

# Workshop on Peer Led Team Learning in Computer Science (PLTL in CS)

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**Microsoft**



# Outline of Workshop

- Introduction to Peer Led Team Learning in CS, motivation and results
- PLTL session
- Results From Study
- Student Leader Perspectives
- Learning Styles and Role Playing
- Team Leader Training
- PLTL Book Guidelines

# Motivation

- Taulbee Survey 2006-07 - CS BS majors decline
  - 50% drop in enrollment since 2001
  - 11.8% female
  - 5.3% hispanic
  - 3.6% african american
- Many other studies show the low number of interest in CS by females and underrepresented minorities

# Possible Goals and Approaches

- Goals
  - Increase number of women and underrepresented groups
  - Increase retention and enthusiasm
- Approaches
  - Active Recruiting of Incoming First-year students
  - Optional/Required of registered students

# What is PLTL?

- Related to a course
  - Students solve problems in small groups (4-8 students) weekly in addition to regular class meeting
  - Interesting exercises to be solved as a group
  - Led by trained undergraduate student leaders who facilitate group learning
- Used in Chemistry for about 12 years, [www.pltl.org](http://www.pltl.org)
- Beneficial to both students and student leaders

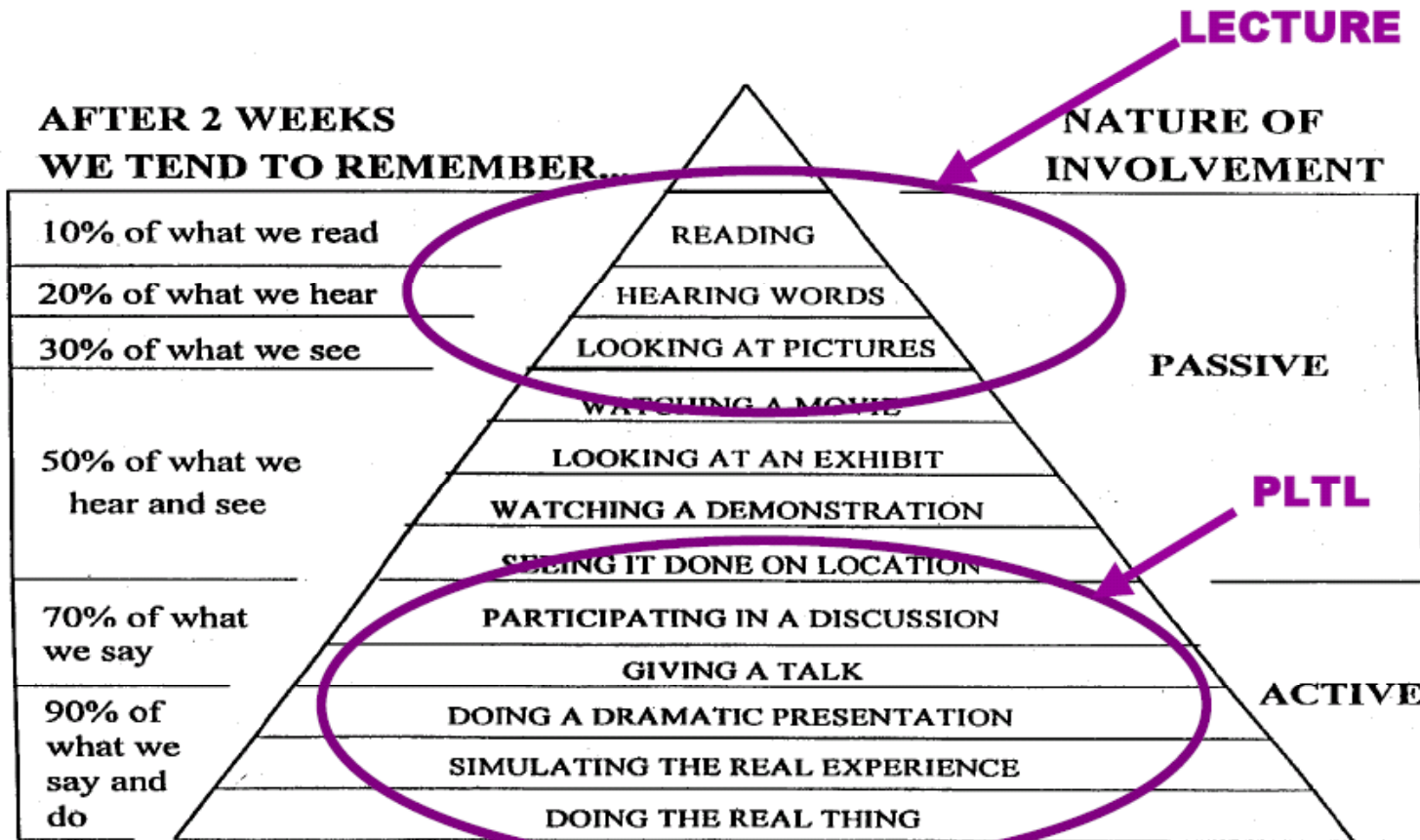
# Groups != Discussion Section

- Students helping, learning from other students
- Less authoritative; liberate and empower students
- Promote Active Learning, encourage teamwork
- More fun!

# Why PLTL?

- Factors affecting intellectual development in college
  - Student/faculty interaction outside the classroom
  - Involvement on campus through various forms of community-building activities
  - Involvement with student peer groups
  - “peer group – the most potent source of influence on growth and development during the undergraduate years.”
    - Astin, A. W., (1993) What Matters in College? Jossey-Bass Publishers, San Francisco. pg. 394-398.

# Cone of Learning (Edgar Dale)



Edgar Dale, *Audio-Visual Methods in Teaching* (5th Edition). Holt, Rinehart, and Winston (1969).



# Effects on Students

- Better/deeper understanding of material
- Lower drop rates
- Better grades (usually)
- Formation of social groups
- Very high satisfaction

# Effects on Peer Leaders

- Better understanding of the material
- Increased confidence to continue in CS
- Appreciation for different teaching /learning styles
- Improved leadership skills
- Collegial relationship with faculty

# What is ESP?

- Emerging Scholars Program
  - Used in math and science courses
  - Recruits under-represented groups
  - Works in small groups on challenging problems
- Benefits
  - Earn Higher Grades
  - Increases enthusiasm for math and science
- “Calculus and the Community – A History of the Emerging Scholars Program” by Rose Asera, 1991, College Board.



## Defining PLTL in CS (also called ESP-PLTL)

- Small groups meet related to a course
  - Not everyone from the course
  - Build friendships to help support you through major
- Active recruiting
- Aim for gender balance
- Undergraduate peer leaders
- Solve challenging problems



# Peer-Led Team Learning in CS (PLTL in CS)

- Combines components from PLTL and ESP
- Eight Universities – Fall 2005 – Spring 2008

Beloit College (WI)

Purdue University (IN)

Duke University (NC)

Rutgers University(NJ)

Georgia Tech (GA)

University of Wisconsin Madison (WI)

Loyola College (MD)

University of Wisconsin Milwaukee (WI)

- [www.pltlcs.org](http://www.pltlcs.org)



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## PLTL in CS variations among 8 universities

- Some focus on non-majors course
- Some focus on CS 1
- Some focus on both (one year)
- Some have just women, most are mixed
- Some include everyone, most are subset
  
- All use active recruiting and undergraduate peer leaders
- All use problem solving in small groups outside of main class period

# Duke University -“PLTL in CS” version Emerging Scholars Program (DES)

- One year program – four courses total
  - First semester
    - Main course: Non-majors course: CPS 4 (Alice) (1 credit)
    - Problem Solving Seminar course: CPS 18S (1/2 credit)
  - Second Semester
    - Main Course: CS 1 course: CPS 6 (Java)
    - Problem Solving Seminar course: CPS 18S (1/2 credit)
  - Active Recruiting (email to targetted groups, accepted student fairs, invite students in main course)
  - Gender balanced
  - Outside Speaker/Field Trip
  - Undergraduate Peer Leaders in Problem Solving Seminar

# CompSci 18S: Problem Solving Seminar

- 2 peer leaders, about 12 students, (1 professor)
- Solve problems in groups of 4
- Either general computer science problems or related to the main course
- Subset of students from main course, those who want the group experience
- Peer leaders trained in workshop, meet weekly



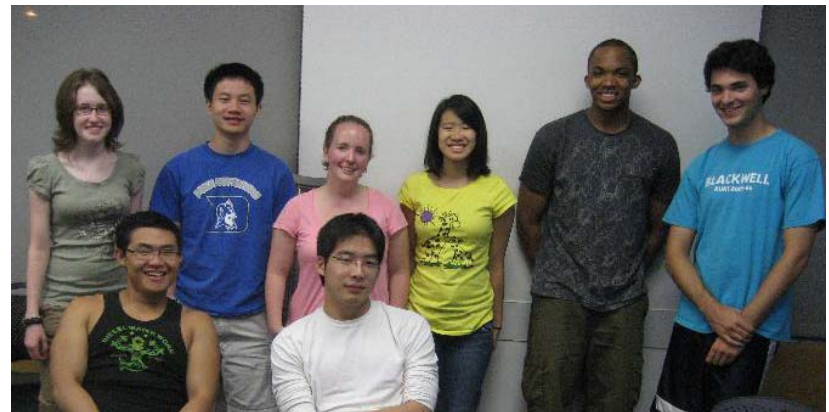
# 2 Main Courses: Non-majors (Alice) and CS 1 (Java)

- Workshop format
  - Lecture 10-20 minutes
  - Students program rest of class
  - Students work in pairs (“pair programming”)
    - Two people, two laptops, consult a lot
  - Assigned seats and pairs, change every 2-3 weeks
- About 35-50 students



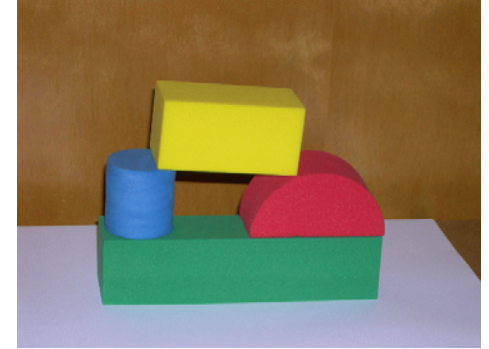
## 2 Main Courses: Undergraduate role

- About 8-10 undergraduate teaching assistants
- Roles:
  - Attend the “workshop lecture” to assist
  - Meet weekly
  - Grade and hold consulting hours
  - Includes the two peer leaders from the problem solving seminar



Now, Let's Try PLTL!

# Example of Problem Solving: Be A Robot

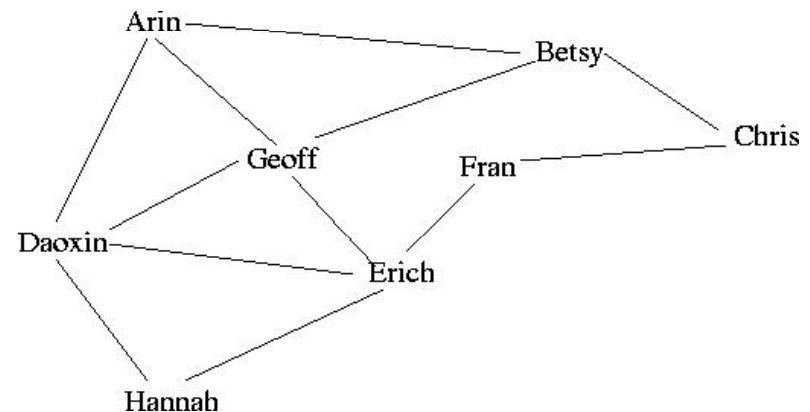
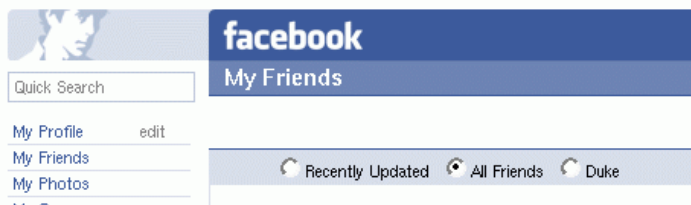


- Group of 4 – brain, eyes, 2 hands
- Only brain knows what you are building
- Only eyes can see
- Must work together precisely like a robot



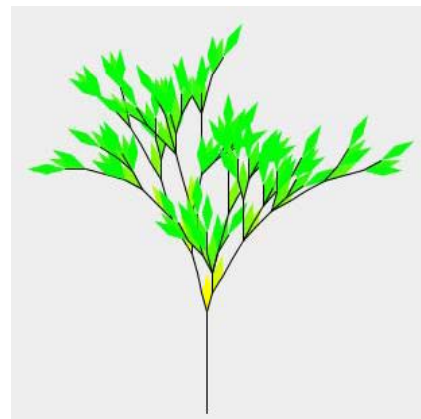
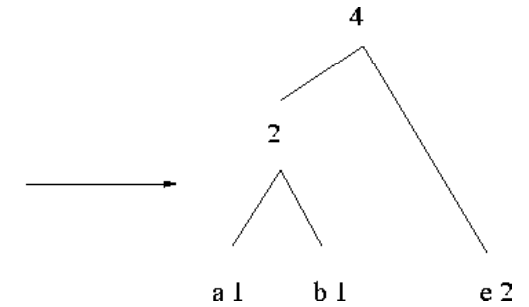
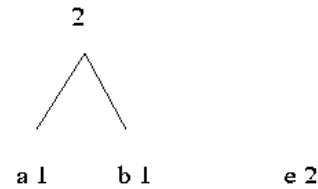
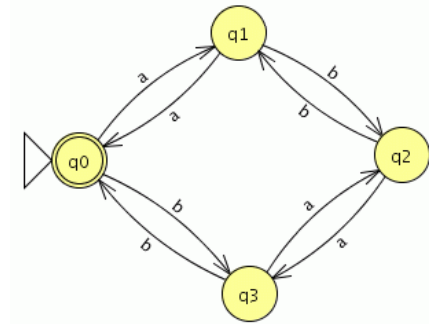
# Example of Problem Solving Finding

- Graph of all friends (of everyone in class, at your university)
- Problems
  - Find number of friends of friends of someone
  - Find the center of the graph – person with smallest sum of shortest distances



# Other Examples

- Finite State Machines
- Turing Machines
- Random Numbers
- Compression  
(Huffman coding)
- Sudoku, Jumble
- L-Systems
- Genomics



	6	1	4	5	
	8	3	5	6	
2					1
8		4	7		6
	6			3	
7		9	1		4
5					2
	7	2	6	9	
	4	5	8	7	

# Results from Study

- Susan Horwitz, Susan Rodger, Maureen Biggers, David Binkley, C. Kolin Frantz, Dawn Gundermann, Susanne Hambrusch, Steven Huss-Lederman, Ethan Munson, Barbara Ryder, and Monica Sweat, [Using Peer-Led Team Learning to Increase Participation and Success of Under-Represented Groups in Introductory Computer Science](#), Fourtieth SIGCSE Technical Symposium on Computer Science Education, 2009 (to appear)

## Results:

### Why did women enroll in PLTL in CS?

41 women responded in 2005-06

60.5%	mailed invitation
15.6%	other
12.8%	info during orientation
9.8%	academic advisor recommendation
9.8%	class announcement
4.9%	parent recommendation



# Results - Why enroll in main course?

31 female/49 male responses 2005 (select all that apply)

F	M	Reason
71.0%	22.5%	I received an invitation
67.7%	28.6%	To see whether I enjoy CS
29.0%	40.8%	Meets requirement for my major
25.8%	79.6%	I know I am interested in CS
19.4%	18.4%	Programming is useful job-market skill
16.1%	57.1%	I plan to major in CS



## Results - Recruiting

- Percentage of women and minorities was higher in ESP-PLTL
- This is over all institutions from 2005-2007.

	<b>ESP-PLTL</b>		<b>Main Course</b>	
	#	%	#	%
Female	122	33.4%	673	29.0%
Minority	43	11.8%	218	9.4%

# Retention Data

Retention Data, All Institutions Combined (2005 - 2007)						
	ESP-PLTL		Non ESP-PLTL		Total (All Students)	
	#	%	#	%	#	%
Completed	383	93.2%	2363	88.0%	2746	88.7%
Dropped	28	6.8%	323	12.0%	351	11.3%
<b>Total</b>	411	100.0%	2686	100.0%	3097	100.0%

# Final Grade Data, all Institutions 2005-2007

	All ESP-PLTL		All Non-ESP-PLTL		Total (All Students)	
	#	%	#	%	#	%
B or better	219	80.2%	1130	68.4%	<b>1349</b>	<b>70.1%</b>
Less than B	54	19.8%	522	31.6%	<b>576</b>	<b>29.9%</b>
<b>Total</b>	<b>273</b>	<b>100.0%</b>	<b>1652</b>	<b>100.0%</b>	<b>1925</b>	<b>100.0%</b>

	ESP-PLTL Female		Non-ESP-PLTL Female		Total (All Females)	
	#	%	#	%	#	%
B or better	70	83.3%	295	70.1%	<b>365</b>	<b>72.3%</b>
Less than B	14	16.7%	126	29.9%	<b>140</b>	<b>27.7%</b>
<b>Total</b>	<b>84</b>	<b>100.0%</b>	<b>421</b>	<b>100.0%</b>	<b>505</b>	<b>100.0%</b>

# Advantages for Peer Leaders (telephone interview)

- Common themes emerged
  - Improved Leadership skills
  - Opportunity to try out educator role
  - Reinforcement of understanding CS concepts
  - Increased confidence to continue in field
  - Friendships with students
  - Would recommend experience to others

# Summarizing results

- Active Recruiting increased number of women
  - Email/mailed invitation was most effective
- Retention of PLTL in CS students was higher
- Grades of PLTL in CS students was higher
- Friendships and Bonding occurred with students
- Advantages for Peer Leaders too
- PLTL in CS workshop April 2007 at Duke

# Web site

- Peer Led Team Learning in CS  
[www.pltlcs.org](http://www.pltlcs.org)



- Questions?