Computer science college seniors in U.S. outperform peers in China, India and Russia, new research says

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Undergraduate computer science programs at universities and colleges in the United States appear to produce more skilled students on average

than equivalent programs in China, India and Russia, according to new Stanford-led research.

An international group of scholars led by the Graduate School of Education's Prashant Loyalka found that undergraduate seniors studying computer science in the United States outperformed final-year students in China, India and Russia on a standardized exam measuring their skills. The research results were published on March 18 in a new paper in *Proceedings of the National Academy of Sciences*.

International comparison of universities usually falls in the domain of popular news rankings and general public perception, which rely on limited information and do not consider the skills students acquire, Loyalka said. That's why he and his team wanted to collect and analyze data on what students learn in colleges and universities in different countries.

"There is this narrative that higher education in the United States is much stronger than in other countries, and we wanted to test whether that's true," said Loyalka, who is also a center research fellow at the Rural Education Action Program in the Freeman Spogli Institute for International Studies. "Our results suggest that the U.S. is doing a great job at least in terms of computer science education compared to these three other major countries."

The findings

As part of the study, the researchers selected nationally representative samples of seniors from undergraduate computer science programs in the U.S., China, India and Russia. Students were given a two-hour standardized computer science test developed by the nonprofit testing and assessment organization Educational Testing Service. In total, 678 students in China, 364 students in India and 551 students in Russia were

tested. In the United States, the researchers used assessment data on 6,847 seniors.

The test, which aligns with national and international guidelines on what should be taught, probed how well students understand different concepts and knowledge about programming, algorithms, software engineering and other computer science principles.

Researchers found that the average computer science student in the U.S. ranked higher than about 80 percent of students tested in China, India and Russia, Loyalka said. In contrast, the difference in scores among students in China, India and Russia was small and not statistically significant.

Researchers also compared a smaller pool of students from top-ranking institutions in each country. They found that the average student in a top computer science program in the U.S. also ranked higher than about 80 percent of students from top programs in China, India and Russia. But the top Chinese, Indian and Russian students scored comparably with the U.S. students from regular institutions, according to the research.

The researchers also found that the success of the American students wasn't due to the sample having a large number of high-scoring international students. The researchers distinguished international students by their language skills. Of all sampled U.S. students, 89.1 percent reported that their best language is only English, which the researchers considered to be domestic U.S. students.

"There is this sense in the public that the high quality of STEM programs in the United States is driven by its international students," Loyalka said. "Our data show that's not the case. The results hold if we only consider domestic students in the U.S."

The researchers also found that male students scored moderately higher than female students in each of the four countries.

"The difference between men and women is there in every country, but the gaps are modest compared to the gaps we see between countries and elite and non-elite institutions," Loyalka said.

Further research

The new research is a part of a larger effort led by Loyalka to examine the skills of students in science, technology, engineering and math fields in different countries. In another forthcoming paper, he and his collaborators examine other skills among students in the same four countries. Further research will also look at the relationship between skills developed in college and labor market outcomes, he said.

Another major goal of the research team is to look more deeply at what might be driving the difference in the performance among countries.

"We're looking at different aspects of the college experience including faculty behavior, instruction and student interactions," Loyalka said. "One of our major goals is to see what types of college experiences could contribute to better student performance."

More information: Prashant Loyalka et al. Computer science skills across China, India, Russia, and the United States, *Proceedings of the National Academy of Sciences* (2019). DOI: 10.1073/pnas.1814646116

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