



The Role of Automation in Undergraduate Computer Science Education

Full Text:  PDF  [Get this Article](#)

Author: [Chris Wilcox](#) [Colorado State University, Fort Collins, CO, USA](#)

Published in:



• Proceeding
[SIGCSE '15](#) Proceedings of the 46th ACM Technical Symposium on
Computer Science Education
Pages 90-95
[ACM](#) New York, NY, USA ©2015
[table of contents](#) ISBN: 978-1-4503-2966-8 doi> [10.1145/2676723.2677226](#)



2015 Article



[Bibliometrics](#)

- Downloads (6 Weeks): 10
- Downloads (12 Months): 105
- Downloads (cumulative): 170
- Citation Count: 1



Recent authors with related interests ▼

Concepts in this article ▼

powered by

IBM Watson™

Presented by: Garrett Dancik

September 18, 2017

<http://dl.acm.org/citation.cfm?id=2677226>

Article: The Role of Automation in Undergraduate Computer Science

- Background:
 - Grading is a very time-consuming element of teaching
 - Automated grading has advantages
 - Students can submit programs online where they are automatically graded
 - Students receive relatively fast feedback
 - Students can submit multiple times, can make corrections and, ideally, better learn concepts
- Objective: Look at effect of automatic grading (+peer instruction) on learning and other outcomes

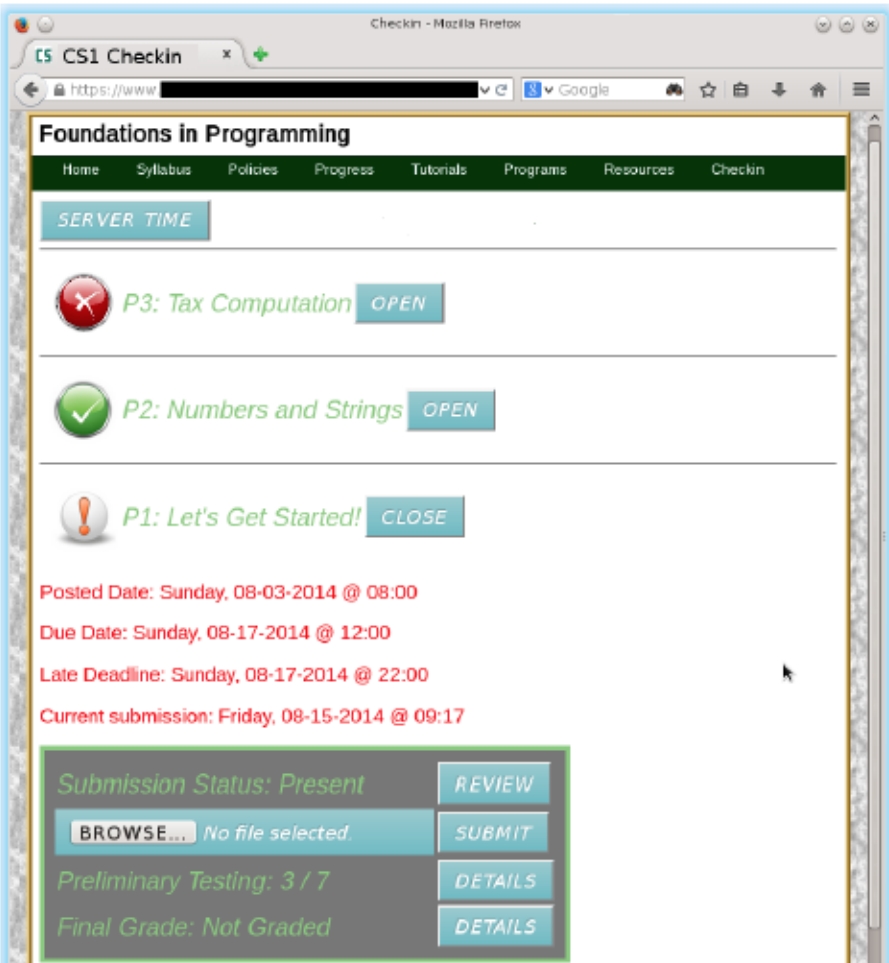


Figure 3: Automated Program Grading Interface.

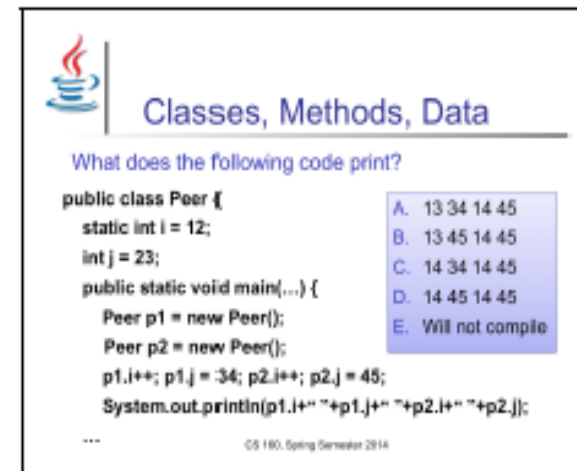


Figure 4: Peer Instruction Example Question.



Semester	Zeros Included	Mean	Median	Sample Size	Stddev	Variance	Increase	Statistical Significance
Spring 2013	Yes	66.1	71.0	234	20.3	410.4	+0.0%	base semester
Spring 2013	No	68.5	71.0	234	16.2	264.0	+0.0%	base semester
Fall 2013	Yes	70.3	76.3	252	24.1	582.7	+6.4%	t = 2.07 p = 0.0388
Fall 2013	No	75.7	79.0	252	14.7	216.3	+10.6%	t = 5.04 p < 0.0001
Spring 2014	Yes	73.9	78.0	232	20.5	422.3	+11.8%	t = 4.11 p < 0.0001
Spring 2014	No	77.6	78.0	232	12.5	156.8	+13.3%	t = 6.63 p < 0.0001

Figure 5: Analysis of Exam Scores.

Conclusions

- Article contributions: the combined adoption of new pedagogic techniques (automated grading + peer instruction)
 - improves the average final exam scores and overall grade.
 - decreases the student withdrawal rate.
 - improves student attendance.
- Limitations
 - Automated grading and peer instruction are confounded
 - Are students just better over time (uncontrolled extraneous variable)?
- Additional observations
 - Automated grading has an unforgiving nature
 - Some students throw submissions at automated grading

Project idea: development of an automated tool for learning *R* programming

R programming and swirl

- R (<http://www.r-project.org>) is a free environment for statistical computing and graphics
- R is an interpreted language
- Many *packages* are available for specialized analyses (<http://cran.r-project.org/web/packages/>)
- Swirl (<http://swirlstats.com>) is a package where you can "learn R, in R."
 - Questions are hard-coded
 - This makes *swirl* appropriate for learning but not for practice and/or assessment

Proposed project

- Develop a swirl-based package that generates template-based problems to help students practice *R* programming and data analysis concepts
- Question templates that use random variable names and/or values:
 - Question: Create a vector named 'x' that stores the values 3 and 11.
 - Solution: `x = c(3,11)`
- Improvement: values in red above are randomly generated each time.

Questions:

1. What is the best way to learn a new programming language?
2. What is the best way to assess (grade) someone's programming ability?
3. Does anyone have experience creating R packages (how do you do this)?
4. Does anyone know how to generate random numbers in *R*?