The Introduction of Informal Cooperative Learning into our Programming Laboratories

Guity Ravai  
*Purdue University*

Ronald Erdei  
*Purdue University*

Ludmila Nunes  
*Purdue University*

Sahithya Kodam  
*Purdue University*

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The Introduction of Informal Cooperative Learning into our Programming Laboratories

Guity Ravai
Clinical Assistant Professor
Department of Computer and Information Technology

Ronald Erdei
Visiting Assistant Professor
Department of Technology Leadership & Innovation
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

<table>
<thead>
<tr>
<th>Group Descriptives</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Lab Exa Fall 15</td>
<td>40</td>
<td>82.36%</td>
<td>16.81</td>
<td>2.657</td>
</tr>
<tr>
<td>Fall 16</td>
<td>55</td>
<td>90.32%</td>
<td>11.91</td>
<td>1.606</td>
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<tr>
<td>Midterm</td>
<td>Fall 15</td>
<td>40</td>
<td>78.13</td>
<td>10.06</td>
</tr>
<tr>
<td>Fall 16</td>
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<tr>
<td>Final</td>
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<td>40</td>
<td>115.45</td>
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<td>Fall 16</td>
<td>55</td>
<td>119.89</td>
<td>15.88</td>
<td>2.141</td>
</tr>
</tbody>
</table>

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

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

**Guity Ravai**
Purdue University
Clinical Assistant Professor
Computer and Information Technology
Email: guity@purdue.edu
Phone: 765-430-2573

**Ludmila Nunes**
Purdue University
Postdoctoral Research Associate
Center for Instructional Excellence
Email: nunes@purdue.edu

**Ronald Erdei**
Purdue University
Visiting Assistant Professor
Technology Leadership and Innovation
Email: erdeira@purdue.edu

**Sahithya Kodam**
Purdue University
Graduate Student
Computer and Information Technology
Email: kodam@purdue.edu


References


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 labs were very helpful in understanding the material better and helped in completing the assignments.