
Computer-Supported Scrum-Based Agile Pedagogy (CSAP)

Dissertation Presentation

By William Tarimo

Advisor: Timothy Hickey

Computer Science, Brandeis University

July 22nd, 2016

Outline

- 1. Summary
- 2. Background & Motivation
- 3. Research Questions
- 4. Scrum & Agile Soft. Dev.
- 5. Scrum & Pedagogy Design
- 6. Computer-Supported
Scrum-Based Agile
Pedagogy (CSAP)
- 7. TeachBack
- Experiments:
 - 8. Computers in the Classroom
 - 9. Early Detection of At-Risk Students
 - 10. Peer-Assisted Learning
 - 11. CSAP in hybrid online/physical classrooms
 - 12. Future Opportunities
 - 13. Contributions of the Research

CSAP: Summary

- Agile methods have revolutionized software development through
 - Continuous transparency, inspection, adaptation, customer collaboration, and incremental delivery
- In this research, we're proposing an analogous framework for pedagogy
 - **Computer-Supported Scrum-Based Agile Pedagogy (CSAP)**
 - Founded on agile teaching, active learning, and technology
 - Computer use provides efficiency, enables new approaches and opportunities
 - Students & teaching staff work as a cross-functional and self-organizing team
 - ... with iterative cycles of transparency, inspection, and adaptation
 - ... with dynamic interaction between content, instruction, and assessment in service of discovering optimal learning and teaching outcomes

Background: Issues We See

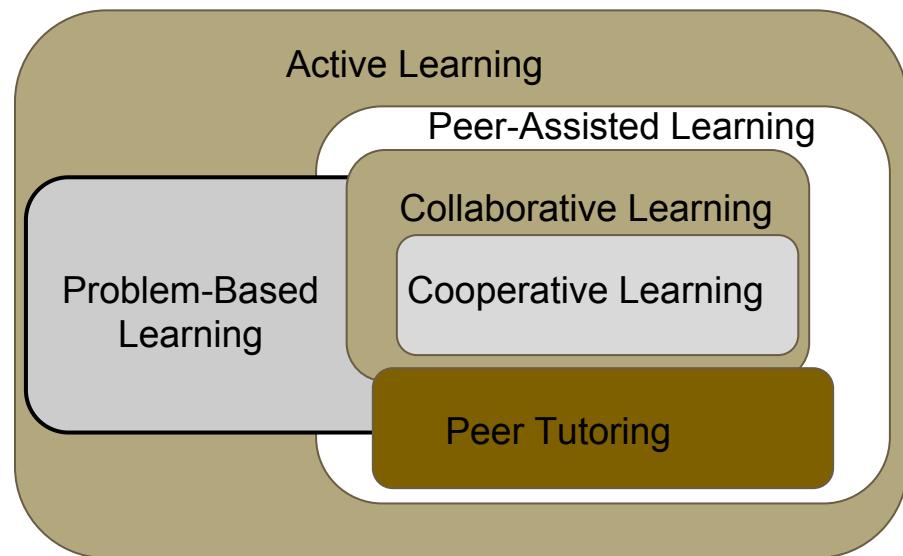
- Prevalence of traditional and inferior teaching/learning practices, in light of better ones
 - “One size does not fit all” - different teacher’s philosophy, demographic, subject area, school’s mission statements
 - Each responds to particular teaching/learning methods differently
- Poor adoption of effective teaching and learning practices from research
- Challenges of the 21st century classroom
 - Unmet student expectations for interactions, autonomy, flexibility, etc
 - Learning objectives often not fully achieved
 - Classroom technology not appropriately designed or used to its potential

Opportunities for developing CSAP

- Effective learning and teaching methods are widely available

Eg. Constructivism

- Eg. Flipped Learning



Opportunities for developing CSAP

- It is the right time for this approach in the 21st century classroom
 - Digital native / millennial students
 - Diversity in students and modes of learning/teaching
 - Abundance of technology and internet
 - Abundance of anytime/anywhere information

Opportunities for developing CSAP

- Educators and researchers are shifting to more learner-centered pedagogy
 - Focusing on the learning process and the particular students
 - Some more interactive and flexible classrooms
 - Virtual and online classrooms
 - MOOCs
 - Technologies: Learning Catalytics, EdX, EdModo, Apple Classroom apps, etc
- **We saw a feasible analogy from Scrum that could be exploited to combine these *opportunities* to effectively address the *issues* we saw**

Research Questions

How can we use CSAP to improve learning and teaching outcomes?

- How does the use of computers in the CSAP classroom affect learning outcomes?
- How can we monitor and predict learning outcomes in a CSAP classroom?
 - Moreover, can we proactively detect and support *at-risk* students?
- How can CSAP be effectively implemented in synchronous mixed online/physical classrooms?
- How can various learning/teaching approaches be effectively supported in CSAP?
 - We formally experimented with an implementation of collaborative learning

Agile Software Development

Agile Alliance: XP, Scrum, Adaptive Software Dev., Agile Organizing Framework, Pragmatic Programming., etc

Philosophy - self-organizing and self-managing teams working towards a goal are more effective than tightly controlled and directed approaches

Agile Manifesto - outlines the principles and values of Agile Soft. Dev:

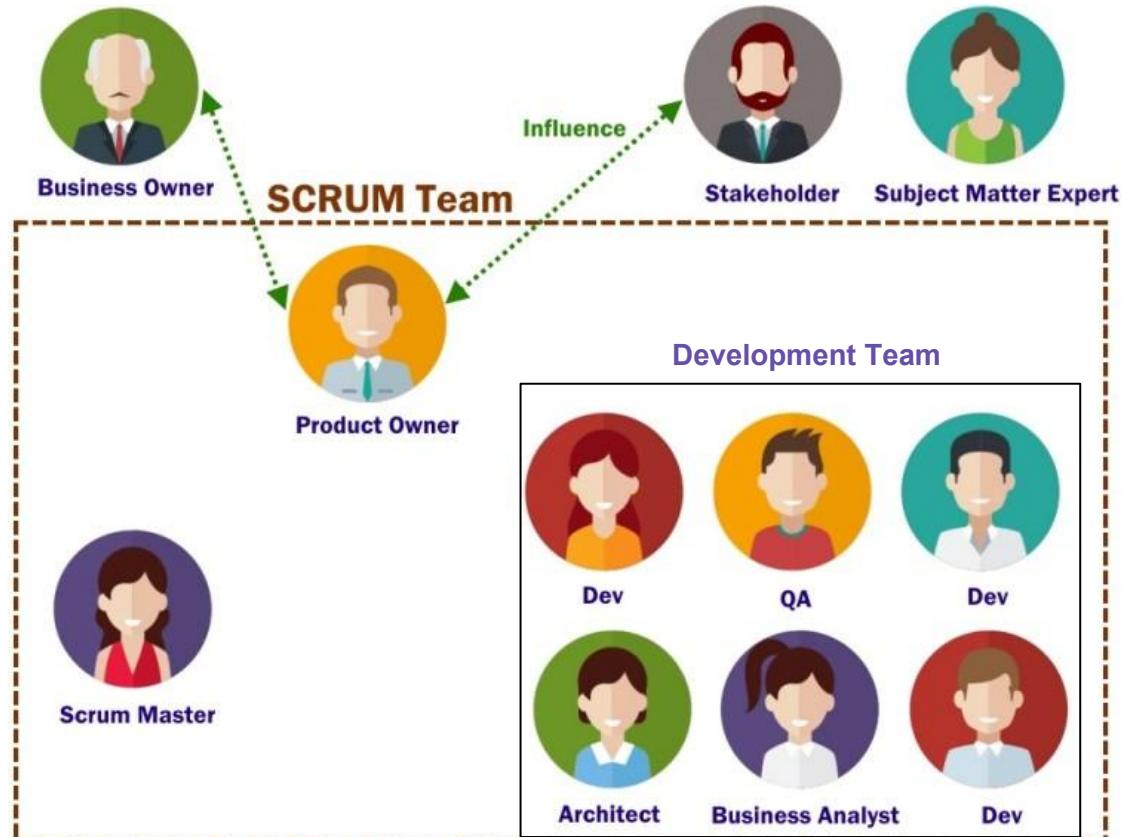
- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

Scrum

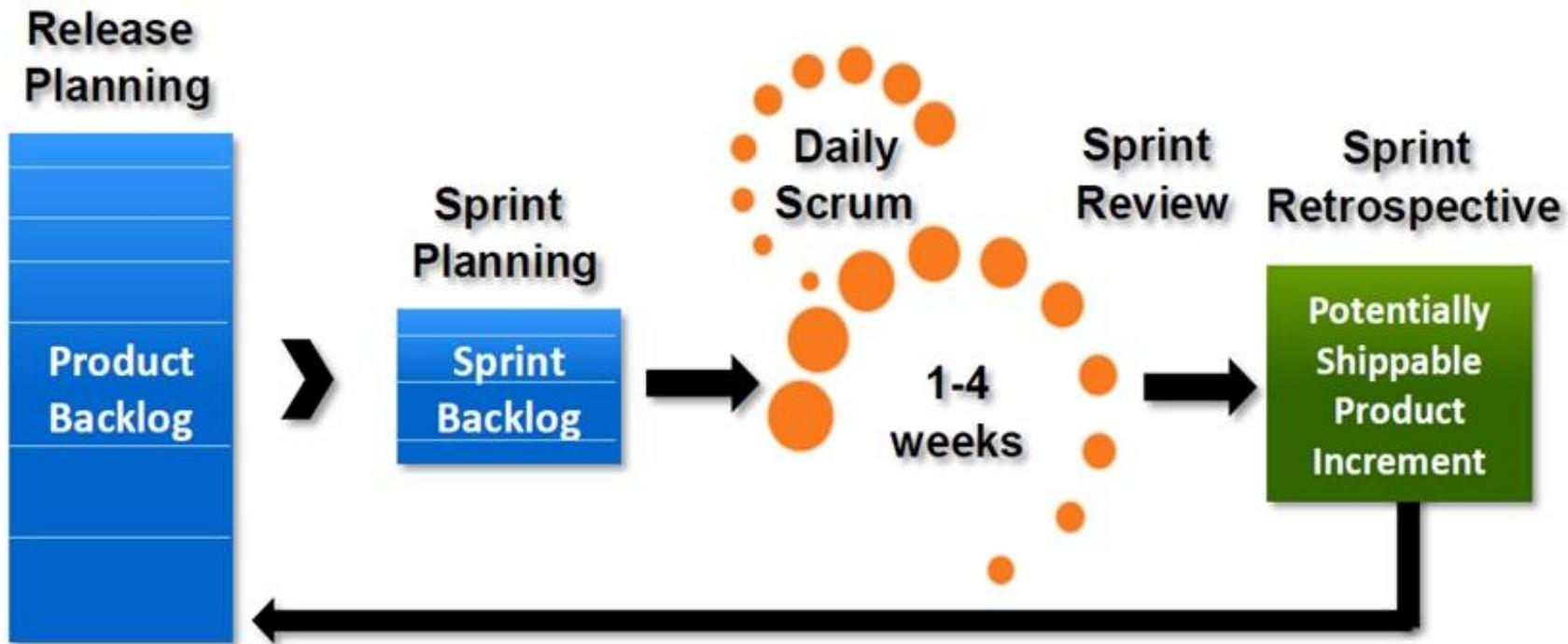
- The most popular and widely adopted of the agile methods
- An iterative design framework, uses self-managing and cross-functional teams, open collaboration, and well-managed chunks of time to achieve goals and deliverables towards a product.
- Scrum consists of: a team + roles + events + artifacts + rules
- At its core - Empiricism - “knowledge comes from experience and making decisions based on what is known”
- Scrum implementations are upheld by 3 pillars:
 - Transparency
 - Inspection
 - Adaptation

Scrum Team

- Product Owner - Owns 'what' is desired and 'why' it's desired
- Scrum Master - Keeper of the Scrum Process, facilitator
- Development Team - Owns 'how' and 'how quickly' work is delivered



Scrum Events



The Analogy: Scrum/Agile & Pedagogy Design

Agile Software Dev.

Agile Manifesto:

1. Individuals and interactions over processes and tools
2. Working software over comprehensive documentation
3. Customer collaboration over contract negotiation
4. Responding to change over following a plan

Scrum:

1. Transparency
2. Inspection
3. Adaptation

Agile Pedagogy

1. Students/teachers and their interactions over specific teaching/learning approaches
2. Working mastery over rote learning or memorization for grades
3. Student-centered instruction over syllabus-driven schedules
4. Receptive and responsive to student learning needs over following a fixed lecture/syllabus plan

1. Transparency, collaboration
2. Continuous testing, feedback
3. Fitting pedagogy to observed needs

How it looks in the classroom

- **Spontaneity:** each class is a sequence of contingent activities, selected by the instructor in real-time to best meet the needs of the students
- **Explicit Learning Goals:** each activity has explicit learning objectives shared with the students and evaluated by in-class formative assessments
- **Active Learning:** most activities involve students interacting directly with the content: collaborative, cooperative, problem-based, projects, etc
- **Agency:** students choose their own projects (with faculty approval) rather than having all students work on the same homework assignment
- **Belonging:** students work together as a class and in groups that change daily

The Analogy

Team:

- 1. Product Owner
- 2. Scrum Master
- 3. Development Team
- 4. Stakeholders

- 1. Instructor
- 2. Instructor, TA, Staff
- 3. Instructor, TAs, Staff, + Students
- 4. Students, parents, institution, etc

Events:

- 1. Sprint
- 2. Daily Scrum
- 3. Sprint Review
- 4. Sprint Retrospective

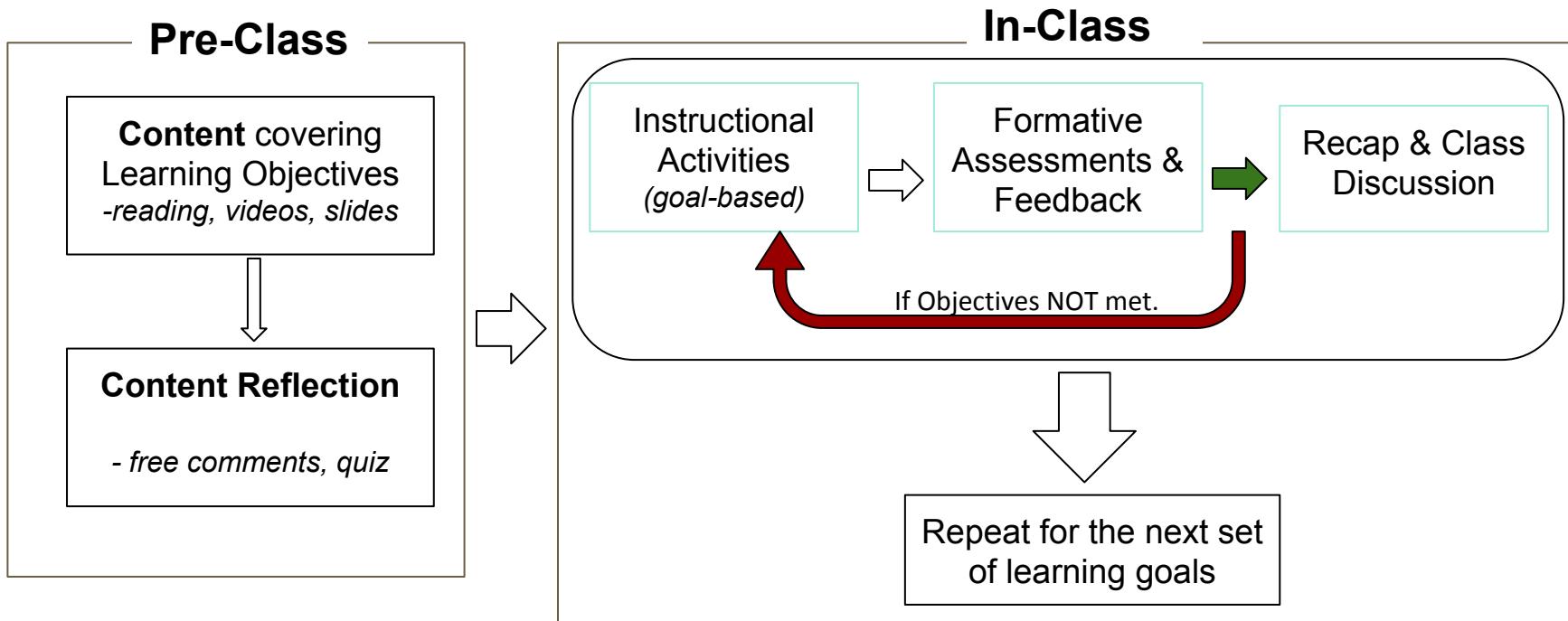
- 1. Unit in a semester course
- 2. Pre/Post-class feedback review
- 3. Unit/Midterm summative or formative exams
- 4. Instructor, TAs, Staff, + Students collectively review: feedback, results, resources, methods, enjoyment

Artifacts:

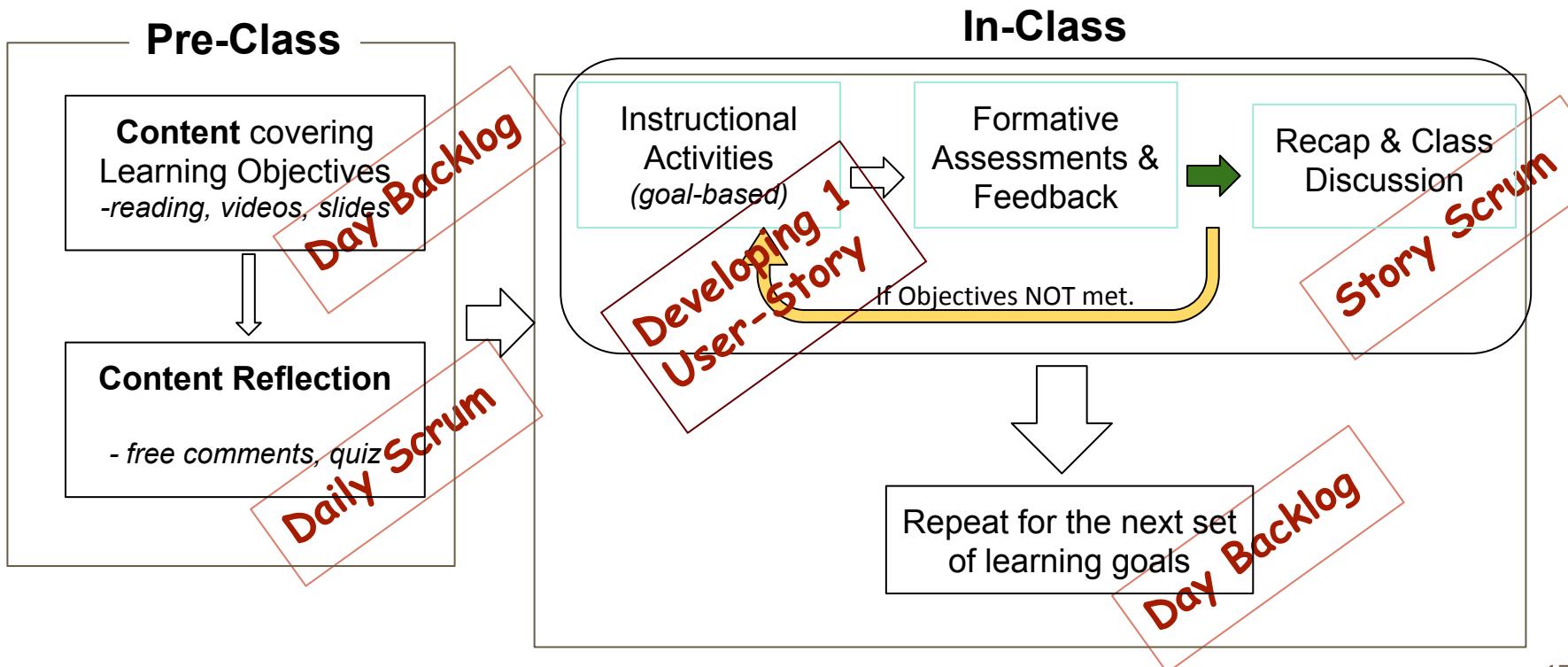
- 1. Software Product
- 2. Product Backlog
- 3. Sprint BackLog
- 4. Increment or "Done"

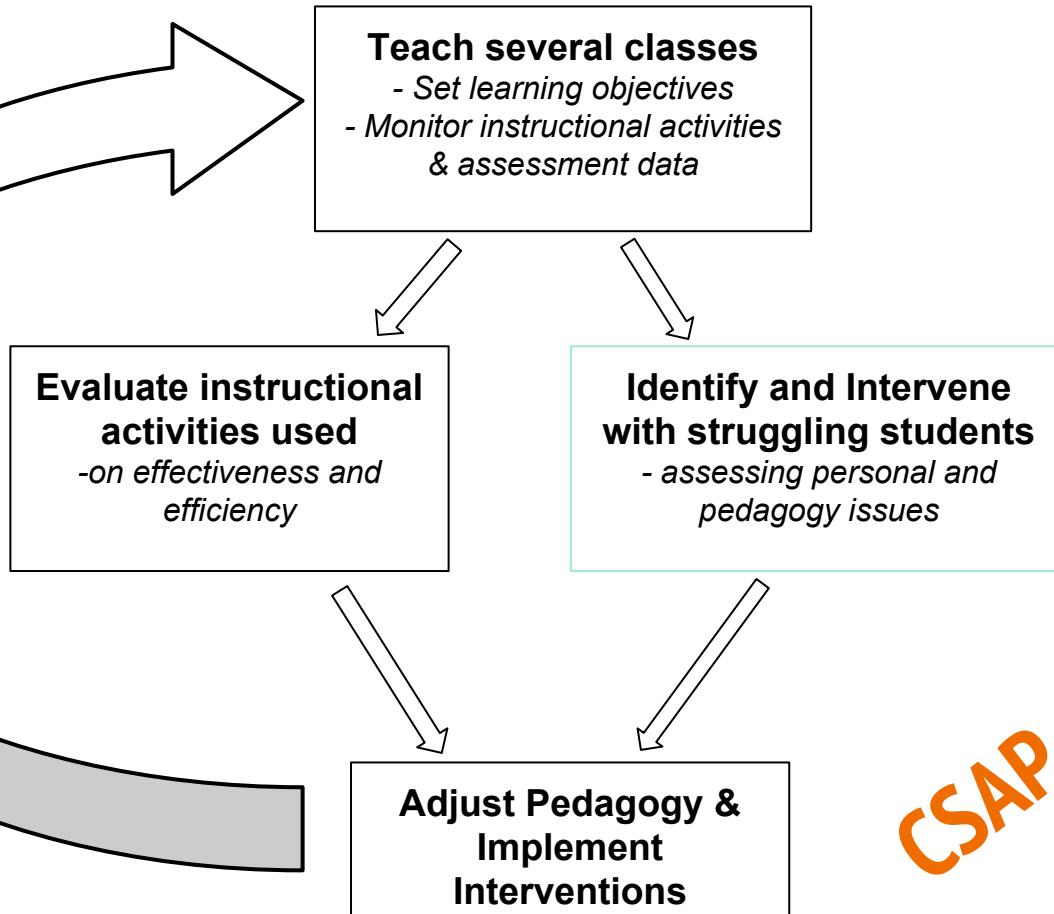
- 1. Optimal students' mastery of learning objectives
- 2. Syllabus
- 3. Unit learning objectives
- 4. Students' satisfactory mastery of unit objectives

CSAP Inside Class



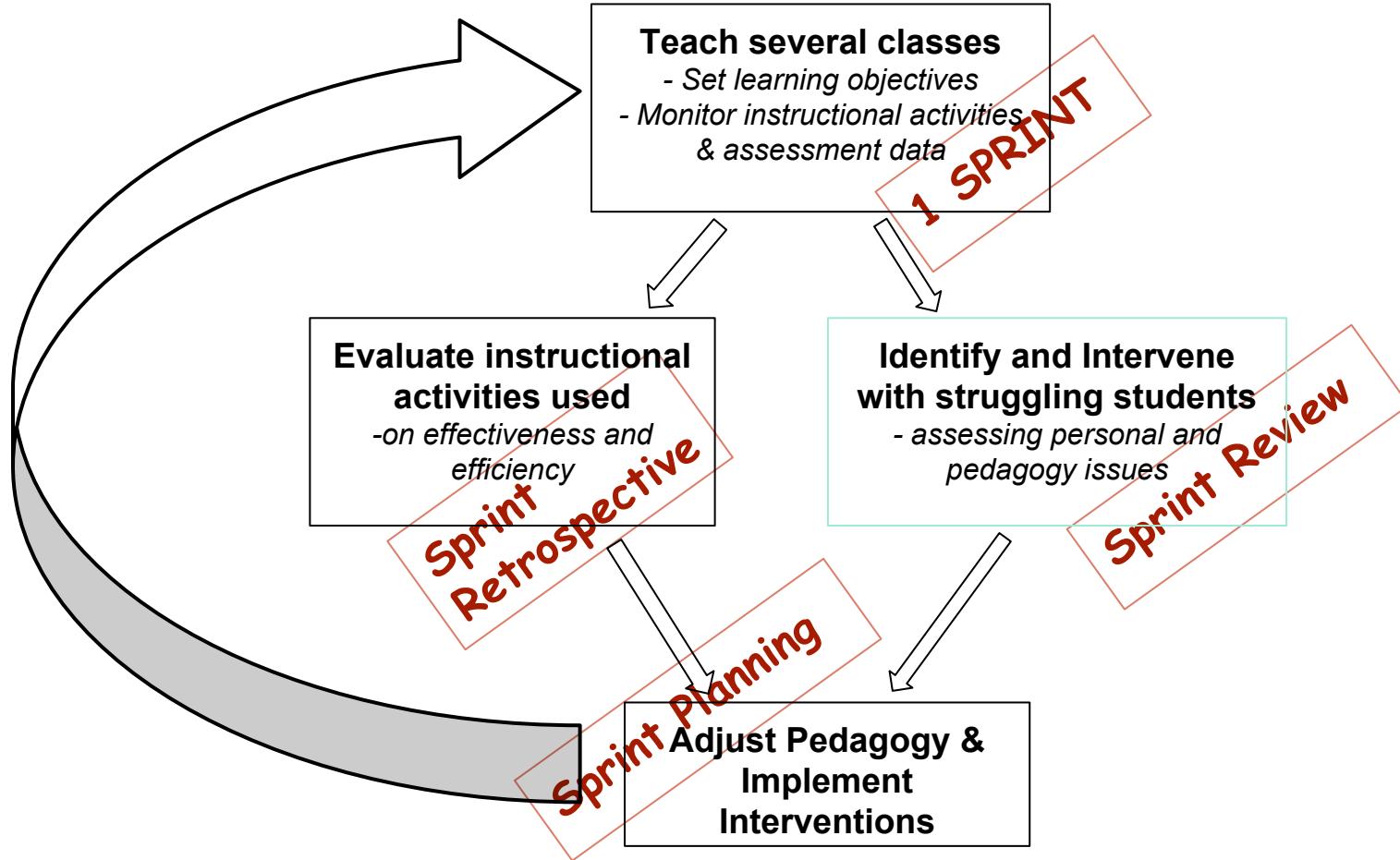
CSAP Inside Class





CSAP Outside Class

CSAP Outside Class



Benefits of Scrum-Based Agile Pedagogy

- ★ Teaching will be more agile and informed
 - More student-centric
 - More goal-oriented - towards optimal mastery of learning objectives
 - More effective
- ★ Teacher gains deep and practical insights on pedagogy with respect to teaching methods and learning by assessing her own teaching & students
- ★ Enforces more transparency on students' and teacher's expectations

Benefits of being Computer-Supported

- ★ Automatic collection of data from students and teaching/learning activities
 - Automatic analysis of data for student learning & teaching insights
 - Automatic analysis of data for understanding of each student's learning characteristics
- ★ Extends seamlessly to hybrid classrooms
- ★ Extends to large classes. Eg 300+
- ★ Supports back-channel communication to help small group of students catch up in real-time
- ★ Formative assessment is faster with real-time grading
- ★ Provides online resources for students to review

TeachBack



TeachBack

- an in-classroom web application designed to support the CSAP methodology

Main features:

- Questions - a clicker-style ARS
- Feedback - a rapid feedback mechanism
- Forum - a monitored in-class help & discussion forum
- GroupWork - a clicker-style Think/Pair/Share assessment system
- Stats - students participation and assessment stats
- + Others

... 1st, Some History

... spring 2013 ...

Affective Tutor

* Required

Your anonymous ID for this session/class! *

We'll use the ID to anonymously group and track your session responses!

How do you feel? *

Engaged
 Bored
 Confused

Why?

Submit

Never submit passwords through Google Forms.

... spring 2013 ...

Affective Tutor				
* Required	A	B	C	D
Your anonymous ID for this session/class!	Timestamp	How do you feel?	Why?	
	4/29/2013 9:56:49	Engaged	today is the last class	tjh724
How do you feel?	4/29/2013 9:58:48	Confused	testing	tjh724
<input type="radio"/> Engaged	4/29/2013 10:20:25	Bored		dm1234
<input type="radio"/> Bored	4/29/2013 12:58:25	Engaged		yanru
<input type="radio"/> Confused	5/1/2013 12:09:56	Engaged	good	tjh
Why?	3/31/2015 18:52:55	Engaged	Following Well	user1
	3/31/2015 18:53:11	Bored	Too slow	user2
	3/31/2015 18:53:21	Confused	Hard	user3
Submit	3/31/2015 18:53:31	Confused		user4
Never submit forms in Microsoft Forms.	3/31/2015 18:54:14	Engaged		user5
	3/31/2015 18:54:21	Engaged		user6

... spring 2013 ...

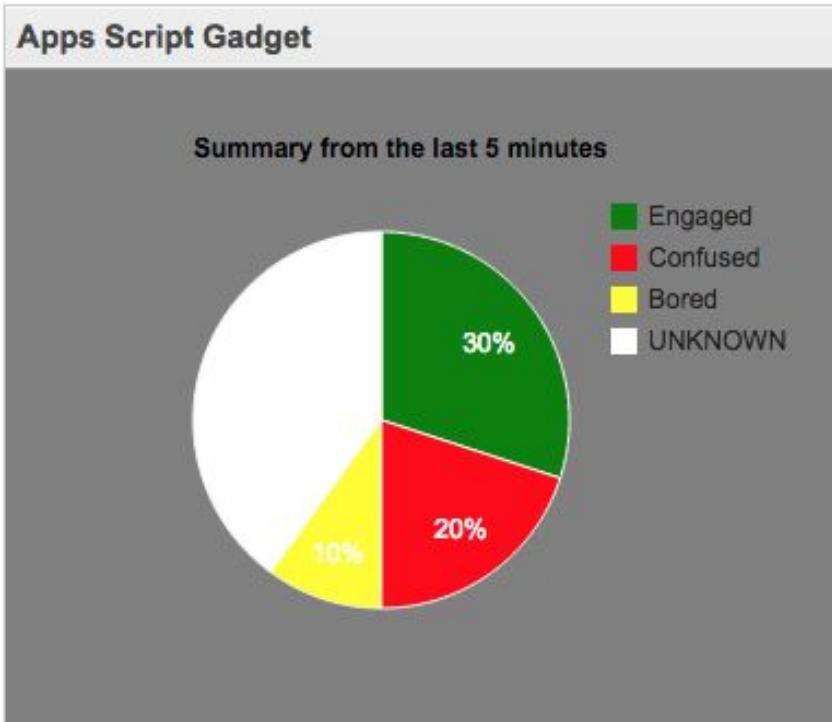
Affective Tutor

* Required

	A	B
Your anonymous ID		
We'll use this to track your responses		
How do you feel?	Timestamp	How do you feel?
	4/29/2013 9:56:49	Engaged
	4/29/2013 9:58:48	Confused
	4/29/2013 10:20:25	Bored
	4/29/2013 12:58:25	Engaged
	5/1/2013 12:09:56	Engaged
Why?	3/31/2015 18:52:55	Engaged
	3/31/2015 18:53:11	Bored
	3/31/2015 18:53:21	Confused
	3/31/2015 18:53:31	Confused
	3/31/2015 18:54:14	Engaged
	3/31/2015 18:54:21	Engaged

Submit

Never submitted to Google Forms.



summer 2013 ...

The screenshot shows the user interface of the Affective Tutor-Assistant 0.8 application. At the top, there is a dark header bar with a "Logout" button on the left, the word "Courses" in the center, and two circular icons with "+" and "c" on the right. Below the header, a large banner displays the message "Welcome, Demo Instructor!". Underneath this, a section titled "Courses You're Enrolled In: 1" lists a single course: "Web Application Development CS152aj, Sum14, Lectures: 6". To the right of the course name, it says "Class iScores: _%" and has a gear icon. At the bottom of the screen, a footer bar contains the text "The Affective Tutor-Assistant 0.8", a copyright notice about the research, the release date "Release Date: 12/5/2013", and a small information icon.

Courses You're Enrolled In: 1

Web Application Development
CS152aj, Sum14, Lectures: 6
Brandeis University, Course PINS: Instructor: 6843234 TA: 8864421 Student: 3769903

Class iScores: _%

The Affective Tutor-Assistant 0.8

Affective Tutor-Assistant is part of a doctorate research in Educational Technology (EdTech) at Brandeis University. The research and this application are the works of [William Tarimo](#) and [Timothy Hickey](#). Release Date: 12/5/2013

Copyright © 2013 by William Tarimo & Timothy Hickey. All rights reserved.

The Affective Tutor-Assistant 0.8

summer 2013 ...

iResponder

Logout + -

Summary Chart Responses Summary

Courses You're Enrolled In

Web Application Development
CS152aj, Sum14, Lecturer: Dr. Brandeis University,

Is the difference between HTML and CSS clear??? 0 = not at all 5 = absolutely

0 = not at all 5 = absolutely	Responses: 17
1 = I didn't learn anything 10 =	Responses: 12
2 = I still don't get it at all 5 = It is	Responses: 17
3 = I know it very well	Responses: 16
4 = I know it well	Responses: 15
5 = I know it very well	Responses: 16

Exit iResponder

summer 2013 ...

The screenshot shows a digital learning environment with the following interface elements:

- Top Bar:** Includes "Logout" button, navigation icons (refresh, back, forward), and a "Conversations" section.
- Left Sidebar:** "Courses You're Enrolled In" list:
 - Web Application Development CS152aj, Sum14, Lecture 1, Brandeis University, Cou...
 - Affective Tutor-Assistant University. The research...
- Summary Chart:** A donut chart with segments labeled 3.00: 1, 4.00: 1, and 4.00: 1.
- Conversations Section:** Titled "Conversations".
 - Question: "Is there any way we could have a list with the definitions of all of the new words we learned?" with 2 options.
 - Question: "Could we get a list of the unix commands we used today, or the total list we should know?" with 4 options.
 - Responses:
 - 14:19: hspector: I second this question!
 - 14:51: tjhickey: yes
 - 14:56: wtarimo: <http://ss64.com/bash/>
 - 14:57: wtarimo: Free book: <http://sourceforge.net/projects/linuxcommand/files/TCL/13.07/TCL-13.07.pdf/download>
 - New Response input field with a checkmark icon.
 - List of questions:
 - The touch command just changes the time? (Options: 6)
 - What is the difference between using ol and ul when making a list? (Options: 1)
 - What are all the uses for the script tag? (Options: 2)
 - Does CSS have the tr, th, span, and div stuff? Or is that specific to HTML? (Options: 1)
 - Is role used for tagging elements like class and id, or is it used for something else? (Options: 0)
 - Are there any other attributes besides li that is used inside an ordered list or an unordered list? (Options: 1)
- Bottom Navigation:** "Feedback Overview" (15:1:1), "Conversations", and other navigation icons.

summer 2013 ...

Lecture Overview

Logout

Summary Chat

Courses You're Enrolled In

Web Application Development
CS152aj, Sum14, Lecture 1
Brandeis University, Cou...

Affective Tutor-Assistant
University. The research...

Is the difference between CSS clear?

CONFUSED: 1
BORED: 1
ENGAGED: 15

Latest feedbacks recorded

Feedback Overview

Conversations

CanvasJS.com

15

CONFUSED: 1
BORED: 1
ENGAGED: 15

summer 2014 ...



teachback.herokuapp.com

User Account



TeachBack

wtarimo Logout

William

Past Courses

William

Course

Lecture

Activity

Tool



William Tarimo

wtarimo@brandeis.edu

wtarimo

My Current Courses 6

Enroll/Create New Course

94A: EL94a

Brandeis: Wed 17:00-18:00
Instructor: Timothy Hickey

MKTYP CS

Farber 101: Tue,Fri 12:30-14:00
Instructor: Hickey

CS155B: Computer Graphics

Gzang 124: Tue,Frid 9:30-11:00
Instructor: Hickey

BIOL42A: Physiology

Gerstenzang 123: Mon,Wed,Thu 08:00-08:50
Instructor: Maria Miara

TeachBack Announcements 0

NO CURRENT ANNOUNCEMENTS. Create new in a Course page.

Course



wtarimo Logout

⌚ William

Course

> 🏠 Enrollment 4

> ⚙️ Edit Course

> 📚 TeachBack Study

> 📈 Course Stats

🏠 William

👤 Intro to Computer Science!

💻 Lecture

📖 Activity

📍 Tool

Course Page: COSI 101: Intro to Computer Science!

📍 Volen 101 · ⏰ M,W,F 10:00 - 10:50 · 🧑 Instructor: William Tarimo
📅 Spring 2014 · 🏫 Harvard University
[>Show Enrollment PINs](#)

Course Lectures 4

Create New Lecture

L10: Quaternions

📅 On Wed 10/07/2015
ℹ️ 2822048 ...

L01: Overview

📅 On Sun 09/20/2015

Computer Science Basics

📅 On Tue 08/26/2014
ℹ️ Introduction ...

Welcome: Intro

📅 On Tue 08/26/2014
ℹ️ Info about the class ...

Course Announcements 0

ⓘ ANNOUNCEMENTS APPEAR HERE! Create one by clicking on 'New'

New

Lecture

 TeachBack

wtarimo Logout

Course

Lecture

Edit Lecture

Lecture Stats

William

Intro to Computer Science!

Welcome: Intro

Activity

Tool

Lecture Page: Welcome: Intro

Info about the class
On Tue 08/26/2014 10:00-10:50

Lecture Activities 2

Create New Activity

Class Discussion & Formative Assessment
We'll discuss various types of computer peripherals (hardware) We'll do exercises involving categorizing various devices we use all the time.

Rating: ★★★★☆

Lecture Presentation: Introduction to CS
We'll cover basics about computer software and hardware.

Rating: ★★★★☆

Current Activity

Activity - Instructor View

TeachBack

wtarimo Logout

Lecture

Activity

Feedback

Forum 7

Questions 4

GroupWork 4

Activity Stats

Edit Activity

William

Intro to Computer Science!

Welcome: Intro

Lecture Presentation: Introduction to CS

Tool

Lecture Presentation: Introduction to CS

We'll cover basics about computer software and hardware.

Rating:  0

Version 0.8 · [About TeachBack](#) · [Contact Us](#) · [Report Technical Suggestions/Issues](#) · © TeachBack 2015



Activity - Student View

Screenshot of the TeachBack student view interface.

Header:

- TB TeachBack logo
- User profile: mjane
- Logout link

Navigation bar:

- Lecture
- Activity
- Forum (6)
- Questions (4)
- GroupWork (4)
- My Activity Stats

Current location:

- Mary
- Intro to Computer Science!
- Welcome: Intro
- Lecture Presentation: Introduction to CS (highlighted in green)
- Tool

Activity details:

- Activity Page: Lecture Presentation: Introduction to CS
- Rating: 0 (with a red arrow pointing to the rating scale)
- Text: We'll cover basics about computer software and hardware. (with a red arrow pointing to the text)
- My Activity Notes:
 - YOU HAVE NOT WRITTEN ANY NOTES FOR THIS ACTIVITY!
 - Edit button (with a red arrow pointing to it)

Footer:

- Version 0.8 · [About TeachBack](#) · [Contact Us](#) · [Report Technical Suggestions/Issues](#) · © TeachBack 2015
- Bored icon (with a red arrow pointing to it)

Feedback - Student View

 TeachBack

User: m jane Logout

Lecture

Activity

Forum 6

Questions 4

GroupWork 4

My Activity Stats

Home Mary Intro to Computer Science! Welcome: Intro Lecture Presentation: Introduction to CS Tool

Activity Page: Lecture Presentation: Introduction to CS Rating: 0 0 Rate

We'll cover basics about computer software and hardware.

My Activity Notes Edit

YOU HAVE NOT WRITTEN ANY NOTES FOR THIS ACTIVITY!

Version 0.8 · [About TeachBack](#) · [Contact Us](#) · [Report Technical Suggestions/Issues](#)



Bored

Current/Latest Feedback State: Bored

Engaged Confused Bored

Optional Short Comment (50hrs)

Submit

Submit a sentiment that reflects your current state

Feedback - Instructor

TeachBack

Logout

Lecture

Activity

> Feedback

> Forum (9)

> Questions (2)

> GroupWork (0)

> Activity Stats

> Edit Activity

William

Teachback Workshops

First Lecture

First Activity

Feedback

Latest Feedback Summary

Category	Count	Percentage
Engaged	6	75.0%
Confused	2	20.0%
Bored	1	5.0%

Engaged: (Count: 6, Percentage: 75.0%)
>I'm following!
>going well!

Engaged Confused Bored

Class Feedback Timeline

Time	Engaged	Confused	Bored
14:25	1	0	0
14:28	4	0	0
14:31	3	0	0
14:34	4	1	2
14:37	4	1	2
14:40	4	1	2
14:43	4	1	2
14:46	4	1	2
14:49	4	1	2
14:52	5	0	2
14:55	5	1	1
14:58	5	1	1
15:1	5	1	1

Engaged Confused Bored

Forum



TeachBack

wtarimo

Lecture

Activity

Feedback

Forum 22

Questions 3

GroupWork 0

Activity Stats

Edit Activity

William

3D Animation

L06: Logic

Levels

Forum

Posts 22

Create New Post

All Posts

Questions

Resolved

Unresolved

Notes

Interesting

Confusing

My Posts

Private

Popular

I haven't remained lost the entire class. That's never happened before!

Note | at 10:42, 1 year ago | By [REDACTED] | 1 comment | 20 views | 1 recommend

FPS

The bullet shoots in the same direction regardless of the avatars orientation pls help

Resolved | at 10:24, 1 year ago | By [REDACTED] | 1 comment | 16 views

Flowers shoot downwards

When I shoot, the flowers shoot downwards not across. How do I fix this?

Resolved | at 10:24, 1 year ago | By [REDACTED] | 1 comment | 7 views

invisible plane

How did you make the plane invisible?

Unresolved | at 10:17, 1 year ago | By [REDACTED] | 2 comments | 6 views

collision with plane

Questions - Instructor View



wtarimo Logout

Lecture

Activity

> Feedback

> Forum 1

> Questions 5

> GroupWork 0

> Activity Stats

> Edit Activity

William

Computer Graphics

L05: Transforms

First Activity

Questions

Activity Questions 5



Create New Question

rot

find the rotation matrix for the angle 0.5 radians around the x axis cos = 0.878 sin = 0.479

Responses: 39, ✓ 23/39: 58%



Correct Answer:

[1 0 0 0; 0 0.878 -0.479 0; 0 0.479 0.878 0; 0 0 0 1]

matrix mult

[1 4 6; 0 3 2] * [1 2; 2 3; 5 10]

Correct Answer:

[39 74; 16 29]

Responses: 40, ✓ 29/40: 72%



apply matrix to vector

what is [1 2 3; 5 5 0] * [1 4 6]'

Correct Answer:

[27,25]' or [27 25]' or [27; 25]

Responses: 40, ✓ 30/40: 75%



matrix mult

what is [0 1; -1 0] * [3 5]'

Correct Answer:

[5; -3] or [5, -3]' or [5 -3]'

Responses: 41, ✓ 27/41: 65%



Can you multiply two 4x4 matrices together?

Responses: 40



Questions - Instructor View

Activity

Feedback

Forum 6

Questions 5

GroupWork 0

Activity Stats

Edit Activity

Question Summary

Create New Question

Question: What is the intersection "time" t for the ray through the origin in direction $(1,1,1)$ and the plane through $(2,3,4)$ with normal $(3,2,1)$

48 Responses List

48 Responses Chart

Edit Question

4.3

16/6

2.666

?

5.38

Points: 2.0

Points: 2.0

GroupWork - Instructor View



wtarimo Logout

Lecture

Activity

Feedback

Forum 4

Questions 1

GroupWork 4

Activity Stats

Edit Activity

William

Computer Graphics

L15: Prototypes

First Activity

Group Questions

Group Tasks 4



Create New Task

Group Tasks 4

Student Groups 14

Spin the objects in the scene

Write the code that goes in the render method which will make all of the objects (except the plane and lights) continually spin

InGroup: 16, ✓ 12/16: 75%

Individual: 31, ✓ 12/31: 38%



operations on a scene

write a javascript expression which, when you run it in the developer console moves every object up 1 unit

InGroup: 24, ✓ 16/24: 66%

Individual: 34, ✓ 13/34: 38%



Point3D

Create a Point3D class with
a constructor, and add,dot,toString methods
`z = new Point3D(1,2,2)`
`w = newPoint3D(1,1,1)`
`console.log(z.dot(w))`

InGroup: 25, ✓ 20/25: 80%

Individual: 35, ✓ 22/35: 62%



multiplication

add a multiply method to the Complex class
and you should cut/paste in the Complex.prototype code here ...

InGroup: 30, ✓ 20/30: 66%

Individual: 35, ✓ 16/35: 45%



GroupWork - Student View



jsmith Logout

Lecture

Activity

Forum 6

Questions 4

GroupWork 4

My Activity Stats

John

Intro to Computer Science!

Welcome: Intro

Lecture Presentation: Introduction to CS

Group Questions

Group #1 John Smith Mary Jane

Info: 2. You're required to submit your FINAL PERSONAL response from any of the group responses; it doesn't have to be one of your answers!

Group Responses

Question: Evolution

Did humans evolve from monkeys?

No

jsmith | at 09:24, 5 months ago

Points: 2.0 | Good!

My 1st



Yes

mjane | at 11:07, 5 months ago



No

2 2^{final} | mjane | at 11:18, 5 months ago

Points: 2.0

My 2^{final}



Select Answer

Submit

Group Chat

I agree, that's why we still have both humans and monkeys today.

jsmith | at 17:04, 6 minutes ago



I think both humans and monkeys evolved from the same common ancestor. So the answer is no.

2 | mjane | at 17:00, 10 minutes ago



yeah

jsmith | at 00:51, 5 months ago



New Comment



Participation & Performance Stats

TB TeachBack

wtarimo Logout

William

Course

Enrollment 4

Edit Course

Course Stats

William

Intro to Computer Science

Lecture

Activity

Tool

Course Page: COSI 101: Intro to Computer Science!

Volen 101 · M,W,F 10:00 - 10:50 · Instructor: William Tarimo
Spring 2014 · Harvard University

Class Activity Stats

Select range for lecture dates! Default: Course start to end dates.

Start Date 01/14/2014 End Date 12/31/2015

Questions Stats Forum Stats Feedback Stats GroupWork Stats Attendance Stats At Risk Stats

Full Name	E-mail	%C	Pts.	Correct	InCorrect	Ungraded 0	%Answered
Mary Jane	mjane@email.com	100.0%	6.0	36.0	0.0	0/0	50.0%
John Smith	jsmith@email.com	0%	0.0	0.0	0.0	0/0	0%

Attendance Stats



wtarimo Logout

- William
- Course
- > Enrollment 43
- > Edit Course
- > Course Stats

Class Activity Stats

Select range for lecture dates! Default: Course start to end dates.

Start Date	End Date
08/28/2015	12/18/2015

Questions Stats Forum Stats Feedback Stats GroupWork Stats Attendance Stats At Risk Stats

Active Participation · Showed Up Only · Absent

Full Name	Email			
[Redacted]	[Redacted]	18	0	8
[Redacted]	[Redacted]	18	1	7
[Redacted]	[Redacted]	21	0	5
[Redacted]	[Redacted]	21	0	5
[Redacted]	[Redacted]	22	1	3

At-Risk Assessment

TB TeachBack

wtarimo Logout

Start Date 08/28/2015 End Date 12/18/2015

Questions Stats Forum Stats Feedback Stats GroupWork Stats Attendance Stats At Risk Stats

Based on less than 25.0 % attempts or performance on graded Questions and GroupWork(individual answers) problems.

Full Name	E-mail	QnsAnswd	%QnsAnswd	%QnsAnswdC	GrWkAnswd	%GrWkAnswd	%GrWkAnswdC
[Redacted]	[Redacted]✉	24/33	72.7%	58.3%	67/67	100.0%	4.5%
[Redacted]	[Redacted]✉	28/33	84.8%	28.6%	60/67	89.6%	1.7%
[Redacted]	[Redacted]✉	33/33	100.0%	51.5%	61/67	91.0%	9.8%
[Redacted]	[Redacted]✉	33/33	100.0%	51.5%	58/67	86.6%	19.0%

Recent Ways TeachBack has Been Used

1. Pre-class posting of activities and assignments
 - Reflection posts/comments or quiz
2. In traditional lecture classes as an interactive and assessment companion
3. Full deployment in active and flipped classes
4. Facilitation of in and out of class assignments, quizzes and exams
5. A repository of notes, class content for self-study and revision
6. Collection and analysis of students participation and assessment records.
Including various types of attendance

CSAP Experiments Using TeachBack

Research Question #1

- How does the use of computers in the CSAP classroom affect learning outcomes?

Computers in the CS1 Classroom

William T. Tarimo, Fatima Abu Deeb, Timothy J. Hickey.

The 7th International Conference on Computer Supported Education. May 2015

A Flipped Classroom With and Without Computers

William T. Tarimo, Fatima Abu Deeb, Timothy J. Hickey

Computer Supported Education, pp 333-347. Springer International Publishing Switzerland, February 2016

The Experiment

Compare two approaches to similarly flipping a CS1 class

I. Computer-supported

For all interactions, formative assessments, feedback, coding using TeachBack and Spinoza & other tools

II. Without students' computers

Use pen & paper, in-person discussions, traditional interactions

Constants: Instructor, pedagogy, materials, lectures, questions and coding challenges

Flipped CS11a during Fall 2014

Course: Introduction to Programming in Java and C

- I. 2 sections, each ~145 students
- II. Pre-class: Assigned readings + mandatory reflection or short assignment
- III. 50-minute class (M,W,F): 3-5 interactive activities
- IV. Four 3-week units with summative exams in the end
- V. Section 1 no computers during unit 3, section 2 no computers during unit 4.

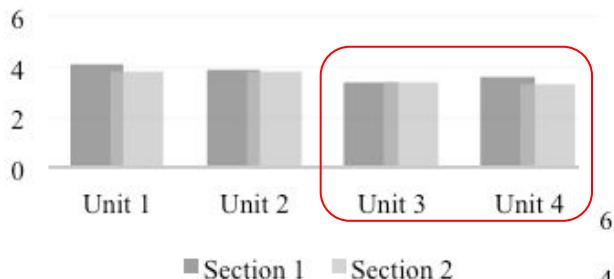
Data Collected

- End-of-unit surveys
 - various self learning assessments
 - assessments of teaching styles and tools
- Frequency of visits to TAs hours
- Hours spent on the course outside of class
- Participation in TeachBack and Spinoza
- End of unit quiz grades
- Final course grades

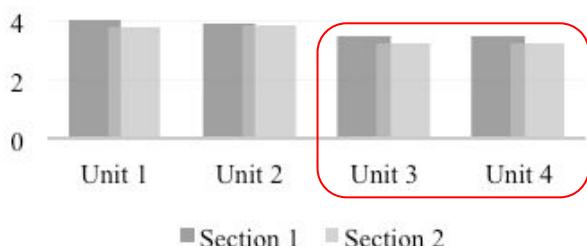
Results

1. (TeachBack & Spinoza) computer use didn't harm learning outcomes

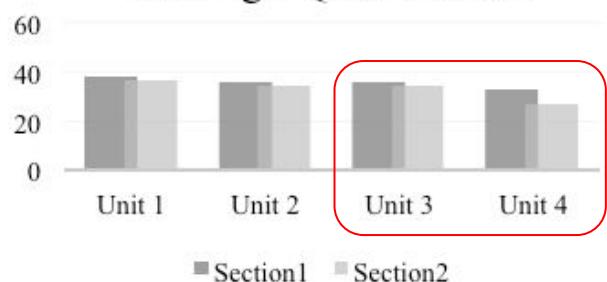
Average Unit Enjoyment



Average Unit Understanding



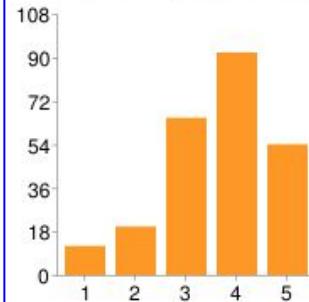
Average Quiz Grades



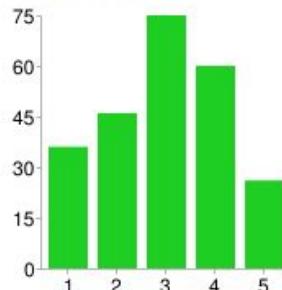
Results

2. Most students prefer the computer-supported pedagogy option

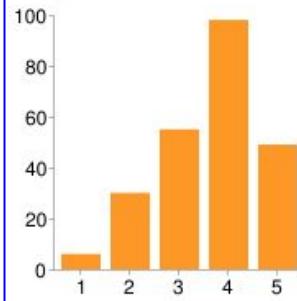
How well do you learn from TeachBack/Spinoza lectures in



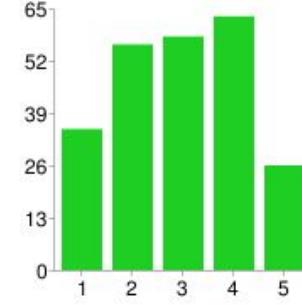
How well do you learn when you are asked to write programs on paper with your friends in class?



How well do you learn from TeachBack/Spinoza lectures in this class?



How well do you learn when you are asked to write programs on paper with your friends in class?



UNIT 3

UNIT 4

Results

3. Lack of distraction from computer use in class

Most students didn't report being distracted

- Largely due to the engaging and segmented class meetings
 - Short interactive activities => students engaged with material, peers and instructor
- Students are more likely to be distracted by computers in traditional lecture classrooms

Results

4. A few students were distracted by computers in class

- A few students indicated learning and concentrating better without computers
- Also reported being easily distracted in general (ADHD)
- Some Comments:
 - *"Not using a computer, it lead me to better concentrate."*
 - *"Not being allowed to use our computers helped for concentration and focus."*

Results

5. Students generally approved of the active learning approach

- With or without computers
- Some comments:
 - *"The class was very lenient towards our learning ... Learning is the number one goal."*
 - *"I was forced to try to learn the material to the best of my ability beforehand to as possible whether or not I was using my computer or notebook."*

Research Question #2

- How can we monitor and predict learning outcomes in a CSAP classroom?
 - Moreover, can we proactively detect and support *at-risk* students?

Early Detection of At-Risk Students in CS1 Using TeachBack/Spinoza

William T. Tarimo, Fatima Abu Deeb, Timothy J. Hickey.

Consortium for Computing Sciences in Colleges — Northeastern Region. April, 2016

The Experiment

Class: Flipped CS11A class in fall 2014

Analysis: How data from students interactions, feedback and performance in formative assessments correlated with performance in the course

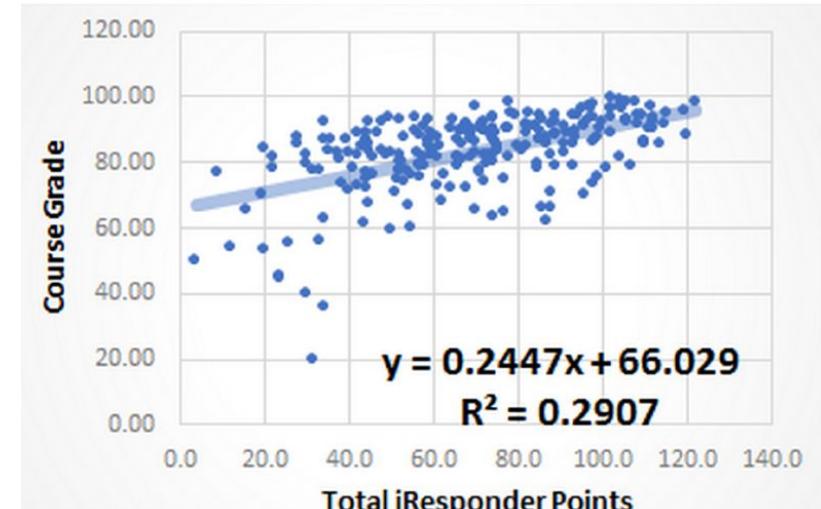
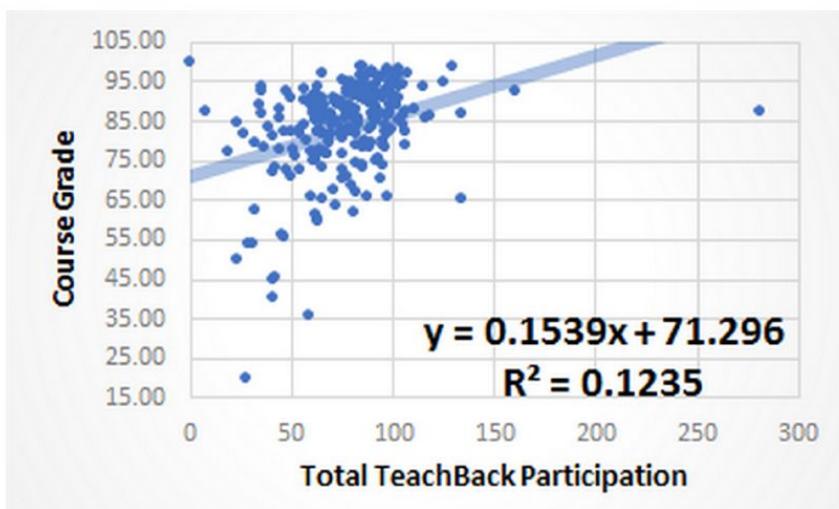
Measures we looked at: engagement, learning speed, confidence, drive, and persistence

Results

- Positive correlations to course grade
 - Engagement: f.a. questions answered, Feedback records, Forum posts & comments
 - Learning Speed: Total points earned in formative assessment activities
 -
- Suggestive correlations
 - Drive: Mandatory and optional programming challenges attempted in Spinoza
 - Persistence: Average compilation attempts on programming challenges in Spinoza
 -
- Poor correlation
 - Confidence: student self-assessed level of confusion when first encountering new topics
 - Overall feedback from being Engaged, Bored and Confused

Results

- Positive correlations to course grade: Engagement and Learning Speed

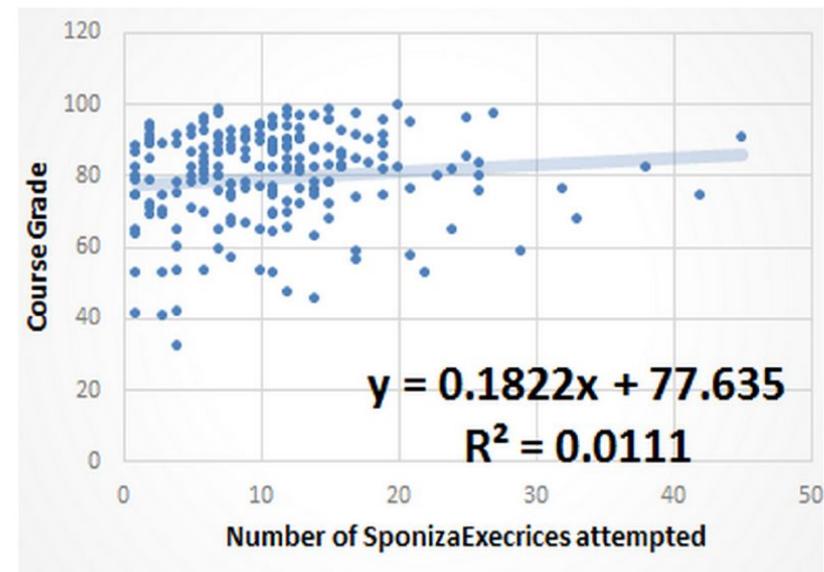
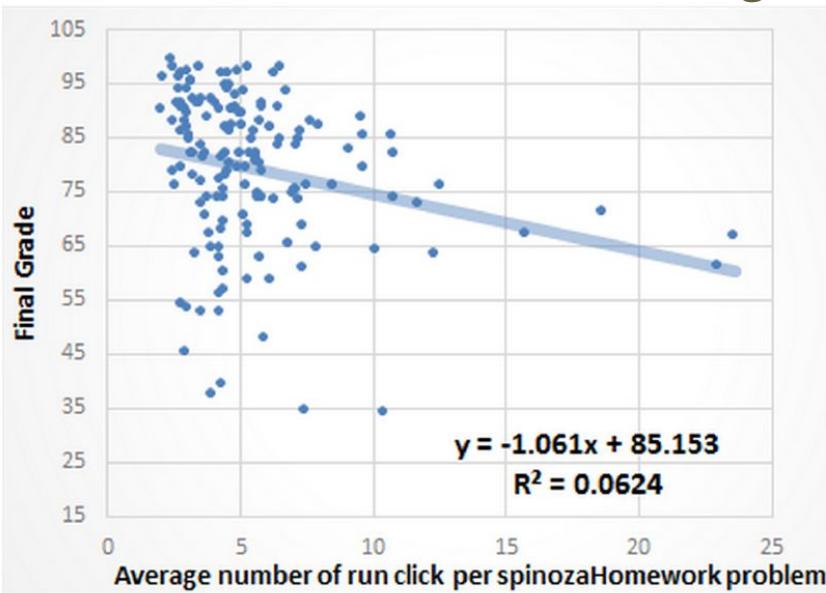


Engagement: Course Grade vs of Teach-
Back Participation

Learning Speed: Course Grade vs Total
iResponder Points

Results

- Poor correlations to course grade: Persistence and Drive

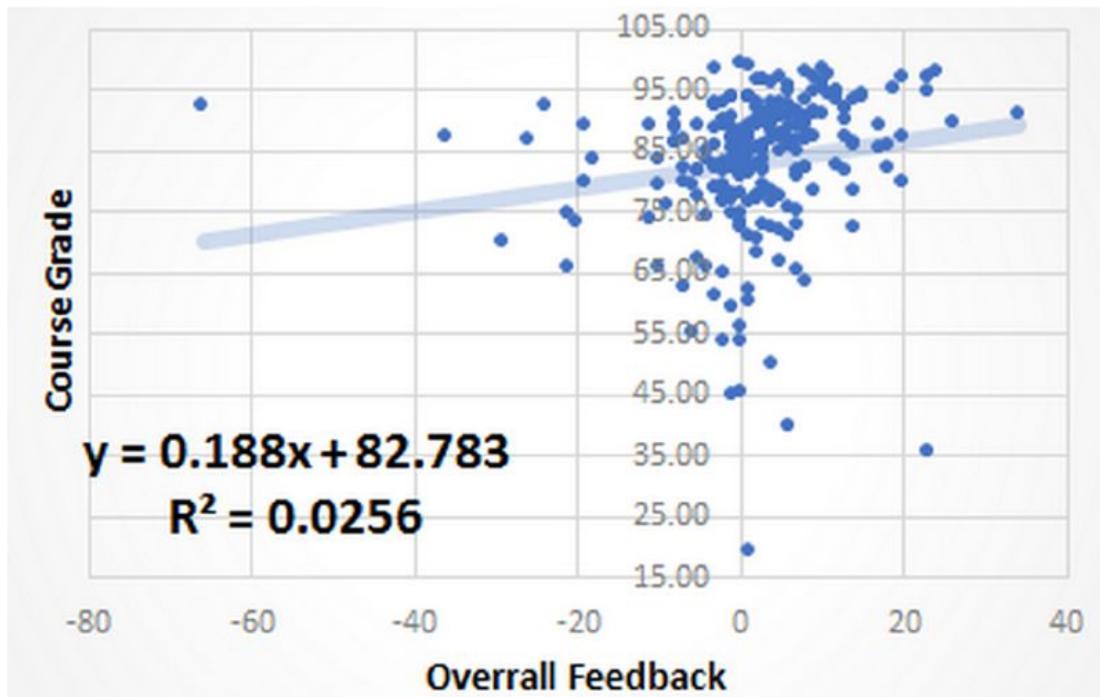


Persistence: CourseGrade vs Average
Number of Compilations per Homework Problem

Drive: CourseGrade vs Number of Exercises Attempted

Results

- Poor Predictor: Confidence



Detecting & Supporting At-Risk Students

- Detection:
 - currently using participation and performance in formative assessment
- Example Interventions:
 - Struggling students are emailed, asked to visit TAs or the instructor's office hours
 - Group TA visits for students with common misunderstanding
 - + Others

Questions Stats

Forum Stats

Feedback Stats

GroupWork Stats

Attendance Stats

At Risk Stats

ⓘ Based on less than 25.0 % attempts or performance on graded Questions and GroupWork(individual answers) problems.

Full Name

E-mail

QnsAnswd

%QnsAnswd

%QnsAnswdC

GrWkAnswd

%GrWkAnswd

%GrWkAnswdC

Research Question #4

- How can CSAP be effectively implemented in synchronous mixed online/physical classrooms?

Fully Integrating Remote Students into a Traditional Classroom using Live-Streaming and TeachBack

William T. Tarimo, Timothy J. Hickey
Frontiers in Education (FIE). October 2016

The Experiment

Class: Flipped Computer Graphics class, Fall 2015

Analysis: The effects of allowing optional remote attendance by using live lecture-streaming and required TeachBack use. From half-way in the semester

Data: TeachBack attendance, engagement and performance. Echo360 data. Final exam and course grades.

Results: A feasible and pedagogically justifiable alternative/supplement to regular class attendance

Results: Effects on Absenteeism

- Overall class attendance remained the same, counting remote attendance
- On average /day: 75% physically in class, 18% remote, and 7% absent

ABSENTEEISM, GROUPED BY NUMBER OF CLASSES MISSED BY STUDENTS
DURING PARTS 1 AND 2 OF THE COURSE.

Missed Classes	Students (Part 1)	Students (Part 2)
0	23	17
1	11	12
2	5	8
3	0	2
4	2	0
6	0	2

Results: Student Use of Live-streaming

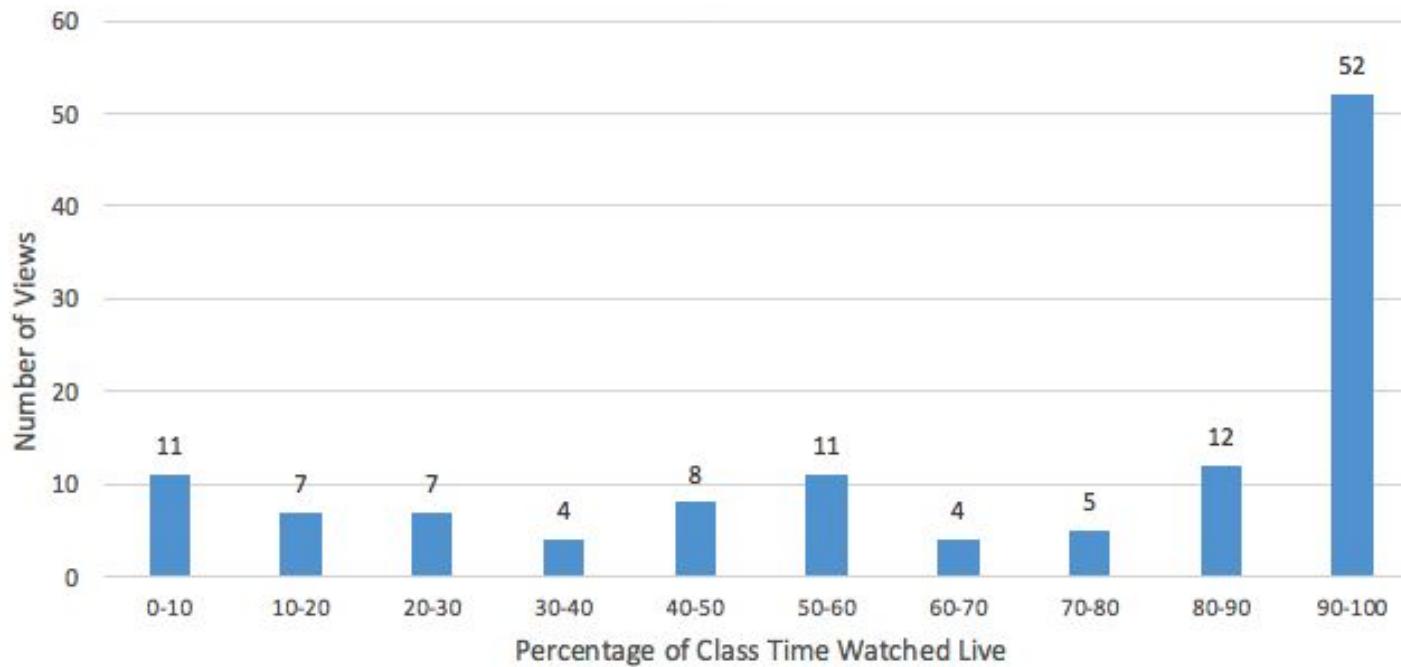
- Students embraced the option

REMOTE ATTENDANCE, GROUPED BY NUMBER OF CLASSES
LIVE-STREAMED BY SPECIFIC STUDENTS.

Classes	Students	Percentage of Class
0	10	25%
1	10	25%
2 - 5	14	32%
7 or More	7	18%

Results: Student Use of Live-streaming

- Students were committed to streaming-lectures while remote



Results: Effects on Learning Outcomes

- Has insignificant effect course performance compared to absenteeism

**LINEAR REGRESSION ANALYSIS: MODIFIED COURSE GRADE VS.
ABSENTEEISM AND REMOTE ATTENDANCE.**

Item	R²	P-Value	Coefficient
Remote Attendance	0.011	0.519	-0.261
Absenteeism	0.211	0.00283	-2.081

Results: Effects on Learning Outcomes

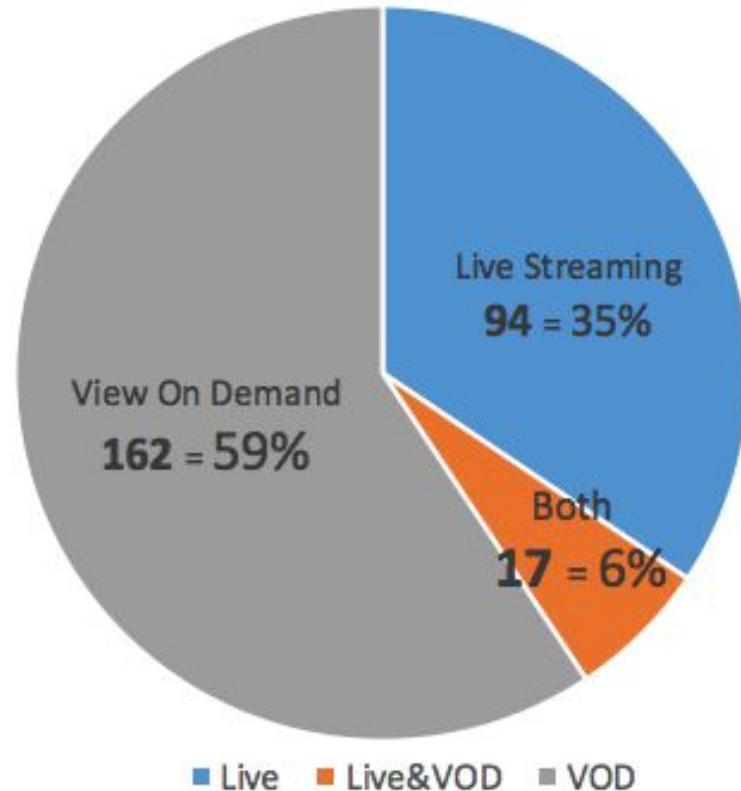
- Has insignificant effect on participation grade compared to absenteeism

LINEAR REGRESSION ANALYSIS: CLASS PARTICIPATION GRADE VS. ABSENTEEISM AND REMOTE ATTENDANCE.

Item	R ²	P-Value	Coefficient
Remote Attendance	0.0156	0.441	-0.476
Absenteeism	0.435	0.0000036	-4.568

Results: Use of Lecture Recordings

- Popular resource for both remote and face-to-face attendees



Results: Student Opinions

1. 51.5% - All or most courses should have the option
2. 30.6% - Just affective or more, 50% thought it was inferior, 19.4% Didn't try the option
3. on scale [1, 5], 87.2% rated TeachBack as effective at 3-5
4. on scale [1, 5], 79.4% rated Echo360 as effective at 3-5. Amid poor video quality complaints
5. Comments: Convenience, Anywhere attendance, Valuable Alternative
 - a. Also: Risk of poor concentration, depended on good connection
 - b. Better as an option, Separate TeachBack groupings, Good when not abused

Research Question #4

- How can collaborative learning be effectively supported in CSAP classrooms?

The Experiment

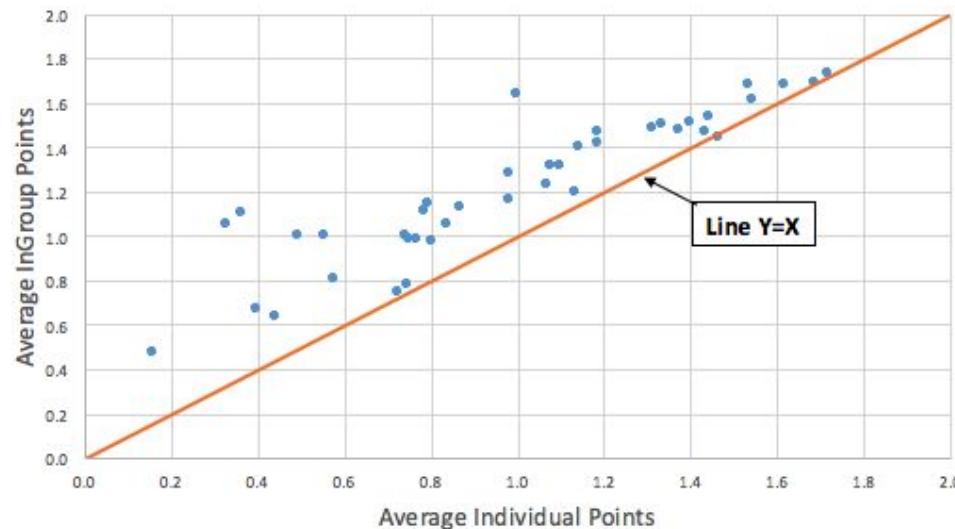
Class: Flipped Computer Graphics, Fall 2015

Analysis: Investigated learning during collaborative assessment activities using GroupWork.

Data: GroupWork grades, Final written exam, Course grades, Student survey

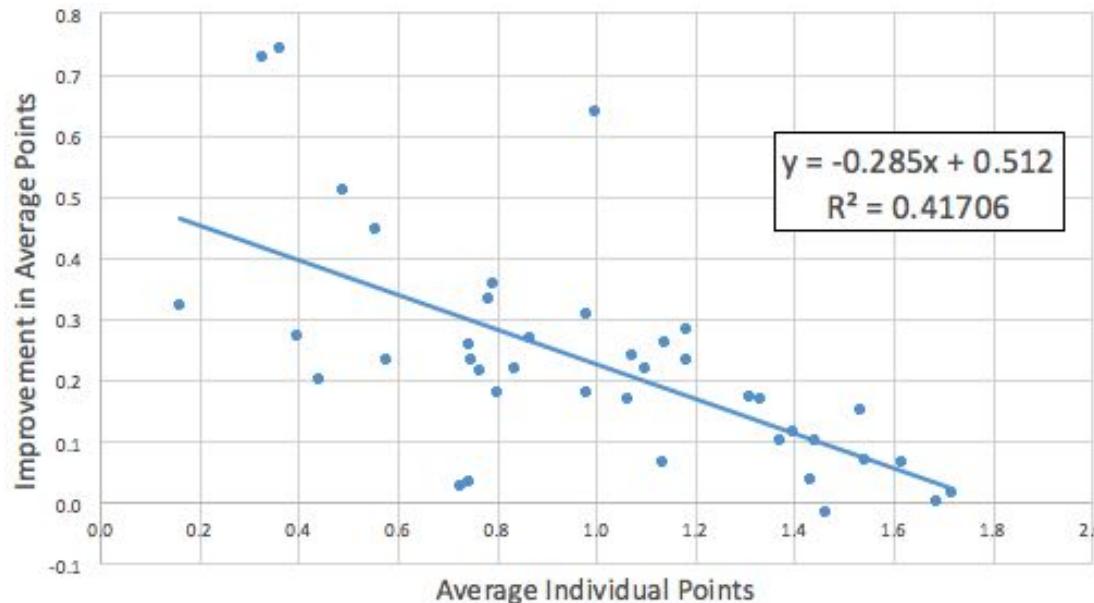
Results: Learning during GroupWork

- Student's average performance: On average, most students performed better when working in groups
- Class average: From 0.995 to 1.223, statistically significant with $p = 0.0001$. An Effect Size of 0.618



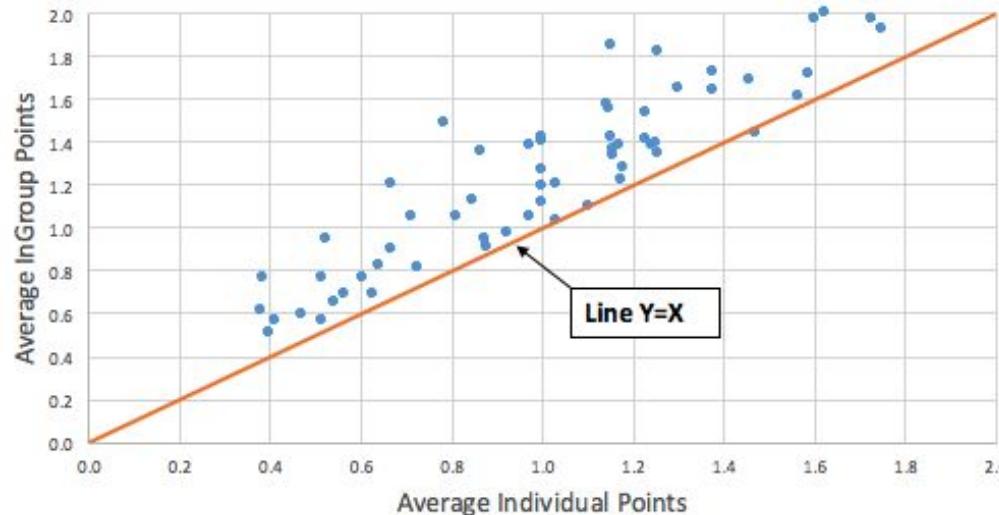
Results: Learning during GroupWork

- Struggling students benefit the most from collaboration



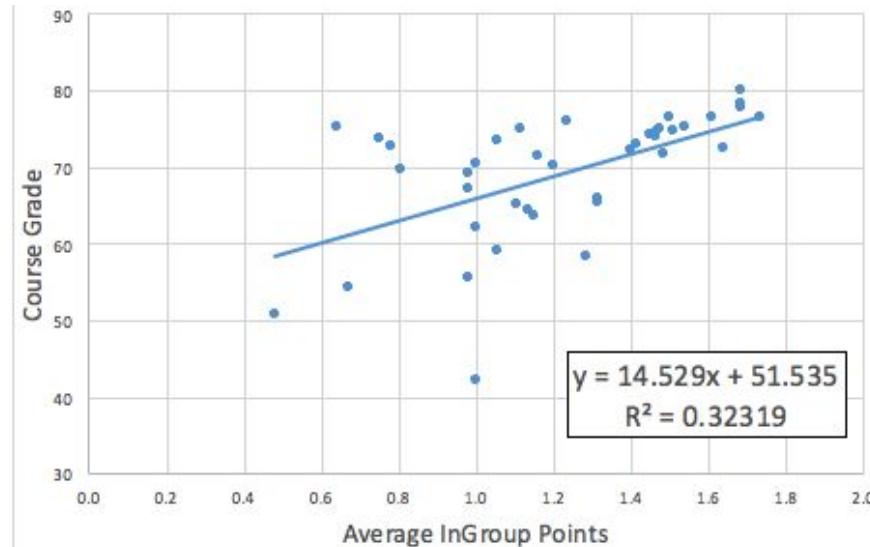
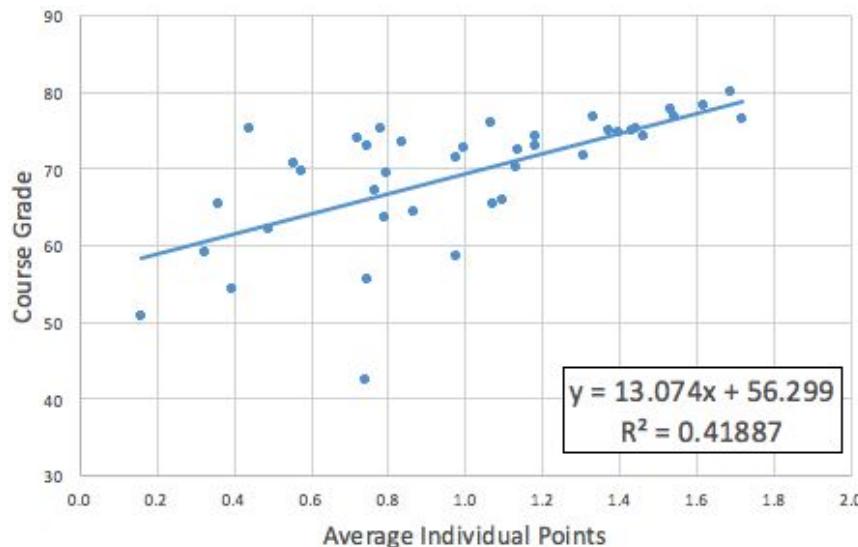
Results: Learning during GroupWork

- Per problem average performance: On average, across all problems, students performed better when working in groups
- Class average: From 1.003 to 1.236, statistically significant with $p = 0.0001$. An Effect Size of 0.609



Results: Effects on course outcomes

Individual performance is a better predictor - since course grades are individual measures



Results: Student Opinions

1. GroupWork activities were useful towards learning:
 - i. - 80.5% rated 3-5. 55.5% rated 4-5. On a scale of [1,5]
2. On satisfaction with GroupWork use: On a scale of [1,5]
 - i. - 75% rated 3-5, with 44.4% rating 4-5.
3. Students liked the integration of the Think-Pair-Share methodology in GroupWork
4. GroupWork introduced collaboration and cooperation learning opportunities
5. Students liked the ever-changing GroupWork groups
6. Even balance on preference between GroupWork forum and F2F discussions while in class

Limitations & Future Opportunities

- Most reported quantitative analysis was based on CS courses taught by a single instructor at the university level.
 - CSAP can also be used in other disciplines and at the junior and senior high school levels.
 - >> Conduct studies across more disciplines, instructors and education levels
- >> Add more features to TeachBack to support additional learning/teaching activities and methods
 - Better streamlining of the CSAP practice with additional features and advanced analytics
- >> Work on a plan for the future of TeachBack after the research

Contributions of the Work - CSAP

We proposed and evaluated the feasibility and effectiveness of the CSAP methodology in improving college learning and teaching

- a. Showed that computers can be effectively used in the classroom to support learning and teaching
- b. Data from computer-mediated classrooms can be used to many benefits as shown in CSAP
- c. We implemented and reproduced the benefits of various teaching/learning methods using CSAP and TeachBack. Eg. Collaborative, Cooperative, Problem-Based, Think/Pair/Share etc
- d. Showed that CSAP and TeachBack can be used for discovery and experiments on teaching and learning (as a SOTL platform)
- e. We showed how (and that) CSAP can be supported in mixed remote/physical classrooms

Contributions of the Work - TeachBack

Designed and developed TeachBack to support CSAP and flipped classrooms.

- a. Used in several classes and disciplines at Brandeis and beyond to practice flipped and CSAP based classrooms.
 - i. Computer Science - Timothy Hickey - 12+ Courses - 100s of students
 - ii. Mathematics - Rebecca Torrey - 2 Courses - 69+43 Students
 - iii. Biology - Maria Miara & Elaine Lai - 3 Courses - 232+128+80 Students
 - iv. Anthropology - Travis Parno - 1 Course - 77 Students
 - v. Economics - Carol Osler - 1 Course - 59 Students
 - vi. + Others outside Brandeis University



and as of last night ...

1,579
Users

60
Courses

... that's in 2 years
Excludes The Affective Tutor data

194
Notes

1,042
Questions

37,134
Answers

2,073
Course Enrollment

340
Lectures

377
Activities

103
Group Work

3,711
Responses

1,052
Posts

4,855
Comments

10,094
Feedback

The End.

Thank You!

Time For Questions

Appendix

Scrum Components

Roles	Artifacts	Events
<ul style="list-style-type: none">• Product Owner• Development Team• Scrum Master	<ul style="list-style-type: none">• Increment• Product Backlog• Sprint Backlog	<ul style="list-style-type: none">• Sprint• Sprint Planning• Daily Scrum• Sprint Review• Retrospective

Scrum Methodology

Input from End-Users,
Customers, Team and
Other Stakeholders



Product Owner

1	FEATURES
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Product Backlog



Team

Team Selects
How Much To
Commit To Do
By Sprint's End

Sprint Planning
Meeting
(Parts One and Two)



Sprint Backlog

Product
Backlog
Refinement



No Changes
in Duration or Goal



ScrumMaster



Daily Scrum
Meeting and
Artifacts Update



Review



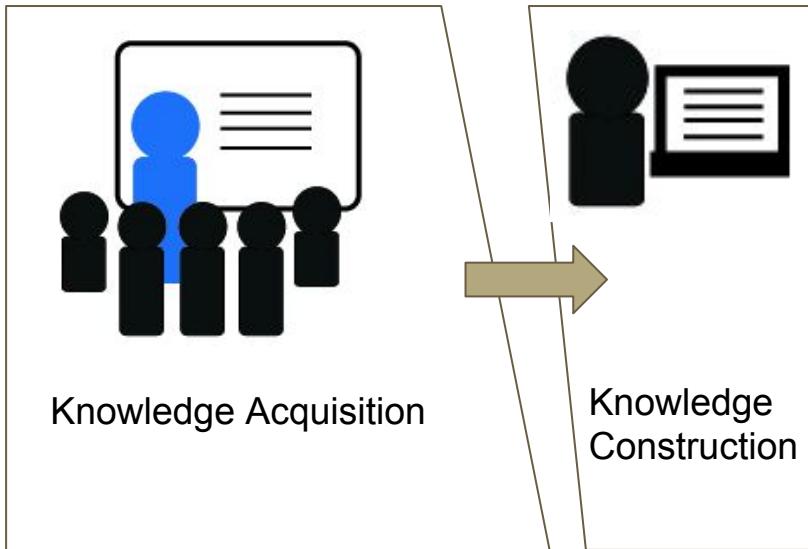
Potentially
Shippable Product
Increment



Retrospective

Flipped Classroom

TRADITIONAL MODEL



FLIPPED MODEL

