

AT HOME WITH ENGINEERING EDUCATION



JUNE 22 - 26, 2020

Asee's Virtual Conference

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VIRTUAL
CONFERENCE**

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At Home with
Engineering Education



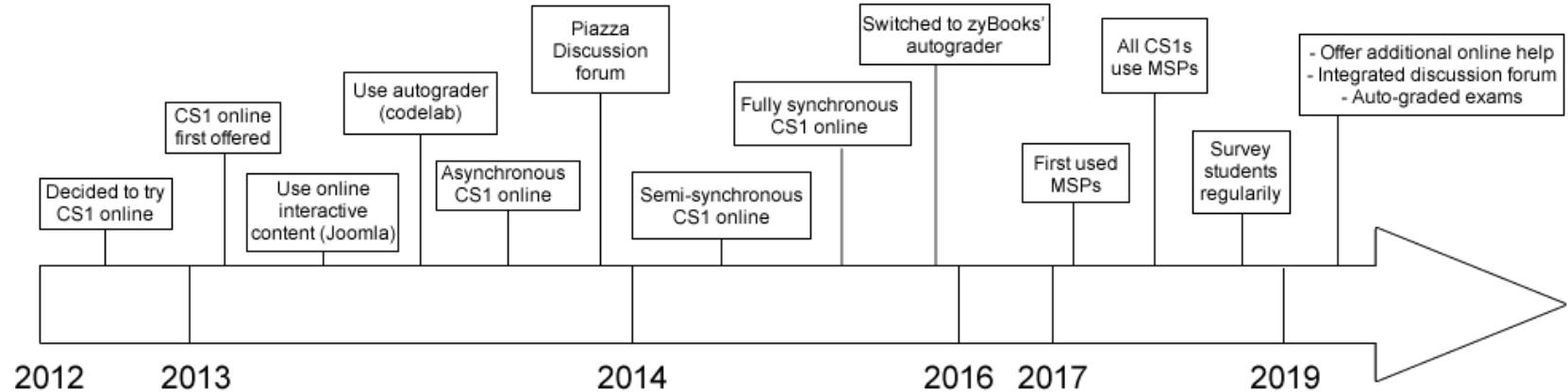
Experiences in Developing a Robust Popular Online CSI Course for the Past 7 Years

Joe Michael Allen¹ and Frank
Vahid^{1,2}

¹University of California, Riverside

²zyBooks

Our journey (2012 – today)



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CSI course details

Public research university

- Ranks among top 20 public universities
- Serves a majority of students from minority groups & first-generation college students

Operate on a quarter system

- 300-500 students /quarter
- 80-100 online students /quarter

Course

- CS majors and Non-majors
- C++: input/output statements, assignments, branches, loops, functions, and vectors
- 3 hour lecture, 3 hour lab, midterm & final

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2012



- First time teaching one online CS1 section
- Desire: better serve our students
- Thought: flexibility, cross-campus enrollment, scaling, additional revenue
- Learning outcomes OK, evaluations were acceptable, instructors were satisfied
- Lots of room for improvement

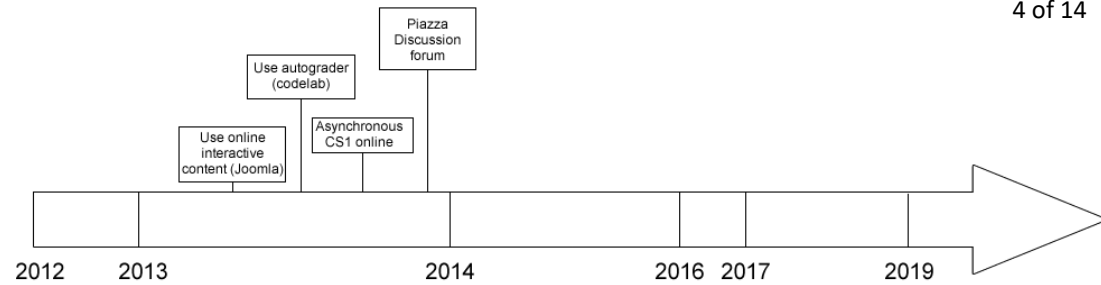
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2013 - 2014



- Online interactive content (homegrown)
- Automated program grading
- Asynchronous class structure
- Discussion forum (Piazza)
- No recorded video (almost)
- Exams

question ☆ stop following

Help with Lab

On Lab 2.27, I am unable to complete 5th criteria "Part 2: No overflow" because my number keeps overflowing to $-5.93035e+08$ when the answer is $6e+15$. I made 4 cout statements and the last 2 I `static_cast<double>` in o get a floating point. Please let me know if anyone has any tips!

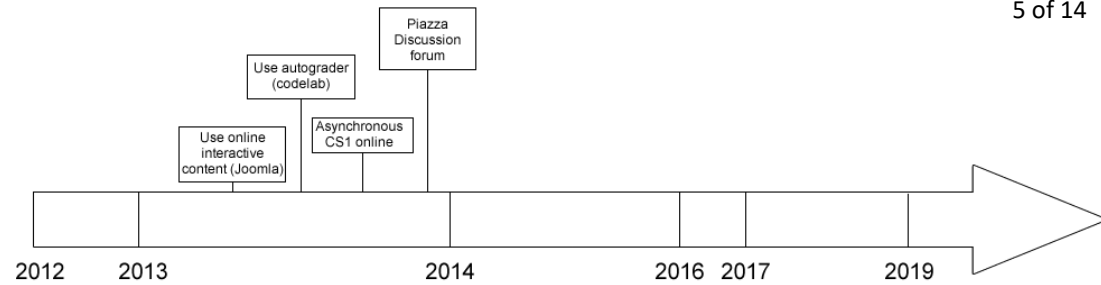
labs

[edit](#) · good question | 0 Updated 7 months ago by ,

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2013 - 2014



We learned

- Students loved the interactive learning content
- Appreciated the automated grading of homework, but we had system issues.
- Good use of Piazza

Biggest lesson: students did not do well without meetings

- Trouble getting motivated
- Most did not watch the videos content

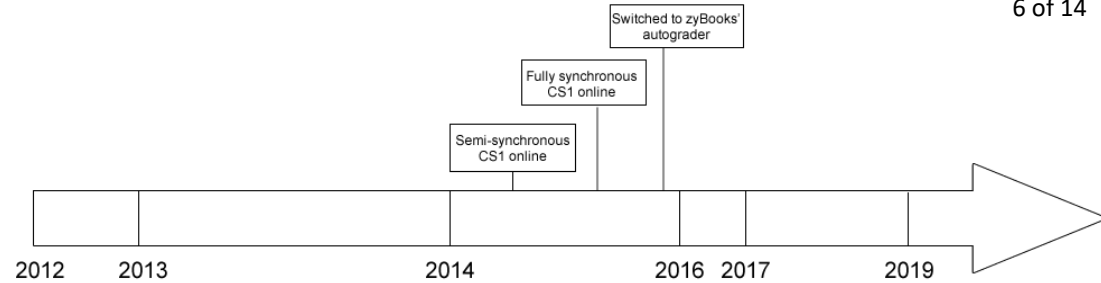
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2014 - 2016



From asynchronous to synchronous

- More online meetings; eventually scheduled online meeting times
- Read before class; more examples during 'lecture'
- Active 'lecture'
 - Live coding
 - TA involvement
 - Chat
- Labs
- Course content - zyBooks

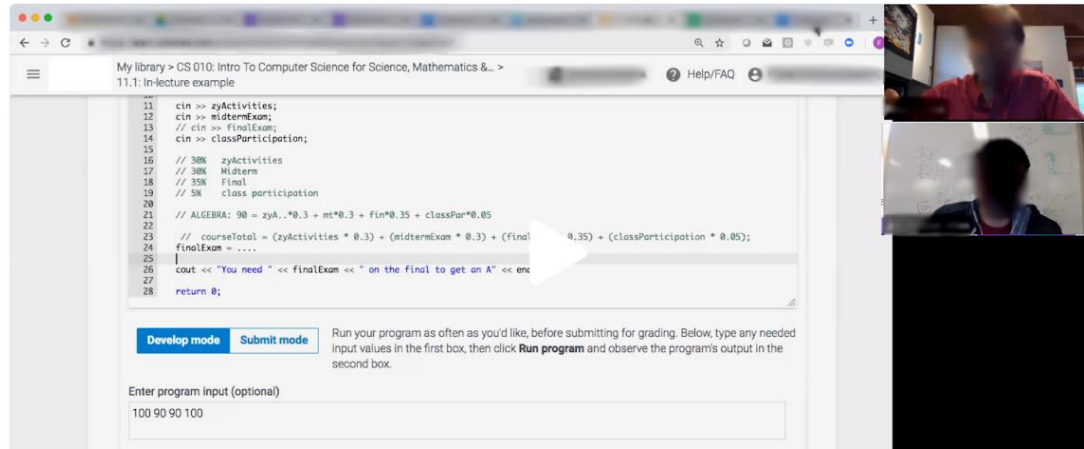
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Active 'lecture' – Live coding & TA involvement



```
11 cin >> zyActivities;
12 cin >> midtermExam;
13 // cin >> finalExam;
14 cin >> classParticipation;
15
16 // 30% zyActivities
17 // 30% Midterm
18 // 30% Final
19 // 5% class participation
20
21 // ALGEBRA: 90 = zyA.*0.3 + mt*0.3 + fin*0.35 + classPar*0.05
22
23 // courseTotal = (zyActivities * 0.3) + (midtermExam * 0.3) + (finalExam * 0.35) + (classParticipation * 0.05);
24 finalExam = ....
25
26 cout << "You need " << finalExam << " on the final to get an A" << endl;
27
28 return 0;
```

Develop mode Submit mode Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first box, then click **Run program** and observe the program's output in the second box.

Enter program input (optional)

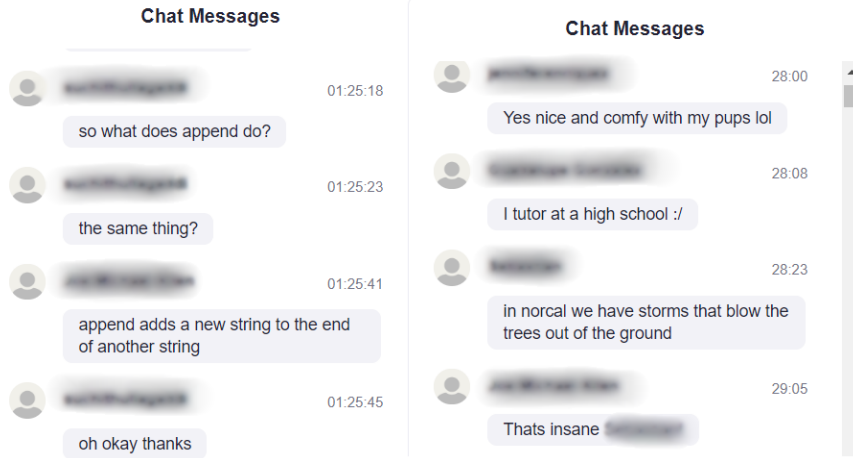
100 90 90 100

Screenshot of our CSI online synchronous 'lecture'

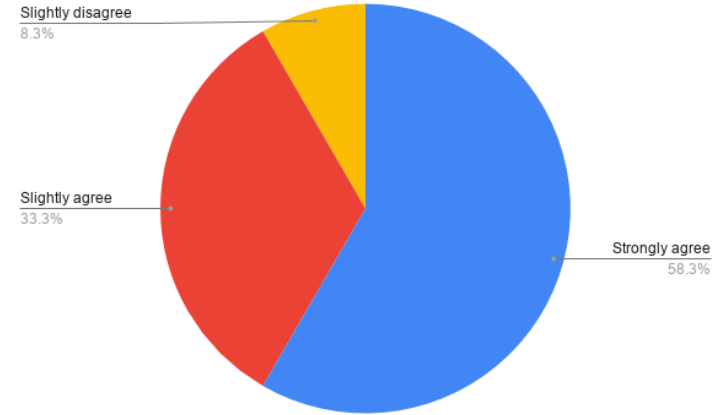
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Active 'lecture' – Chat



Screenshots of the chat box from lecture



“I found the chat box very helpful during lecture”

Course content - zyBooks

(right) Sample TOC showing content covered each week

<input type="checkbox"/> 1. Wk1: Introduction	■ 95%	■ 100%	■ 100%	▼
<input type="checkbox"/> 2. Wk2: Variables/Assignments	■ 71%	■ 97%	■ 100%	▼
<input type="checkbox"/> 3. Wk3: Branches	■ 72%	■ 100%	■ 100%	▼

2.22 LAB: Divide by x

Visible to students [Edit lab](#) [Share](#) [Note](#)

Write a program using integers userNum and x as input, and output userNum divided by x four times.

Ex: If the input is 2000 2, the output is:

```
1000 500 250 125
```

Note: In C++, integer division discards fractions. Ex: $6 / 4$ is 1 (the 0.5 is discarded).

(left) Programming assignment given to students via the program auto-grader

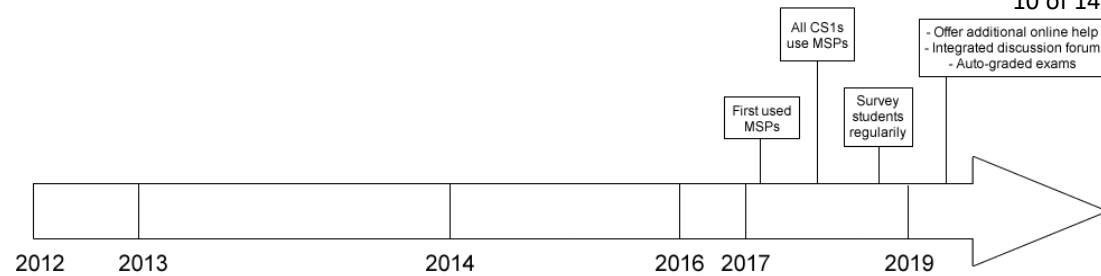
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2017 - today



Experiment with new features

- Many small programs (MSPs)
- Survey methodology
- New chat forums (Discord)
- Auto-generated auto-graded exams
- Coral language

OLP



MSP



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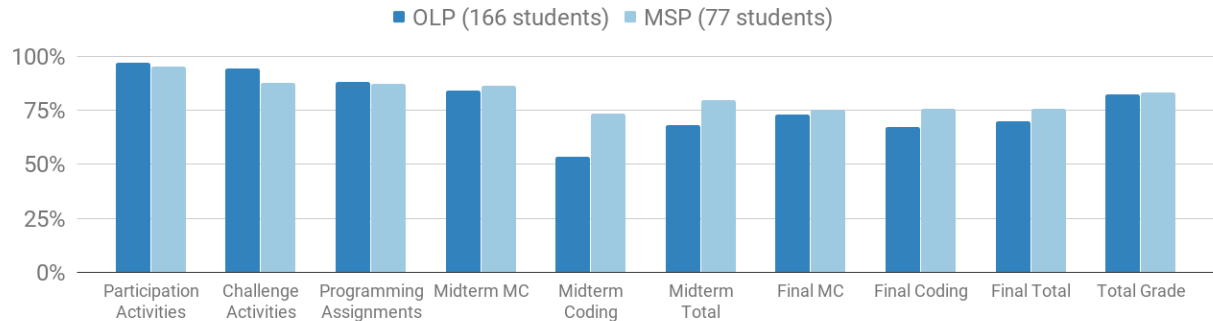
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Many small programs (MSPs)

MSPs: Smaller programming assignments each week

- Exam scores improved
- Students less stressed
- Multitude of other benefits



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Summary: then vs. now

Grades

- 2016: in-person (87%) vs. online (77%)
- 2019: in-person (86%) vs. online (83%)

Student evaluations

- 2013: in-person (4.3) vs. online (3.7)
- 2019: in-person (4.5) vs. online (4.5)

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Student comments

- “I thought I wouldn't like the online class but I really enjoyed the class and learned a lot from the first day.”
- “I strongly would recommend anyone to take this course online rather than in person! Believe it or not, this was actually my most interactive class even though it was online!”
- “At first I was completely unaware that this was an online class, and after that I was pretty wary. However, after taking the class, I realized that the online format works really well and is as good as or even better than taking an in-person class. I absolutely loved this class.”

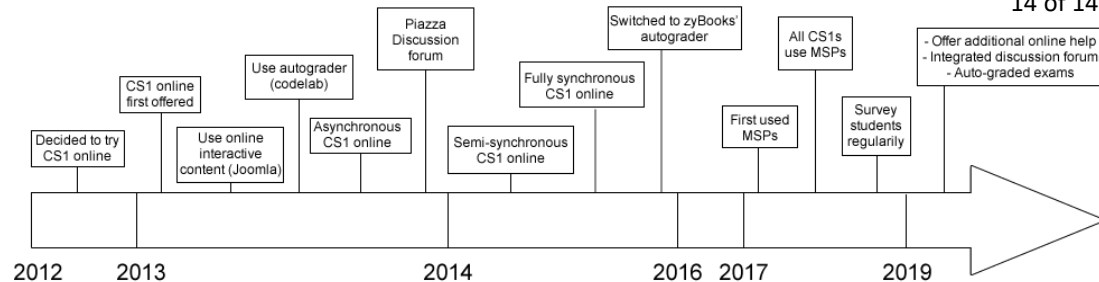
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Conclusion



OK course in 2013 is now one of the most popular and highest rated courses

- Offer at least one CS1 online course every quarter since 2013
- Grades and evaluations between in-person and online are almost identical

Key lessons

- Synchronous online meetings
- Online chat forum (especially with a TA present)
- Quality online interactive content (no videos)

Email: jalle010@ucr.edu

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