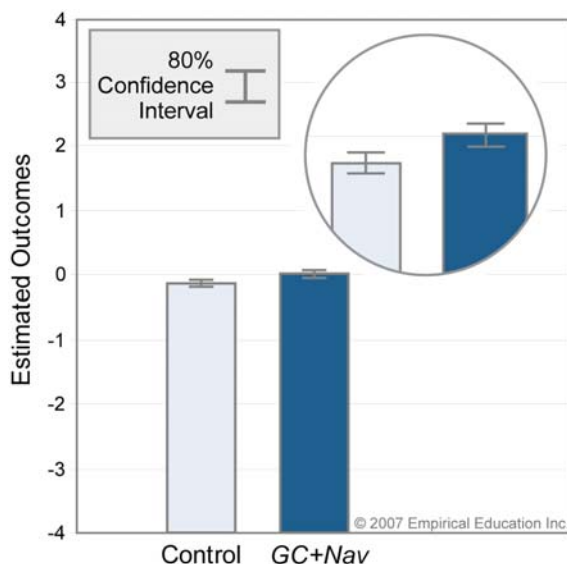


Comparative Effectiveness of the Texas Instrument's TI-Navigator™: *A Year 2 Report of a Randomized Experiments in the East Side Union High School District and San Diego Unified School District*

Introduction. We sought evidence of the effectiveness of the TI-Navigator classroom networking system for the second year of a two-year research study of Texas Instruments classroom technology. This randomized control trial compared Algebra I and Geometry instruction using the TI-Navigator system, which includes the TI-84 Silver Edition graphing calculator, to instruction with graphing calculators alone. The technologies did not provide a separate math curriculum, but did include curricular materials that specified calculator-based activities. The outcomes of interest are the student test scores in Algebra I and Geometry. For both subjects, we had two sets of scores: the Northwest Evaluation Association (NWEA) End of Course tests and the California Standards Test (CST).

We asked whether students in classrooms with access to the TI-Navigator system and training achieve higher scores than students in classrooms receiving only graphing calculators and training, whether TI-Navigator has a differential impact for students with various incoming math achievement levels, and whether the impact depends on gender or English proficiency. We researched these questions for classes in two urban school districts in San Jose and San Diego, California. East Side is a high school district within San Jose of about 25,000. San Diego City Schools is a K-12 district of about 135,000. In both cases about 28% are English learners.

Findings. For the most part, the experiment could not discern an impact as a result of providing the equipment and training for TI-Navigator. As shown in the figure below, we found a modest effect for Geometry achievement using the NWEA End of Course Geometry test. This figure shows the outcome measure in standardized units. However, this impact was not reflected in CST Geometry scores.



**Impact on NWEA Geometry Achievement:
Adjusted Means for Control and GC+Nav**

In Algebra, while we found no overall difference, there was some evidence of a small negative impact for students scoring “below basic” on the CST and, holding pretest score constant, for English proficient students. The results of the NWEA End of Course Algebra I test did not reflect those same results.

Implementation must be considered in interpreting these findings. Our surveys and observations make clear that this implementation was not a fair test of the difference TI-Navigator might make if used more extensively. Of the 19 teachers originally assigned to the treatment group, about half did not use the system at all for instruction. Of the remaining nine teachers, only three could be considered “Comprehensive-Implementers.” Of those three, only one used TI-Navigator daily. Technical glitches deterred many from using the system after previous failed attempts. Overall use may have been constrained by the fact that California prohibits calculator use on state tests.

Our results also must be qualified by the fact that, while finding differences on one test, we did not find differences on the other test. The significant amount of attrition, both at the teacher and student levels, although not believed to be associated with the

program being tested, raises issues about generalizability. For example, it is clear that in both experimental conditions, lower scoring students were significantly more likely to not have posttests, indicating that our findings are not applicable to the lowest scoring students in these districts.

Overall, we found that the TI-Navigator affected the average number of minutes the technology was used. The teachers with TI-Navigator reported using the technology about 15 minutes more per week per class period than teachers without. Future exploratory analyses may prove useful in suggesting whether extent of usage can account for student outcomes. In particular, since TI-Navigator resulted in greater technology use, examining the correlation between technology use and achievement may suggest a mechanism by which TI-Navigator could be effective. Future studies of TI-Navigator will benefit from greater support for implementation. We also recommend continuing to include Geometry in the topics to which TI-Navigator is applied, since the positive result found in this experiment should be replicated.

Design and Analysis. In the first year of this two-year experiment, we used a matched pair design to randomly assign 44 teachers to use graphing calculators with their existing math curriculum or to conduct “business as usual” in the classroom. In this second year, teachers kept their random assignments, the original graphing calculator group receiving TI-Navigator and the original control group receiving graphing calculators. The technologies were intended to be integrated with the school’s standard Algebra I and Geometry curricula.

All teachers participating in the study received TI graphing calculators, which have several features that can be used in Algebra I and Geometry classrooms. Program group teachers also received the *TI-Navigator*TM 3.0 system, which is designed to work with the TI graphing calculators and adds two capabilities: 1) wireless communication between students’ graphing calculators and the teacher’s PC computer and 2) activity center, quick polling, and screen capture activities. Separate, three day, professional development was provided for both sets of technology, the TI-Navigator system with graphing calculators and the graphing calculator alone. TI also provided all study teachers a standard notebook computer with a calculator emulator, a data projector, and calculator-based ranger units.

For this experiment, we randomized teachers in approximately equal numbers to the TI-Navigator and control groups. Because results from the experiment’s first year suggested a differential impact by English language learner status, we examined this moderator to determine whether the effect can be replicated. We also examined gender as a potential moderator.

The data for this study consist of student outcomes, demographics, and classroom observations. In addition to conducting formal and informal teacher interviews, we also collected 15 web-based survey responses from all participating teachers in each group. We retrieved TI-Navigator system log files from pilot classroom computers to confirm TI-Navigator use.

We designed the experiment described in this report to provide useful information to the participating school districts. Because we were testing a specific implementation of TI-Navigator in a particular setting, we caution readers about generalizing the results to districts with different populations, resources, and other relevant conditions. Although our results cannot be used as definitive evidence of the value of TI-Navigator, the areas of positive findings lead us to recommend that schools planning to implement TI-Navigator provide adequate support, both technically and educationally, while rolling out implementation in a manner that allows for continued tracking of student achievement gains.

To read the complete report, contact:

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