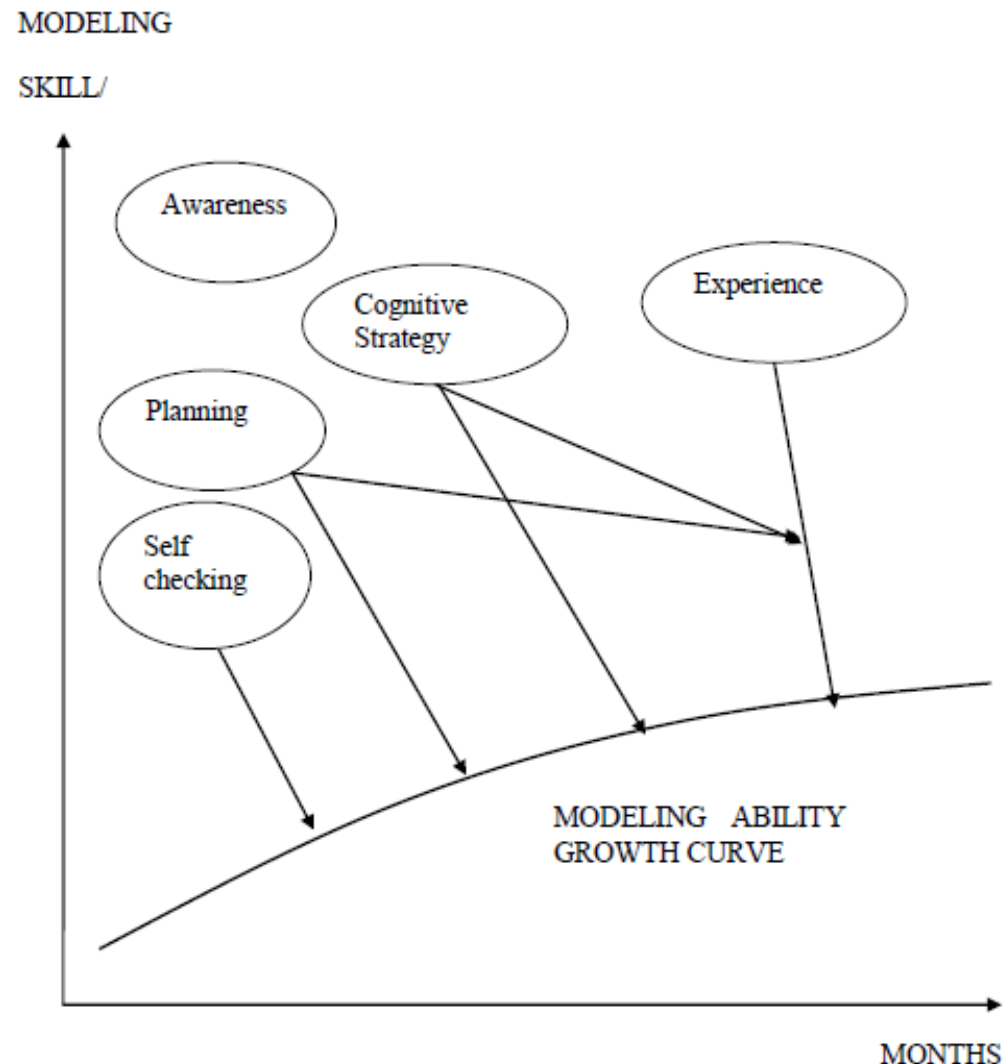
Factor: Dominant Phase	Team spends most of its time to understand state or formulate problem.	team spends most of its time on the model's implantation.	Team allocates most time to interpreting the results, documenting etc.	Team allocates comparable time to each task.
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Conceptual Understanding & Professional Issues

- **Conceptual knowledge**
 - Concept Inventories
 - Mixed results
 - Probability & Statistics I
 - Effects sizes same for experimental vs comparison group on SCI
 - Engineering economics
 - Same instructor; significant differences between experimental vs comparison group
 - Thermodynamics
 - Depends on class
- **ABET Outcomes**
 - Significant differences between test and comparison groups!
 - Knowledge of professional and ethical responsibility
 - Ability to apply knowledge about current issues

Improvements in modeling abilities

- Random Coefficients Model - Growth Curve Model
 - Dependent variable- modeling skill
 - Independent variables- MEA experience, metacognition, control variables



National Academy of Engineering Frontiers of Engineering Education

Victor Breedveld
*PRS Coupled w
Think Pair Share*

Raymond Tu
*Peer
Teaching*

Brian Bingham & Ellis Ming
*Project based
1st Year Experience*

Lisa Bullard
Scaffold Notes

Kathleen Wage
*ACL at
graduate level*

Diana Lados
*Project based
over multi years*

Stella Quinones
Minute Papers

Burcin Becerik-Gerber
*Role based coupled w
Project*

**Make the
lecture active**

**Informal
Group
Activities**

**Structured
Team
Activities**

**Problems
Drive the
Course**

**Instructor
Centered**

**Student
Centered**

**Active
Learning**

**Collaborative
Learning**

**Cooperative
Learning**

**Problem-
Based
Learning**

Questions to think about...

- **Where do you see yourself along the continuum?**
- **Where do you want to be along the continuum?**
- **What do you need to get there?**