# A Preliminary Analysis of the Effectiveness of Myro/Java In Computer Science 1

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*Abstract: Personal robots, where each student has access to her/his own robot to use both in and out of class, are becoming popular platforms to use in CS1 courses. The Myro API developed by the Institute for Personal Robots in Education (IPRE) is a Python-based API and curriculum used at many colleges and universities. In 2010 the author implemented the Myro API in Java and has taught a section of CS1 using Myro/Java every semester since fall 2011. Pre and post surveys were developed to assess the effectiveness of Myro/Java and these surveys have been administered to all sections of CS1 (both Myro/Java sections and traditional sections) each semester since fall 2011. In this paper the initial analysis of parts of the post survey are presented.*

*Key words: Personal robots, CS1 curricula, Java, Myro, IPRE*

## INTRODUCTION

Use of robots in Computer Science curricula is a popular way for universities to meet the challenge made by former ACM President David Patterson: "To draw students to CS, we must first look to create a curriculum that reflects the exciting opportunities and challenges of IT today versus the 1970s." [11] Many schools are using personal robots (where each student has his or her own robot on which to work, both in and out of class) in their CS1 course because they are tangible, fun to program, and provide immediate feedback to students [1, 7, 10]. Curricular materials developed by the Institute for Personal Robots in Education (IPRE) [2, 4, 8] are used at many of these institutions and early results suggest that IPRE curricular materials are effective in CS1 [6, 13].

IPRE defines an API called Myro (for *My R*obot) that allows programs to interact with and control a personal robot [8]. Myro was originally defined in the Python programming language; in 2010 the author implemented the Myro API in Java [3, 9]. Beginning fall semester 2011 the author has taught one section of Computer Science 1 (CSC121) each semester using Myro/Java. In addition to these Myro/Java sections of CSC121, two "traditional" sections of CSC121 have been offered each semester. Students in all sections of CSC121 completed pre and post surveys, and some preliminary results of these surveys are presented here.

## SCRIBBLER/FLUKE HARDWARE

The Scribbler robot, shown in Figure 1, is a relatively small (188 x 158.8 x 81 mm), rugged, relatively cheap (approximately US$120) robot manufactured by the Parallax company [12]. Movement is accomplished by two independently controlled motorized wheels, and sensors include two obstacle detectors, two line sensors, and three light sensors; it also has three programmable LEDs and a speaker that can emit simple tones.

The Fluke, shown in Figure 2 connected to a Scribbler, is a circuit board designed by Georgia Institute of Technology that attaches to the Scribbler's serial port and provides a Bluetooth antenna, a low-resolution (256x192) color camera, three obstacle sensors, and two programmable LEDs [5]. The Fluke costs approximately US$100, bringing the cost of the Scribbler/Fluke robot to approximately US$220.

**Figure 1 – Scribbler Robot**

**Figure 2 – Scribbler with IPRE Fluke**

Each student taking the Myro/Java section of CSC121 is given a robot kit consisting of a Scribbler, Fluke, Bluetooth dongle, and carrying sack to use during the semester. All software used in the course is distributed under the GNU General Public License and students are encouraged to install course software on their personal computers. Students take their robot kits to the dormitories with them and are encouraged to work on assignments where they live.

**SURVEY INSTRUMENT**

Each semester DePauw University offers three sections of CSC121, with each section enrolling approximately 30 students. Each semester since fall 2011, the author has taught one section of CSC121 using the Myro/Java curriculum; the other two sections of CSC1221 each semester were taught by other faculty using a "traditional" Java curriculum.

The author developed pre- and post-surveys to be administered to every student enrolled in CSC121[1]. The surveys were based on surveys developed at The Georgia Institute of Technology and Bryn Mawr College for use in evaluating their CS1 courses.

In addition to gathering general demographic data (e.g., class year, gender, etc.) and some attitudinal data (e.g., comfort level with technology, willingness to seek help, confidence in math, etc.), students were asked to respond to the following questions relating to their experiences in the course, where answers ranged from 1 (Strongly Agree) to 5 (Strongly Disagree):

- My experience in this class caused me to decide to take another computer science class
- During the class I wrote a program that was not an assignment for this class
- I expect that I will have to write a program (in any language) after I finish this class
- There was at least one homework that I spent extra time on because I thought it was cool
- What I learned in this class is important to my future career
- I discussed difficult assignments and/or detailed lectures with friends in the class
- I talked with my friends (not in the class) about this class
- I enjoyed this class
- Compared to students in this class, I feel like I know a lot about computers

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[1] These surveys were approved by DePauw University's Institutional Review Board.

**SURVEY RESULTS**

The surveys have been administered to all CSC121 students for three semesters; the post survey was completed by 74 students enrolled in the Myro/Java sections and 103 students in the traditional sections[2]. Table 1 summarizes the average response to each of the above questions for the Myro/Java and traditional sections, and shows the calculated t-test p value. (Responses are on a scale of 1-5 with 1 meaning "Strongly Agree" and 5 meaning "Strongly Disagree".)

| Prompt | Mean Response | | p |
|---|---|---|---|
| | Myro/Java | Traditional | |
| My experience in this class caused me to decide to take another computer science class | 2.53 | 2.38 | 0.4493 |
| During the class I wrote a program that was not an assignment for this class | 3.37 | 3.34 | 0.8975 |
| I expect that I will have to write a program (in any language) after I finish this class | 2.61 | 2.50 | 0.5697 |
| There was at least one homework that I spent extra time on because I thought it was cool | 2.09 | 2.53 | 0.0079 |
| What I learned in this class is important to my future career | 2.39 | 2.25 | 0.4218 |
| I discussed difficult assignments and/or detailed lectures with friends in the class | 1.96 | 1.98 | 0.8867 |
| I talked with my friends (not in the class) about this class | 1.65 | 1.78 | 0.2176 |
| I enjoyed this class | 1.61 | 1.85 | 0.0753 |
| Compared to students in this class, I feel like I know a lot about computers | 2.35 | 2.84 | 0.0025 |

**Table 1. Post Survey Response Summary**

**DISCUSSION**

Of the nine prompts presented in Table 1, only two show statistically significant difference at $p<0.05$ between the Myro/Java and Traditional sections:

- There was at least one homework that I spent extra time on because I thought it was cool (p=0.0079).
- Compared to students in this class, I feel like I know a lot about computers (p=0.0025).

Additionally, one prompt showed statistically significant difference at $p<0.10$ between the two groups of students:

- I enjoyed this class (p=0.0753).

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[2] DePauw's Institutional Review Board authorized administration of the surveys only to students 18 years old and older, following standard Human Subjects guidelines and regulations. In addition, participation in the survey was voluntary (again by IRB authorization). This explains why not all students enrolled in the course completed surveys.

For each of these prompts students in the Myro/Java sections agreed with the statement more than students in the traditional sections.

The fact that students in the Myro/Java sections spent extra time on at least one homework assignment because they thought it was "cool" suggests that they found at least one homework assignment intriguing and interesting enough to motivate them to experiment and explore, which is encouraging. Perhaps this might also explain why they enjoyed the course slightly more than students taking the traditional curriculum.

It is interesting that students in the Myro/Java sections felt like they knew a lot more about computers than their classmates, whereas students in the traditional sections did not have this same sense. The author was surprised and intrigued by this result and has no explanation yet for this difference.

What is perhaps just as interesting about the data in Table 1 are the prompts that show no significant difference between the two groups. For example, students in the Myro/Java sections were no more likely than other students to take additional Computer Science courses, write extra programs (i.e., that weren't required for class), or talk with friends about their experience in the class.

### CONCLUSIONS AND FUTURE WORK

From the preliminary analysis of the post survey data, presented in Table 1, students in the Myro/Java sections were not "harmed" by using Myro/Java; they were as likely to take another Computer Science course as students in the traditional curriculum, they expected to write computer programs in the future as often as students in the traditional curriculum, they talked with friends (both taking the class as well as those not taking the class) about the class as frequently as students taking the traditional curriculum, and felt that what they were learning in the course was as useful to their future as students taking a traditional curriculum.

On the other hand, there were some areas where students taking the Myro/Java sections apparently benefitted. They spent extra time on at least one homework assignment because they thought it was "cool" more often than students in the traditional curriculum, and they enjoyed the course slightly more than students in the traditional curriculum. Surprisingly, students in the Myro/Java sections felt like they knew more about computers than their classmates more often than students in the traditional curriculum.

Future work includes the following analyses:

- Determining whether there are any correlations between attitude (e.g., comfort with technology, confidence in math, etc.) and responses to survey questions.
- Determining whether there are significant changes in attitude during the course by analyzing differences between pre and post surveys.
- Compare results of Myro/Java with Myro/Python taught at other institutions.
- Analyze the effect the instructor has on the survey results.
- Study the effect of Myro/Java on students' decision to major in Computer Science, and their success in future Computer Science coursework.
- Analyze why students using Myro/Java feel they know more about computers than their classmates.

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