

Using the Media Computation Approach to Teach a Web-Based Java Programming Course

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Abstract

Nationally, student success rates in introductory programming courses have been declining. At Kent State University, introductory programming courses offered in the Associate of Applied Business (AAB) in Computer Technology (CT) program have student success rates ranging from 68.0% to 75.6% which may be contributing to the declining enrollment in programming courses. In an effort to improve student success in introductory programming courses, the *media computation approach* developed at Georgia Tech was introduced for a asynchronous web-based introductory Java programming course.

Introduction

In recent years enrollment in programming courses has been declining partly because of lower retention rates (Guzdial, 2002), and partly due to a perception that the job market is shrinking (Litecky, et. al., 2008). Institutions of higher education have undertaken various projects to improve retention rates, and hopefully also attract some additional students. These programs typically involve ways to increase student engagement. One example of this approach comes from the Ohio University College of Business where the introductory Visual Basic course was changed to focus on ASP.NET web development rather than traditional Windows Forms development (Brown, 2007), a change that resulted in a 135% increase in enrollment for the course. Brown concludes that students have a familiarity with web-based information and applications due to the pervasiveness of the Internet during their formative years, and that this familiarity translates into an increased interest and level of engagement, eventually resulting in the increased enrollment observed.

Increased enrollment is not the only benefit that can be derived from an increase in student engagement. Current learning theory suggests that a high degree of student engagement is required to support the reflective and cognitive processes necessary for deep learning which enables students to reuse knowledge learned in new situations. Therefore, changes in teaching approach that lead to greater student engagement will help facilitate deeper learning and also lead to greater student success rates (grade of C or better), another important factor in student retention.

Another example of an effort aimed at improving retention can be found at Georgia Tech where researchers hypothesized that students from the "MTV generation", who have grown up in an

environment filled with a cacophony of multi-media stimulus, may be interested in creating similar media when learning to program (Guzdial and Soloway, 2002). Guzdial (2003) later developed the “media computation approach” to teaching introductory programming courses using multimedia manipulation as a context for teaching programming principals and language syntax, which proved successful in significantly increasing the student success rate at Georgia Tech. Table 1 below illustrates the improvement achieved at Georgia Tech using the media computation approach (Tew, et. al., 2005). Similar results were later achieved when the media computation approach was implemented at Gainesville College (a two-year institution).

Table 1 Impact of Media Computation Approach on Student Success Rates

	Enrollment	Success Rate
Georgia Tech’s CS1		
Average 2000 – 2002	930	71.2%
Media Computation		
Spring 2003	120	90.0%
Fall 2003	303	86.5%
Spring 2004	395	89.9%

Introductory Programming Courses at Kent State University

Three introductory programming courses are taught within the AAB in CT program at Kent State University: Visual Basic, C++, and Java. The Visual Basic course is a required course for all students in the program, while C++ and Java are elective courses typically taken only by students with a concentration in Application Development. As one would expect given this curriculum, there is significantly more data for the Visual Basic course than for the others. Table 2 summarizes the aggregate student success rates for these three courses for the period from spring 2004 through fall 2007.

Table 2 Student Success Rates 2004 - 2007

	Visual Basic	C++	Java
Enrollment	538	118	150
Student Success Rate	75.6%	72.0%	68.0%

Due to declining enrollments in the Application Development concentration within the AAB in CT degree, it has become necessary to offer the Java class via the Web in order to have sufficient enrollment. Web-based instruction, at least in the case of the Java class, results in a lower student success rate than traditional classroom delivery. The student success rates for Java classes with web-based vs. classroom delivery from 2004 through 2007 are shown in Table 3.

Table 3 Web-based vs. Classroom Student Success

	Enrollment	Success Rate
Web-based delivery	55	63.6%
Classroom delivery	95	70.5%

Student Demographics and Attitudes

A survey was conducted during the first two weeks of the semester to obtain information on student demographics, preparedness, and attitudes regarding programming. Selected items from this survey are summarized in Table 4.

Table 4 Summary of Initial Student Survey Responses (N=9)

Survey Item	Answer
Gender	88.9% Male
Major	66.7% Technology
Have you programmed a computer before?	77.8% Yes
Rate your experience with image manipulation tools such as Photoshop.	22.2% None 22.2% Beginner 55.6% Intermediate
Rate your experience with sound manipulation tools such as Sound Forge.	66.7% None 33.3% Beginner
I am confident in my problem solving ability.	22.2% Strongly agree 66.7% Agree 10.1% Neutral
I am looking forward to this class.	44.4% Strongly agree 55.6% Agree

The initial survey data shows a significant majority of respondents have had previous programming experience, and that more than half of respondents rate themselves at the intermediate level of experience with image manipulation. These statistics suggest that students are well prepared to begin their studies of Java using the media computation approach.

Students were administered a second survey at mid-term to gather data on student learning behaviors and attitudes toward the course. With respect to difficulty, Table 5 indicates that student responses were skewed toward the difficult end of the continuum, but with no responses at the extremes. Despite the tendency to view the course as somewhat difficult, the majority of students were neutral with respect to their enjoyment of the class with no students ranking the course at the extremes of the continuum.

Table 5 Course Difficulty vs. Student Enjoyment (N=5)

	Easiest				Hardest
	1	2	3	4	5
How hard is this class turning out to be?	0%	20%	40%	40%	

	Hate It				Love It
	1	2	3	4	5
How much are you enjoying this class?		20%	60%	20%	

All respondents to the mid-term survey indicated that they felt they were learning to program. This is important to note because it represents the students self-perception of their success in the class. The survey responses also indicate that very few students use the programs they create for the course for their own benefit outside the course; nor do many do more than the minimum required work. This is troubling because highly engaged students typically will look for opportunities to apply their new knowledge in new and different situations.

Table 6 Student Behavior and Perception of Learning (N=5)

	Yes	No
Are you learning to program?	100%	0%
Do you ever use the programs from this class or write other programs for your own problems or data?	20%	80%
Do you ever write pieces of code outside of what's required for homework?	40%	60%

Results

At the time of this writing, final grades were not yet available for this initial trial of the media computation approach at Kent State University; however, mid-term grades may provide some indication as to whether student success rates will vary significantly from past measures. At mid-term a total of four students had withdrawn from the class, while another three had earned a grade of F. There were also eight students with A's, none with B's, and two with C's resulting in a success rate of 58.8%. In a class with a starting enrollment of 17, each student represents 5.9% of the class so it is unlikely that the mid-term success rate of 58.8% is statistically different from the 63.6% success rate experienced in previous web-based Java classes.

Summary

While the results obtained from this initial study do not duplicate the significant improvements in student success observed at Georgia Tech and Gainesville College, there are no indications that student success has been impacted negatively. Therefore, it is planned to continue using the media computation approach. A thorough review of the end of term data will be conducted, including the results of student evaluations. Once the end of term review has been completed, the learning modules and assessments used for this class will be reviewed and appropriate changes made to improve the quality of the instruction and assessment of students.

References

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