



By Annie Murphy Paul

## HEALTH &amp; SCIENCE

# The Protégé Effect

Why teaching someone else is the best way to learn

By [Annie Murphy Paul](#) @anniemurphypaul | Nov. 30, 2011

For thousands of years, people have known that the best way to understand a concept is to explain it to someone else. “While we teach, we learn,” said the Roman philosopher Seneca. Now scientists are bringing this ancient wisdom up to date, documenting exactly why teaching is such a fruitful way to learn — and designing innovative ways for young people to engage in instruction.

Students enlisted to tutor others, these researchers have found, work harder to understand the material, recall it more accurately and apply it more effectively. In what scientists have dubbed “the protégé effect,” student teachers score higher on tests than pupils who are learning only for their own sake. But how can children, still learning themselves, teach others? One answer: They can tutor younger kids. The benefits of this practice were indicated by a pair of articles published in 2007 in the journals *Science* and *Intelligence*. The studies concluded that first-born children are more intelligent than their later-born brothers and sisters and suggested that their higher IQs result from the time they spend showing their younger siblings the ropes. Educators are experimenting with ways to apply this model to academic subjects. In an ingenious program at the University of Pennsylvania, a “cascading mentoring program” engages college undergraduates to teach computer science to high school students, who in turn instruct middle school students on the topic.

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But the most cutting-edge tool under development is the “teachable agent” — a computerized character who learns, tries, makes mistakes and asks questions just like a real-world pupil. Engineers and computer scientists at Stanford and Vanderbilt universities have created an animated figure they call Betty’s Brain, who has been “taught” about environmental science by hundreds of middle school students. Even though users’ interactions with Betty are virtual, the social impulses that make learning-by-teaching so potent still come into play. Student teachers are motivated to help Betty master the material, so they study it more conscientiously. As they prepare to teach, they organize their knowledge, improving their own understanding and recall. And as they explain the information to her, they identify knots and gaps in their own thinking. A 2009 [study](#) of Betty’s Brain published in the *Journal of Science Education and Technology* found that students engaged in instructing her spent more time going over the material and learned it more thoroughly.

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Feedback from the teachable agents further enhances the tutors' learning. The agent's questions compel users to

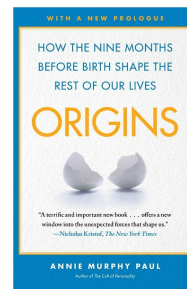
reported in 2006 on the use of a teachable agent by high school students learning to engage in deductive reasoning. On a subsequent test of their skills, the students who had observed agents using rules of reasoning to solve a problem "significantly outperformed" students who had only practiced applying the rules themselves.

Above all, it's the emotions elicited by teaching that make it such a powerful vehicle for learning. Student tutors feel chagrin when their virtual pupils fail; when the characters succeed, they feel what one expert calls by the Yiddish term *nachas*. Don't know that word? I had to learn it myself: "Pride and satisfaction that is derived from someone else's accomplishment."



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Paul is the author of *Origins* and the forthcoming book *Brilliant: The New Science of Smart*. The views expressed are solely her own.



Paul's latest book is *Origins: How the Nine Months Before Birth Shape the Rest of Our Lives*.

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