Ed Boyden's blog

Ed Boyden is an assistant professor in the MIT Media Lab. His lab broadly invents new tools to engineer brain circuits, in order to treat intractable disorders, augment cognition, and better understand the nature of existence.

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Monday, July 14, 2008

Inverting the Core

What if all classroom work aimed to solve real-world problems?

When I was a new student at MIT, there were legends of a math class in which the professor would occasionally assign an unsolved (and possibly unsolvable) problem. And every now and then, a student would resoundingly nail it. Soon after arriving at MIT, I was successfully spending my leisure hours inventing control algorithms for underwater robots, writing physics-based computer animation engines, devising new pattern-recognition algorithms, and building new kinds of NMR spectrometers. Now, more than a decade later, and being a professor myself, it's clear that some of the most valuable learning I did at MIT occurred during the solving of real-world problems. Simply put, in the Internet age, once you learn the basic core material, perhaps the best way to direct the growth of learning is to chase down real-world problems and fix them. You learn how to wrestle with failure, and how to get the resources you need.

Every now and then, it's useful to see how seriously one takes one's ideas. So let's take the above observation to its logical end: what if we decided that all work that students do in service of their education--problem sets, homework, exams--should be aimed at having a direct impact on solving a major current real-world problem? Please note: this doesn't at all imply the abandonment of learning of core things (calculus, physics, basic chemistry and biology, signal processing); it's just that a particular piece of homework might involve, instead of proving a discovery by Einstein right for the thousandth time, the solving of a piece, however small, of something unknown and important.

Clearly, this requires a mapping process--professors and teachers must parse real-world problems into decoupled chunks that can be addressed by individuals, while still enabling learning of the core materials. There are certainly some good examples of classes like this already. Lab classes at many universities exist in which students build medical devices, create computers, design virtual worlds, write business plans for ventures in developing countries, and learn how to make autonomous robots. Here I am wondering if, in addition, it would be possible to map real-world problems into the problem sets, homework, and exams for all the other classes--perhaps even introductory core classes. It's interesting to think about whether this might help humanity solve some outstanding problems. A back-of-the-envelope calculation: if 4,000 undergraduates at a university spent 40 hours a week during the school year solving problems that map onto

real-world problems, that's more than 3,000,000 extra hours a year of inventing, design work, and creation, aimed at the problems that face humanity today. Multiply that times the number of universities engaged in such fields, and the new ideas and contributions to the world could be staggering. At MIT, undergrads do a lot of research. In my group, undergrads are here nights and weekends, even on busy school weeks, innovating incredibly novel inventions and conducting complex experiments. It is interesting to think about how that passion could be harnessed during the rest of their schedules.

An open question, though, is how much work it would take to map real-world problems into the thousands of smaller pieces that would be appropriate for classwork. And then to render them in engaging, interesting ways so that students will learn their core materials while they solve them. The new field of human-based computation is beginning to explore related questions. I was particularly intrigued by a recently released game that people can play to help solve questions in the field of protein folding--but many problems are not as clearly understood, or modular enough, to be broken into many subparts in such a way. It's possible that a discipline will need to arise around the analysis of really tough problems, and the breaking down of them into smaller parts. We also need to devise new and effective strategies to engage humans (with the assistance of computers) in the solving of such problems. It'll be interesting to see how far these ideas will scale in the years to come.

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Tags: education, MIT, class, problem-solving, project, college, human computation, universities, students, undergraduates

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Eduzendium
Eduzendium is a project by the online enzyclopedia Citizendium that tries to map the real world problem of writing articles that accuratly describe a concept onto students.
At the moment people often use wikipedia articles to inform themselves that don't effectivly or accuratly explain the concept that people want to look up.
Therefore writing good articles about concepts has realworld applications, since good articles that describe how things work help other people to learn.
It's also something that can be done in introductory core classes, since good articles that explain core concepts are needed.

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Inverting the Core
Ed - this is the first Blog I read of your's. It prompted an thought and idea though.

Many institutions are funded by Federal and State dollars for basic research. Why not have society (or government) create a top 10, 20 or 100 list of problems we're facing and have students work on solutions? By leveraging student brain power and enthusiasm there may be ideas generated that actually solve these problems, or lay the foundation for solving them. Perhaps some type of sociology or humanities class credit can be given for taking the class, but the net result is valuable basic applied reseach and solutions.

Maybe something already exists already - who knows?

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