

Microsoft External Research

Transforming Computer Science in the Gaming Age

Microsoft Research and academics use video game inspired courses to lure next generation of computer scientists.

Since the mid-1980's, computer science has continued to be the fastest growing majors at colleges and universities across the United States. Attracted by the billion-dollar Silicon Valley success stories, people flocked to computer science classes. But when the tech bubble burst in 2000, so did the interest of many prospective students. Since then, educators have struggled to attract, engage and retain a new generation of computer programmers, developers and engineers.

The dwindling interest in "traditional" computer science is a problem that has concerned IT educators and companies alike. The fact is, the world runs on computer technology. Without active, engaged, intelligent computer scientists, the future of innovation is at risk.

So the question is: How do you attract talented, committed students and transform them into passionate, creative computer scientists?

A New Solution

Tackling the problem head-on, many schools have begun to tap into the well understood passion of their students: video games.

To reach new students, some educators are turning to inventive and often unconventional classes to attract and ultimately teach the next generation of computer scientists. By offering a variety of game-inspired courses, colleges and universities are beginning to see a resurgence of interest in computer science, and are attracting a more energetic and engaged crop of students.

"The schools we're working with, the ones offering game-based courses, in some cases are seeing over a 100 percent growth in enrollment. It's unprecedented the way students are responding to the gaming courses," said John Nordlinger, senior research program manager, Microsoft Research.

Microsoft Research has been on the leading edge of this educational approach, providing technological resources and funding dozens of universities through its Gaming in Computer Science initiative. This effort enables college professors to create game-inspired or game development curricula in introductory computer science courses that teach fundamental programming concepts and techniques. These courses, combined with robust assessment, make it possible to gauge the efficacy and impact of these programs, which, to date, have been decidedly positive.

Leading the Way

This year, Professors Michael Zyda from the University of Southern California (USC), Andrew Phelps from the Rochester Institute of Technology (RIT) and Kelvin Sung from the University of Washington-Bothell (UWB) each received support through the Gaming in Computer Science initiative.

Each has taken a unique approach to implementing the gaming courses, but across the board they've seen major improvements in the rates of attraction, retention and comprehension among students.

For Zyda, game-based learning offers a multitude of benefits, but most of all, he says, it is relevant to today's students —offering an avenue to engage with computer science in a way that makes sense to them.

My students are passionate about gaming, so when you approach computer science from the games context you are able to reach them in a meaningful way," Zyda said.

Fast Facts

Project: Gaming in Computer Science

Project Principals:

Professor Michael Zyda, Professor Kelvin Sung, Professor Andrew Phelps

Partners:

University of Southern California
 University of Washington-Bothell
 Rochester Institute of Technology

Web Sites:

<http://gamepipe.usc.edu>

http://depts.washington.edu/cmmr/Research/XNA_Games

<http://www.it.rit.edu/it/undergrad/bsgdd/faq.maml>

<http://creators.xna.com>

<http://leffe.cs.uvic.ca/gdcse/html>

Profile:

College and university professors are turning to new methods to recruit and engage the next generation of computer scientists. To meet those challenges, Zyda of USC, Phelps of RIT and Sung of UWB have created game-inspired or game development curricula in introductory computer science courses that help teach fundamental programming concepts and techniques.

Gaming in Computer Science Initiative

Through the Gaming Initiative, Microsoft Research has invested \$2 million in gaming kits, request for proposals (RFPs), assessment studies, case studies and targeted funding since 2004. This year alone, six academic researchers shared \$480,000 in funding and had access to game-related resources available from Microsoft, XNA Games Studio and Microsoft Flight Simulator X through the Gaming in Computer Science RFP. Other programs include the Annual Microsoft Academic Days Conference on Game Development in Computer Science Education.

The Gaming Initiative is administered by the External Research Group within Microsoft Research and is part of the group's ongoing commitment to investing deeply in innovative research. Through this group, Microsoft Research collaborates with the world's foremost researchers in academia, industry and government to move research in new directions across nearly every field of computer science, engineering and general science.

Microsoft Research:

<http://research.microsoft.com>

The Gaming Initiative:

<http://research.microsoft.com/ur/us/gaming>

In Zyda's classes, students work in multidisciplinary teams to approach assignments — building games by leveraging Microsoft XNA Game Studio as a platform. From musical scoring and graphic design to straight-up computer science, students are able to embrace every aspect of game development and the power of immersion, to make learning about computer programming exciting and interactive.

"By allowing students to get involved with something they really care about and work closely with other students, this program brings back the joy of computing," Zyda said. "That's evident in the 60 percent-plus retention rate we have in our gaming degree programs."

Much like Zyda, Sung of UWB has grabbed hold of the benefits of gaming and implemented a form of "edutainment" in his classrooms based on the Microsoft XNA framework. But unlike Zyda, Sung sees gaming more as a tool to root students in the basics of computer science rather than curricula unto itself.

"To create an ideal learning environment, we have created assignments that allow students to engage with the subject in a more concrete way," Sung said. "That is, typically, computer science is abstract, so by using game design elements students can access the material in a way that is real to them."

Moreover, Sung believes that this type of program is easy for faculty members to adopt and blend into existing lesson plans, which, he says, is the best way to ensure that the material is not only comprehensible but retained by students over time. And, according to Sung, many of his colleagues at UWB have taken notice of the success in his classes and have begun to develop similar assignments themselves.

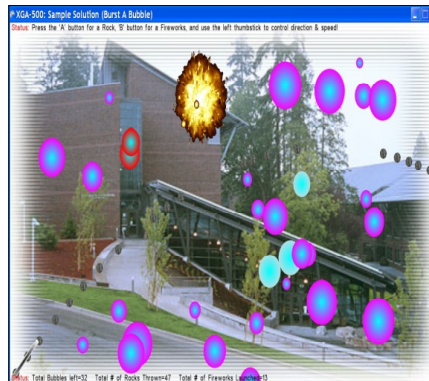


SkyDie, an interactive programming game developed for use by Zyda.

Taking what might be described as a blended approach, Phelps has brought game-inspired education to RIT, and believes that game-based assignments are an essential tool in teaching computer science in a way that is translatable to the IT and gaming industries.

"Our framework is built using C# with the Microsoft XNA framework through the Reality and Programming Together (RAPT) materials and the Multi-User Programming Pedagogy for Enhancing Traditional Study (MUPPETS). This allows our students to develop games and other programs in the same way they would outside the academic setting — it's hands-on and relatable," Phelps said.

Phelps' program is a hybrid of both straightforward game design and the utilization of game-inspired applications to foster learning. Phelps says his program gives a more cohesive picture of where games can help across the breadth of introductory programming courses.



Bubble Shooter, used in Professor Sung's CS1 course.

"When students take these courses, we are seeing an improvement when they are in advanced courses, and they also are exhibiting renewed interest in core computing concepts," Phelps said. "While there isn't yet an abundance of data, preliminary results are showing a strong correlation between earlier game-based assignments and success later during more advanced courses."

What's Next?

No matter the approach, the results are becoming clear — students and faculty alike are responding to game-based courses, and moreover, students are thriving because of them. Although some concerns remain over the future of computer science and how to attract engaged, passionate students to fuel the next generation of technological breakthroughs, all the early data suggests that game-oriented curricula are reinvigorating the study of computer science. These courses are proving a great way to build teamwork and teach multidisciplinary skill sets with comprehensive and engaging work — skills that are necessary in the broader IT industry. Part of that long-term success is a growing understanding that even before college students must begin to focus more on their math and science skills and Microsoft Research is looking for solutions to address and broaden the pipeline of capable, competent students within technology disciplines.

Moreover, Microsoft Research has made a significant commitment to partner with educators and students to help new computer scientists develop. And Microsoft believes that embracing new, innovative ideas is an important and necessary aspect for the ongoing teaching of computer science, and related topics.

© 2008 Microsoft Corporation. All rights reserved. This case study is for informational purposes only. MICROSOFT MAKES NO WARRANTIES, EXPRESS OR IMPLIED, IN THIS SUMMARY. Microsoft is a registered trademark of Microsoft Corporation in the United States and/or other countries. The names of actual companies and products mentioned herein may be the trademarks of their respective owners.