

# IDA | Research Summary

## Czech Philosopher Comenius Planted the Seed



IDA's Welch Award annually recognizes the best external publication by IDA researchers. Last year marked the 10th anniversary of the award, named for retired U.S. Air Force General Larry D. Welch, who served as president of IDA from 1990 to 2003 and again from 2006 to 2009. This summary is the fifth in a series reflecting on the 10 winning publications since the award's inception in 2011. The Welch Award winner for best external publication in 2017 was "**Effectiveness of Intelligent Tutoring Systems: A Meta-Analytic Review**."

IDA researcher J. D. Fletcher of the Science and Technology Division and former lecturer James A. Kulik of the University of Michigan based their winning article on IDA research for the Office of Naval Research. The article, which appeared in *Review of Educational Research* in 2016, reviewed efforts to build intelligent computer-based systems that provide adaptive, individualized tutorial instruction to military personnel.

Fletcher's interest in tutor-quality education grew from the writings of Czech philosopher John Amos Comenius (1592–1670). Comenius had observed that students learned best from a tutor who came to their homes to teach them individually. Unfortunately, only a small portion of the population—the wealthy—had access to that educational privilege. Inspired to improve on that situation, Comenius theorized that the benefits of one-on-one instruction could be brought to the masses by having tutors



teach multiple students at one time. His ideas became the basis for public classroom education.

Flash forward to the 1960s when Fletcher was in graduate school and the concept of digital, computer-assisted tutoring began to be developed and applied in academic circles. Similar to Comenius's thinking, the idea behind digital tutoring was that lessons via computer could be given to thousands of students at once. But unlike classroom instruction, computers could more precisely tailor the pace and content of instruction to the individual abilities and progress

of each student, thus making assessable and affordable the advantages of individualized tutoring to large numbers of learners.

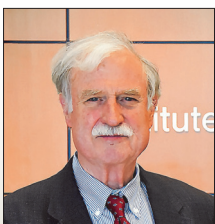
Years later, after working in the field of education and digital tutoring at IDA, Fletcher saw that the same approach could extend to training personnel in technical areas of military action. Military operations succeed or fail depending on the knowledge and skill of the soldiers, sailors, airmen, and marines involved. However, the rapidly increasing technical complexity of military operations is raising the level of training needed to perform them.

Fletcher and Kulik's 2016 meta-analysis reviewed the capabilities of computer-based, tutorial instruction that were available and affordable at the time. By, in effect, using computers to provide an individual tutor for each learner, as recommended by Comenius, they found computer-based instruction compared to standard classroom instruction to be less expensive and substantially more effective in meeting a wide range of learning requirements.

Fletcher convinced James Kulik, who wanted to retire (and has now done so), to join him on the project. Kulik is widely known and respected for his lifetime work on the development and application of meta-analysis.

"I was fortunate to have his assistance and expertise in preparing a review for digital tutoring," said Fletcher. "Winning the Welch Award was unexpected, but both Kulik and I were very honored and pleased to receive it."

Kulik has now retired, and Fletcher is nearing retirement himself, but he would like to finish a few more research efforts first. "It all started with Comenius," he said, noting that one of the articles he is working on is about the little known philosopher who developed the affordable classroom learning procedures with which we are all now familiar. As their report suggests, these procedures can be affordably and effectively adapted to the specific needs of each learner through the use of computer technology.



**J. D. Fletcher** ([dfletche@ida.org](mailto:dfletche@ida.org)) is an adjunct researcher in the Science and Technology Division of the Systems and Analyses Center. Fletcher earned his doctoral degree in educational psychology from Stanford University. Prior to joining IDA in 1986, Fletcher worked for the Army Research Institute as a research psychologist.