

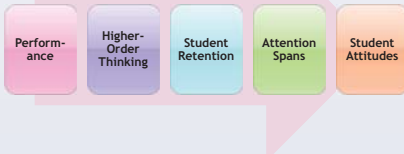
ACTIVE LEARNING IN ENGINEERING: PERSPECTIVES FROM GRADUATE STUDENT INSTRUCTORS

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What is Active Learning?

"Any instructional method that engages students in the learning process ... [it] requires students to do meaningful learning activities and think about what they are doing." (Prince, M. (2004). *Journal of Engineering Education*. 223-231)

Research shows that active learning leads to improvements in:



Purpose

This research investigates how engineering graduate student instructors (GSIs) describe and use 'active learning' in their classes, and identifies potential factors that may contribute to the likelihood that GSIs will adopt these techniques in their teaching practice.

Research Questions

- How do GSIs describe 'active learning' and use these teaching methods in their classes?
- What factors contribute to the likelihood that GSIs will adopt the use of active learning in their teaching practice?

Methodology

All 213 Engineering GSIs were invited to complete an online survey in the Winter 2012 term.

Survey

- Survey questions focused on: (1) GSI background information, (2) definition of 'active learning,' and (3) beliefs about the value of "good teaching" & confidence on teaching-related items.

Data Analysis

- Analysis of open-ended survey responses coded by quantifying the frequencies of responses and identifying emerging themes.
- Logistic regression used to test for significance differences between GSIs who report using particular 'active learning' teaching methods.

Participants

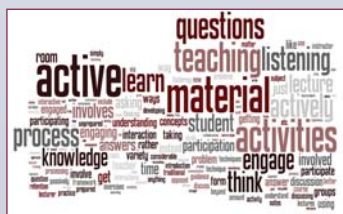
73 engineering GSIs provided responses to the survey 2-3 weeks before the end of the Winter 2012 term (34% response rate)

Terms Teaching	Winter 2012	
	Number	Percentage
One	34	46.6%
Two	25	34.2%
Three or more	14	19.2%
TOTAL	73	100.0%
Teaching Department		
Aerospace Eng.	2	2.7%
Atmospheric & Space Sciences Eng.	1	1.4%
Biomedical Eng.	5	6.8%
Civil and Environmental Eng.	8	11.0%
Chemical Eng.	10	13.7%
Electrical Eng. & Computer Science	24	32.9%
Engineering First Year Programs	2	2.7%
Industrial and Operations Eng.	8	11.0%
Mechanical Eng.	9	12.3%
Materials Science & Eng.	3	4.1%
Nuclear Eng. & Radiological Sciences	1	1.4%
TOTAL	73	100.0%
Teaching Responsibilities*		
Hold office hours	64	87.7%
Attend class	42	57.5%
Teach a lab	24	32.9%
Teach a discussion section	28	38.4%
Give lectures (not in a discussion section or lab)	23	31.5%
Grade homeworks or papers	17	23.3%
Grade exams	43	58.9%
Grade student labs or projects	29	39.7%
Supervise team projects	12	16.4%
Supervise graders	23	31.5%
Hold review sessions	24	32.9%
Email with students	68	93.2%
Maintain website	24	32.9%
Create assignments (homework, exams, etc.)	33	45.2%
Create solutions (homework, exams, etc.)	41	56.2%

*GSIs were allowed to choose more than one option, so percentages do not add up to 100%

Word Cloud: Define the term 'active learning'

The most common definitions included specific examples of classroom activities (e.g., working on problems & discussing them, brainstorming, responding to questions, etc.) Engineering GSIs also defined active learning in terms of what it is not, namely, not "passively listening" to lectures or "simply lecturing."



Note: This word cloud doesn't include occurrences of the words "learning," "students," & "class" in order to show a broader range of responses.

Active Learning Use



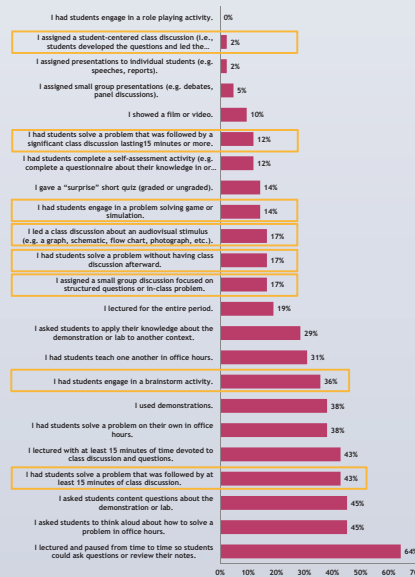
When asked, "Did you ever use active learning teaching methods in the class you taught this semester?" **75% of engineering GSIs said, "Yes."***



*However, their explanations highlight the varying degrees to which they integrated active learning into their classroom.

Range of Specific Teaching Methods

To identify specific teaching methods, engineering GSIs were asked to choose which teaching approaches they used during the term.



From this list of 23 teaching approaches, eight were chosen to create a new way to define active learning use (as indicated by)

Comparison of GSIs' Background, Perceptions & Use of Active Learning

Terms Teaching	Used Active Learning		Did Not Use Active Learning	
	Number	Percent	Number	Percent
Terms Teaching				
One	15	48.4%	16	51.6%
Two	9	52.9%	8	47.1%
Three or more	6	54.5%	5	45.5%
Teaching Responsibilities				
Teach a lab	7	46.7%	8	53.3%
Teach a discussion section	6	42.9%	8	57.1%
Hold office hours	7	53.8%	6	46.2%
Grade*	0	0.0%	6	100.0%
Give lectures	5	100.0%	0	0.0%
Supervise team projects	2	66.7%	1	33.3%
Other/Unknown	3	100.0%	0	0.0%
Interaction with a Peer Mentor				
Gathering feedback, observations	13	65.0%	7	35.0%
Other interaction	6	50.0%	6	50.0%
None	11	40.7%	16	59.3%
Personally value "good teaching"				
Very high & high	24	54.5%	20	45.5%
Average	5	41.7%	7	58.3%
Very low & low	1	33.3%	2	66.7%
Confidence in "thinking of students as active learners" (i.e., knowledge builders rather than information receivers)				
Very confident & confident	9	69.2%	4	30.8%
Neutral	15	57.7%	11	42.3%
Very unconfident & unconfident	6	37.5%	10	62.5%
Not applicable	0	0.0%	2	100.0%
Did not respond	0	0.0%	2	100.0%
Confidence in "encouraging student interaction"				
Very confident & confident	8	72.7%	3	27.3%
Neutral	12	54.5%	10	45.5%
Very unconfident & unconfident	9	45.0%	11	55.0%
Not applicable	1	25.0%	3	75.0%
Did not respond	0	0.0%	2	100.0%

*Grading incorporates homework, papers, student labs or projects

Lessons Learned

- Engineering GSIs are able to (1) define active learning in their own words and (2) the majority report using it in their classes → Suggests the value of pedagogical training on 'active learning' teaching methods (training is required for all engineering GSIs)
- Engineering GSIs who report that they think of students as 'knowledge builders rather than information receivers' are more likely to use active learning → Suggests providing GSIs with data (e.g., educational research to show the benefits of these teaching methods)
- Engineering GSIs who interact with a peer mentor (Engineering Teaching Consultants) are more likely to use active learning → Suggests GSIs should try to take advantage of these GSIs & their services.

