

The Need to Start Research Education Early

William J. Joel

Undergraduate Research Alliance

"I hope I remember everything," said Toni.

"You won't," said Trapp. "That's how you learn. But after you make the same mistake one, or two, or five times, you'll eventually get it. And then you'll make new mistakes."¹

By our mistakes we shall learn. If I had a nickel for each time I've tried to put this across to a student

It seems as if academic courses aren't always designed to foster making mistakes. Too often the emphasis is on getting the best grade possible, as opposed to simply learning something new. But, in the real world, there are no tests to take, no quizzes or exams to struggle through. There's just the need to get the job done to the best of your ability.

So, where in our curriculum do we provide students with an opportunity to fail? Where do we allow them to see that proving a hypothesis invalid is as beneficial as showing that it works?

A truly successful education goes beyond mere memorization of facts. It engages students in seeing the connections among these facts and seeing the story behind the facts, and it asks them both to apply what they've started to learn and to evaluate their efforts. Please note, I didn't say "evaluate their success." That would have been misleading, for not all efforts lead to a successful outcome. Then again, it all depends on how you measure success.

Let's talk about research, original research conducted by undergraduate students. Immediately I can hear the naysayers declaring that undergraduates can't be prepared to participate in original research until, perhaps, their final year of study. Balderdash! And that, dear friends, leads us to this essay's heart. I believe that not only can all undergraduates perform original research but, where possible, they should.

Research's Impact on Undergraduates

I've been a professor for about 30 years, and for most of those years I've worked with undergraduates on research projects, whenever I can convince

them to do so. I've taught, for the most part, at four-year liberal-arts institutions—teaching schools, where research is often undertaken in the time left over between teaching responsibilities. But this hasn't stopped me. Rather, it has made me even more determined. Perhaps a story might help illustrate research's true impact on my undergraduates.

At my first school, Marist College, I had the pleasure of working with two undergraduates and a colleague in psychology on a project assessing how static images affect computer-aided instruction (CAI). Basically, our research showed that including still images in CAI had no statistical benefit for middle-school students. A picture isn't always worth a thousand words.

However, we did find that for those students who understood something about the CAI lesson content, as demonstrated by a pretest, the inclusion of images provided a statistically significant benefit. Perhaps this had more to do with learning styles than simply adding graphics to CAI. Perhaps.

Subsequently, my colleague and I, assisted by one of the two students, wrote a paper that we later presented and saw published. On receiving our author's copies, we sent an appropriate share to our student writer. He was amazed. He never imagined his efforts would lead to his name on a published paper.

And I could tell other such tales, such as the student who was astonished when I wasn't upset that we hadn't met all our research goals. When asked, all I could say was, "that's research for you."

Also, several years ago, a student and I had a poster on simulating Chinese brushstrokes (see Figure 1) accepted for the International Symposium on Nonphotorealistic Animation and Rendering

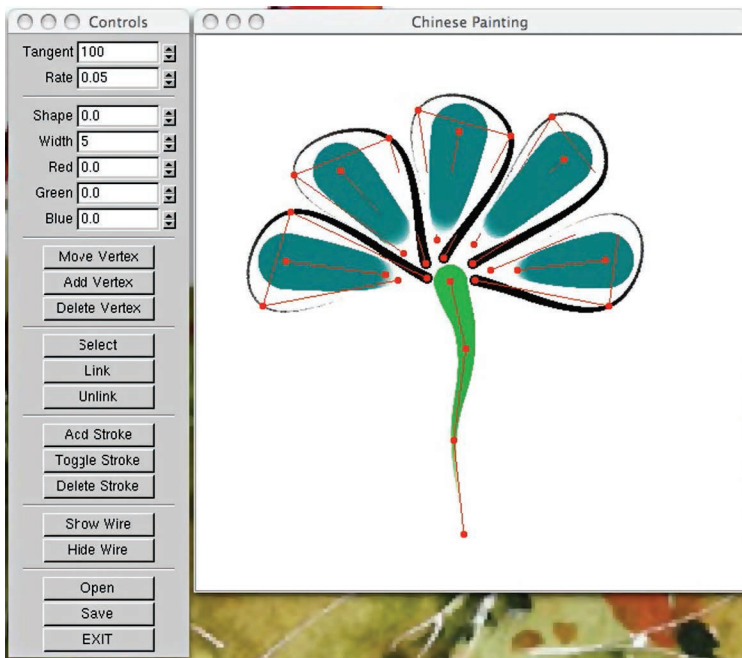


Figure 1. An undergraduate student and I created this program for simulating Chinese brushstrokes. We presented a poster for this research at the International Symposium on Nonphotorealistic Animation and Rendering.

(colocated with Siggraph).² Yes, it was simply a poster, but this demonstrates that the research that undergraduates can accomplish needn't be ostentatious but simple and to the point. By the way, our poster was well received.

Coming to Consensus

However, I wasn't satisfied with merely promoting research's benefits to my own students. In approximately 1998, I began an annual Siggraph birds-of-a-feather session on undergraduate research. Each year's session found a new group of attendees to hash out what undergraduate research was, what a student needed to know to get started, and what support was required. You can easily imagine the range of opinions at these sessions. Even so, there were three conclusions that we all shared.

First, we agreed that undergraduate students can truly be engaged in original research, working independently, and not simply as an extra pair of hands for faculty or a graduate student. However, we didn't agree on when students should begin. Some participants felt that significant learning first needed to take place. Others, including me, felt that even beginning undergraduates had something to offer.

Second, we agreed that for undergraduate research to be successful, the parent institution needed to buy into the idea. The consensus was that this didn't mean the school needed to provide monetary support. (Then again, money never

hurts.) Rather, the institution needed to publicly show that research was both an essential and a necessary component of an undergraduate's curriculum. Given the need to pack more and more topics into a degree, this isn't always an easy sell.

Finally, we recognized that many, many institutions don't offer graduate degrees, and as such don't have a research program undergraduates can join. We determined that communication among these schools, to share expertise, resources, and such, was imperative. We hoped that if a formal conduit for communication were in place, then interinstitutional projects might arise. This is where the Siggraph Education Committee stepped in to help.

The Undergraduate Research Alliance

In 2004, under the committee's aegis, the Undergraduate Research Alliance formed to provide just such a communication channel. Since its inception, the Alliance has scheduled a session at Siggraph to provide faculty and students the opportunity to discuss their research ideas, successes, failures, needs, and so on. These sessions are the primary vehicle for communication.

And, given the breadth of attendees at each year's conference, we always discuss research with a lowercase *r*. We believe that you shouldn't measure the merit of original undergraduate research by its scale. True growth in any field is found more often in tiny steps forward, rather than great leaps.

In addition, when possible, the Alliance provides information on undergraduate research on its website (<http://education.siggraph.org/community/ug-research>). This resource, like most of the Education Committee's resources, is self-populated and works best when many submit.

As the Alliance's director, I invite those of you who are interested to participate in at least one of two ways. First, by attending Siggraph, you'll be able to meet and talk with other like-minded attendees. As I stated before, this is the primary way we share ideas.

Second, by sending me information about your efforts to promote undergraduate research, you'll add your voice to the wider discussion. And, with your permission, we'll add your information to our website. This includes requests for help from other institutions, perhaps leading to joint projects.

So, what comes next for the Alliance? This year, we hope to begin assembling an archive of tangible resources that faculty can use to create and sustain undergraduate research programs. Items in the archive might include course syllabi, book reviews, sample grant proposals ... the sky's the limit. But a highly desired component would be

position papers discussing the pros and cons of undergraduate research at a given institution.

I hope to see each of you, one day, at Siggraph. And, perhaps, our schools might join forces in a new and enticing research project.

The possibilities are endless.

Reference

1. L. Sachar, *The Cardturner: A Novel about a King, a Queen, and a Joker*, Delacorte Books for Young Readers, 2010.
2. W.J. Joel, "Delayed Feedback in a Chinese Brush Painting Interface," *Siggraph 2006 Research Posters*, ACM, 2006, article 144.

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