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# The Introduction of Informal Cooperative Learning into our Programming Laboratories


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# The Introduction of Informal Cooperative Learning into our Programming Laboratories

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# What is wrong with the Traditional Pedagogy?

## Learning to Program can be Difficult



World-wide, only 2 in 3 students enrolled in computer programming courses are successful

- Bennedsen and Casper (2007)
- Watson and Li (2014)

# What did we do about it?

## Structured, informal cooperation during computer labs



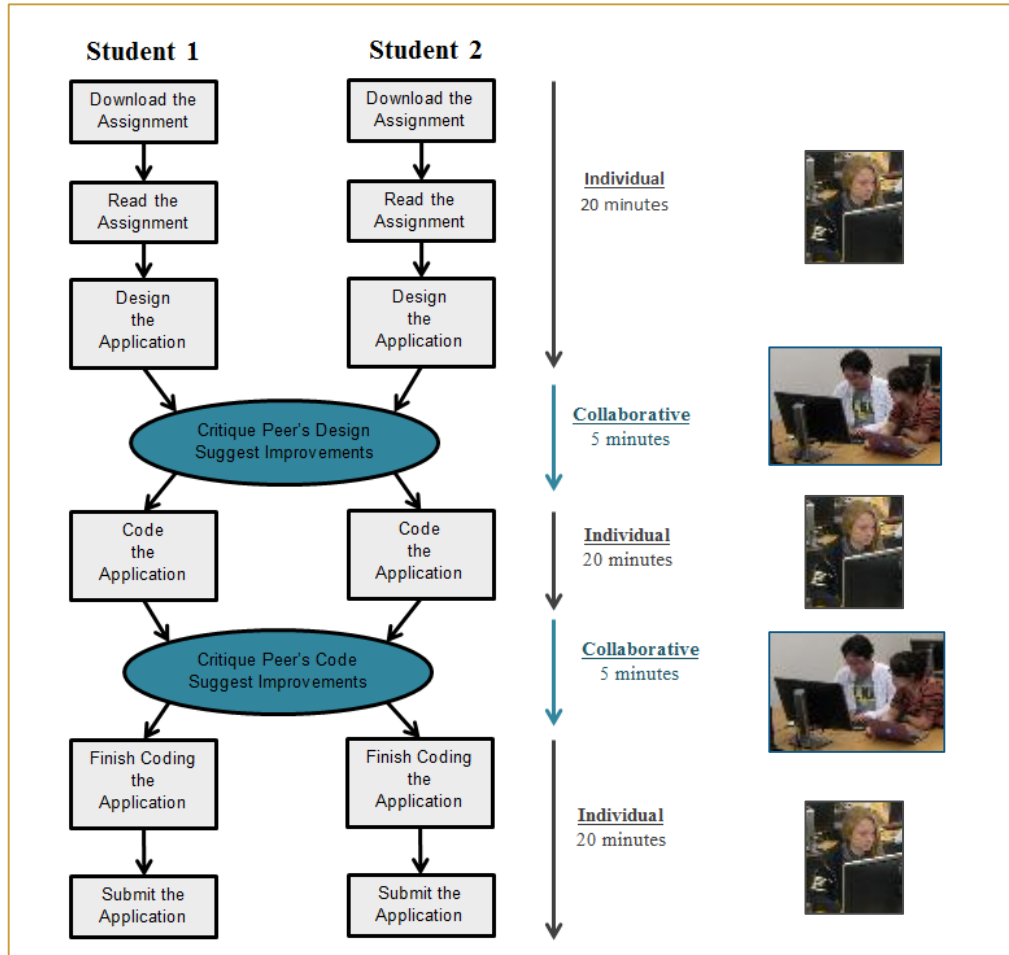
**“Informal cooperative learning** consists of having students work together to achieve joint learning goals in temporary, ad-hoc groups that last from a few minutes to one class period.”

- Johnson et al. (2002, 2006)

# Lab Structure

- ▶ The teaching material for the lab overlaps with the material covered in the lectures.
- ▶ Students work on a hands-on programming assignment which covers the theoretical concepts covered in the previous lecture.
- ▶ The programming assignment for every lab session is a small-sized desktop application.

# In terms of implementation, what does that look like?



## The Treatment

Students briefly work in pairs (i.e., collaborate) at strategic points during their lab session.

# Where did we do it?

## Learning Environment



Mandatory laboratory component of a college-level Introductory Programming Course

Most students (~ 70%) have little or no programming experience

Most students are freshmen

Avg. class (laboratory) size is 22 students

One laboratory instructor

# How did we assess this change?

## Impact on Student Learning

Group Descriptives					
	Group	N	Mean	SD	SE
Final Lab Exa	Fall 15	40	82.36%	16.81	2.657
	Fall 16	55	90.32%	11.91	1.606
Midterm	Fall 15	40	78.13	10.06	1.591
	Fall 16	55	78.15	11.89	1.603
Final	Fall 15	40	115.45	19.32	3.054
	Fall 16	55	119.89	15.88	2.141

Student performance on the programming examinations was better than in the prior semester

Student performance on the conceptual examinations was comparable



# How did we assess this change?

## Student Programming Self-Efficacy & Self-Beliefs

### QUESTION 1

I am confident that I can understand Visual Basic exceptions (e.g., FormatException)

1. Strongly Agree  2. Agree  3. Neither Agree nor Disagree  4. Disagree  5. Strongly Disagree

### QUESTION 8

In my programming labs, I can solve even the most challenging problems

1. Strongly Agree  2. Agree  3. Neither Agree nor Disagree  4. Disagree  5. Strongly Disagree

### QUESTION 19

To be honest, I do not think I can really change my aptitude for programming

1. Strongly Agree  2. Agree  3. Neither Agree nor Disagree  4. Disagree  5. Strongly Disagree

Scott & Ghinea (2014) instrument adapted for use in the specific context of this course.

Our initial findings showed some improvement within the fall semester.

Unfortunately, we did not collect this information the prior semester ... so no comparison at this time

# Instructor Impressions

## Informal Observations & Anecdotal Evidence



Reliance on laboratory instructor

Level of anxiety in the laboratory environment

Sense of isolation while working

Socialization of programming

# What are our next steps?

## Continue to use Informal Cooperative Learning



Continue to use Informal Cooperative Learning in the Classroom

Attempt to increase our confidence in the preliminary findings by collecting more of the data we already collect

Supplement this data with “new” qualitative data from focus groups

# What is next?

## For further study



Student sense of independence from / dependence on the instructor

Student sense of community

Student sense of enjoyment while programming

Student intrinsic motivation and/or time management of programming assignments

# Researchers

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# Gallery: Students working Individually





# Gallery: Informal Cooperation



# Gallery: Lab Instructor Assistance



I thought the labs were effective because we could collaborate with our peers but still had to individually submit the program. This means that we still had to learn and understand what we were doing and not just let our peers code for us.

I've had a very good experience in this class. Seeing this is my first programming class, I can say I've learned a lot and it is a great first step in my programming career.

FIRST TIME CODER

CHALLENGING COURSE.

DOABLE WITH LOTS OF EFFORT  
WITHOUT FRIENDS WOULD HAVE BEEN  
MUCH WORSE

LOST FOCUS TOWARD THE END

The course was good.  
The in labs were very  
helpful in understanding the  
material better and helped  
in completing the assignments.