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Analysis of Costs in an Algebra I Curriculum Effectiveness Study

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Summary

As part of RAND’s ongoing evaluation of the effectiveness of Carnegie Learning’s Cognitive Tutor® Algebra I (CTAI) curriculum in realistic school settings, the research team examined the costs of implementing the CTAI curriculum and comparison algebra I curricula. The CTAI curriculum provides a computer-based tutor for individualized support to students, uses consumable textbooks that students write in, and recommends higher levels of initial training and professional development than comparison curricula. While these features may make the curriculum more or less effective in raising student achievement, a primary focus of the effectiveness study, the affordability of the curriculum is another factor that districts may wish to consider in deciding whether to adopt it. At the time of this evaluation, districts were experiencing significant budget pressures, which may place constraints on whether to adopt a new curriculum and which one to select.

The purpose of this report is to document the cost information collected in this study so that school districts can evaluate the costs associated with adopting and implementing the CTAI curriculum, and how those costs compare with a set of three other algebra curricula used in these districts and across the nation. This information can assist school districts in assessing cost feasibility—whether implementing the CTAI curriculum is feasible given their available resources. This report is intended to complement forthcoming reports on the effectiveness of CTAI, in order to provide educators and policymakers with essential information for future decisions regarding the adoption of algebra I curricula.

Data and Methods

The RAND evaluation of CTAI includes the participation of approximately 150 middle and high schools in 50 U.S. school districts in seven states. The study employed an experimental research design in which half of participating schools were randomly assigned to adopt the CTAI curriculum and the other half to continue using their existing algebra I curriculum. The cost data for this report were collected from schools participating during the first two years of the evaluation, from 49 school districts in six states.

Researchers surveyed one district-level official, such as the superintendent or director of curriculum and instruction, in each district regarding curriculum costs associated with three categories: materials, which include textbooks and software; software implementation resources, such as computers; and teacher training costs. The surveys were initially fielded online, with follow-up by mail and telephone, and the response rate for the survey was 74 percent. Responding and nonresponding districts did not differ significantly, although districts in
Results

A thorough cost feasibility analysis of Carnegie Learning’s CTAI curriculum demonstrated that its reliance on computer-aided instruction and its recommended levels of teacher training result in higher per-student costs than many existing algebra I curricula in participating schools. We report annualized per-student costs that consider inflation, length of adoption or useful life of ingredients, and the average number of students participating in the two study years. Overall costs of CTAI were, on average, about $69 per student higher than the comparison curricula (published by Prentice Hall, Glencoe, and McDougal Littell) that were in place in the participating districts. The CTAI curriculum cost was estimated to be $97.18 per student, compared with $27.88 per student for the other algebra I curricula. The following paragraphs examine the costs associated with each of the three categories.

Although the purchase price of student textbooks (and accompanying workbooks) was higher for the comparison curricula, those curricula did not require replacement of the textbooks each year. In contrast, the CTAI textbooks must be replaced every year. Thus, over the course of curriculum adoption the cost of the CTAI curriculum was estimated to be higher: $21.55 versus $11.28. The cost of the CTAI software was also higher than other algebra I software programs in use by the districts: $29.92 versus $14.04.

Technology equipment, infrastructure, and support expenditures for the CTAI curriculum were higher than for districts using other software packages in their algebra I classrooms. Thirty percent of districts adopting CTAI spent additional money on computers, infrastructure, and/or support staff to implement the curriculum. While the investment in technology may have benefited all students in the school, even those not enrolled in algebra, it was clear that the technology demands of CTAI triggered extensive technology investments that might not otherwise have occurred. These investments raised the up-front cost to implement CTAI compared with other technology curricula.

Teacher training was another reason for CTAI’s higher per-student cost. Schools adopting CTAI in this study were provided an amount of professional development that was equal to the amount that schools typically purchase when they adopt the CTAI curriculum on their own, as reported by Carnegie Learning. Forty percent of the comparison districts reported providing little to no curriculum-specific training to their algebra I teachers. While many of these schools were not newly adopting their algebra curriculum, we asked them to report on any professional development they provided at the time of adoption as well as ongoing professional development. The level of training recommended by Carnegie Learning cost about $15 per student more than training provided for the comparison curricula.

Discussion

This analysis found that CTAI was more expensive to adopt than comparison curricula. The cost of Carnegie Learning curriculum materials, including student textbooks and licenses, was higher than the comparison curricula published by Prentice Hall, Glencoe, and McDou-
gal Littell. The Cognitive Tutor software had greater technology infrastructure and support requirements than other software programs, which caused districts to purchase new computers, upgrade their technology infrastructure, and/or hire technology staff. Although these upgrades may positively impact all students, this additional up-front cost of adopting CTAI may be prohibitive.

The CTAI curriculum is largely based on an approach in which students lead the classroom discussions of mathematics, and teachers facilitate their discussions. According to Carnegie Learning, the combination of the instructional approach and software warranted a significant amount of teacher training. Investments in teacher training lead to higher-quality implementation of the curriculum and could have the potential to improve student achievement outcomes.

Overall, adoption of the CTAI curriculum was likely to cost a district significantly more than what was typically spent on the other algebra I curricula used by participating schools. The RAND research team is completing its analysis of the effectiveness of the CTAI curriculum. Findings from this effectiveness evaluation may play a critical role in supporting districts’ decisions to adopt the CTAI curriculum. If findings suggest significant positive outcomes for students the additional costs associated with implementing CTAI may be viewed as warranted. This report can complement the effectiveness results to serve as a resource to educators and policymakers in weighing the costs and benefits of CTAI adoption.