WIDENING THE PIPELINE OF K-12 STUDENTS WITH FLASH

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ABSTRACT

There are many negative stereotypes about computer science. These preconceived ideas may discourage students, especially women and minorities, from pursuing a computer science education. Our goal is to create a program that dispels these misconceptions, both in inner city middle and high schools and in an outreach program that attracts at-risk students to Lehigh University to learn about information technology. A curriculum that uses Flash programming helps to dispel these misconceptions and bring more minority and female high school students back into the pipeline of potential computer scientists.

INTRODUCTION

There are many well known and well documented stereotypes about computer science [1]. Many of these common stereotypes are misconceptions. Some of these common misconceptions are: "Computer science is only for men," "Computer science is for geeks and nerds," and "Computer science is sitting in a cubicle working alone to write code." These stereotypes are prevalent in society and are picked up by students at a young age. Students begin to associate these stereotypes with working on computers as early as the grade school level. These stereotypes are reinforced by the actions and attitudes of a student's peers.

These stereotypes have two large negative effects on the field of computer science. Firstly, they discourage students, especially women and minorities, from pursuing computer science as a career. Second, the lack of student interest hinders progress, since the number of fresh ideas and innovations is lessened. The demand for professionals in computer science is growing, yet student matriculation, especially that of women and minorities, is declining [2][3][4].

Our goal is a program and curriculum that uses multimedia technologies, specifically the Adobe Flash development environment, to break the stereotypes. We show students that computer science is an interesting and exciting field that involves teamwork, critical thinking and creativity. We seek to close the gap by specifically targeting minorities and women for enrollment into the program. Once there, they learn to see past the stereotype and make their own conclusions about computer science as a career choice. In this manner, we aim to accomplish the goals of two NSF-sponsored programs – LV STEM and Launch-IT.

LV STEM (Lehigh Valley Science, Technology, Engineering, and Mathematics) is an NSF GK-12 project which recruits graduate students to help develop innovative research-curricula in local schools (see www.lehigh.edu/stem). LV STEM puts graduate fellows in K-12 classrooms where they can lend a hand to the instructor while sharing their cutting edge knowledge with students who see them as role models. Teachers, students, professors and industry partners work together to create real world applications that fit into each classroom's curriculum. The Flash team is one of several in the LV STEM program, which covers broader topics than just computer science. Nonetheless, it is one of the stronger, with the Principal Investigator as the head of the team (and coincidentally a co-author of this paper).

The Launch-IT NSF ITEST project is based on a vision of "launching at-risk middle and high school students in the greater Lehigh Valley toward college and careers in Information Technology (IT)" (see www.lehigh.edu/launchit). The first author is one of the NSF Graduate Fellows for this project and the third author is the Principal Investigator. This program brings the students onto Lehigh's campus both to offer upgraded facilities and evoke excitement of attending a university. It runs once a month during the academic year and for three weeks during the summer. Throughout these sessions students in eighth, ninth, and tenth grade are taught to use Flash to create fun and exciting projects that will pique their interest in computer science.

METHODOLOGY

Adobe Flash, previously known as Macromedia Flash, is a multimedia authoring tool used to develop animation and interactivity for the web. Flash can be used to create movies that integrate graphics, animation, audio, and video. Furthermore, Flash contains a powerful scripting language, ActionScript, which can be used to control objects and events in the movie. This gives the user the power to create full fledged applications. One of the best features of Flash, however, is that users can begin to make modules within minutes of starting to use the program.

Flash is appealing to students in a wide range of age groups. Younger kids who merely want to paint pictures will find it more flexible than Microsoft paint. Slightly older students will be able to dive into animating multiple frames and piecing together movies. Finally, the oldest and most advanced can continue to be challenged by ActionScript and the interactions it can provide. There are relatively few, if any, programs which offer such a rich environment for creativity while keeping the learning curve to a minimum.

From the point of view of the instructor Flash is a great opportunity to get students interested in technology. The typical technology curricula we have seen mainly consist of keyboarding, word processing and spreadsheets. While these skills are valuable both in school and the workplace, students begin to associate working on the computer with these rather simple and at times boring tasks. We feel that a technology instructor should seek to provide their students an early glimpse into the fun and creative aspects of computer applications without taking extensive time away from the main curriculum. Flash's low learning curve and immediate graphically rich results fill this need perfectly. Students can begin to produce actual movies from the very first lesson with minimal instruction, letting their interest in computers develop alongside creativity.

During the first phase of the LV STEM project, we successfully deployed Flash at a local middle school. The teachers were given initial training as well as undergraduate students to help them integrate Flash into their classroom. After several weeks of positive feedback it was decided that a formal Flash curriculum would be developed and deployed as soon as possible. Our project consisted of creating a Flash animation of a cell undergoing mitosis. In this manner we were able to take an important scientific topic and explain it visually while allowing students to utilize computer graphics techniques. Students were asked to draw each stage of mitosis, and then link them together in a movie file. Special effects such as sounds and control buttons were added later. As of the time of this writing, the curriculum is still in use.

During the summer 2007 Launch-IT program, Flash was used to teach basic principles of user interface design, problem solving and computer programming. The focus of the curriculum was to show Flash as a full fledged programming language but also something that could be used to create fun and interesting projects. To this end students were asked to create a digital jukebox. Students integrated MP3 audio into the program and created visualizations (Flash movies) to go along with the songs. Students worked independently to make their own creations but were encouraged to work together to share knowledge and help each other. After the jukeboxes were completed, Launch-IT student showed their results to their parents at the final closing ceremonies of the summer program.

FORMATIVE RESULTS

Although the programs are too young to have empirical evidence that correlates participation in the program with pursuit of computer science as an education, there are numerous interim results that show the program is working.

In the summer program there were 25 students enrolled in the Flash curriculum. Of these students 16 were female. Also, 19 of them belonged to a minority group. In the fall program there are 33 students enrolled in the Flash curriculum. Out of the 33 students there are 12 female students. There are also 25 students that belong to a minority group. Another fact of interest is that 20 of the 33 student enrolled in the fall program are returning students from the previous program. Although we see a decline of the number of females enrolled, the percentage of minority students has remained the steady across both programs.

Students participating in the program are asked to provide feedback on the activities they are undertaking. This feedback has been compiled in an interim report for the program. Students were asked to rate the activities on a satisfaction scale, 1=Not at all satisfied; 2=A little satisfied; 3=Pretty satisfied; 4=Very satisfied. Students rated working on the computer at an average of 3.5 over all three weeks. They also rated learning on the computer at an average of 3.37 over all three weeks. This data indicates that all the students on average were between "Pretty Satisfied" and "Very satisfied". The students were also asked to provide feedback to the instructors about the sessions. Below is some of the student provided feedback:

"I learned a lot in Flash today – for example how to make objects move. I was able to do it by myself... "

"Today was very good, I learned alot of things. This is something I will need."

"My day so far was fun. I enjoyed learning more about Flash, and making the shapes move."

"Today was a wonderful day. I laughed a whole lot at lunch; every day I like the Flash animation better and better. Can't wait till tomorrow…"

"My suggestion is that we spend more time on Flash because it's really entertaining and fun."

That is just a small sampling of the feedback received about the program but overall all the feedback is very positive about using Flash to learn about computer science. (Note: some quotes corrected for spelling)

Interest at the high school level

One of the major aspects in our success and momentum is students' word of mouth. Since the initial introduction of the Flash curriculum, several hundred local students have had exposure. Now, at the high school level, they are turning to their technology teachers and asking, "Where is Flash?" This shows that our program is successful at stimulating student interest in further pursuit of computer science education. We are currently in the process of acquiring the Flash suite for two local high schools, which will be followed by teacher training and curriculum development. It is worth pointing out however that even with a discount granted to K-12 institutions, this application may be out of reach of some school districts. Luckily, the newer versions are not radically different for our purposes, thus a single investment is sure to remain current for five years or more.

In our quest to relay student demand for Flash to school administrators, we ran a week long

condensed Flash course at the freshman level using a trial version of the software. Four separate periods with from 12 to 23 pupils each, were presented with a pilot curriculum. A large chunk of the week consisted of introductory concepts, followed by projects towards the end. After a verbal introduction to a topic, students completed step by step tutorials which allowed them to commit skills to memory without the frustration of blind exploration. The tutorials included making a movie of a moving pencil, spinning spirals, and morphing shapes. These building blocks were then used for projects like the fish aquarium and rolling skateboard. On the last day, the students were quizzed on their skills, and most importantly, asked if they would be interested in taking a full flash course if it were offered. Of the 54 that responded, 28 (51.8%) expressed interest (63 participated). The comments varied:

"I enjoyed Flash; I think I would like it a lot better if we had more time. I wouldn't take the class though."

"Flash helped me liven up this class and brought a challenge. I would take this class."

"I like flash but it's kind of hard and confusing. If they had a class here for it I probably would take it since I like it and can get better at it."

"I think flash is cool, but it's not the easiest thing. I wouldn't take the class because it is too difficult for me."

A common theme in the feedback is some level of frustration and confusion. We attribute this to forcing several weeks of curriculum into one. We underestimated the minimum time required for some topics, and also were short staffed since the teachers themselves were learning alongside the students. The mini course will be tested again this spring over a longer period of time to better simulate the workload of a normal class. Nonetheless, even this is an impressive result because the student population was drawn from the entire freshman class, as opposed to a select group of already technology inclined or honors kids. We hope to see more success in the spring and a full Flash course next academic year.

CONCLUSIONS

There are many negative stereotypes about computer science absorbed by children today. By using a Flash based curriculum we hoped to dispel these stereotypes and increase the interest of students, especially women and minorities. Our results show that the program is succeeding in attracting these students. The feedback provided by the students shows they are interested in the curriculum and wish to continue learning about computer science. Bottom line, the Flash based curriculum works in attracting and interesting students in computer science.

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