

# Action Research #3 Report

## Students Achieve More in New York Integrated Math AB with TI Graphing Calculators and TI-Navigator

<b>Teacher/Researcher:</b>	Dana F. Morse
<b>Location:</b>	Skaneateles HS, Skaneateles, NY
<b>Course:</b>	Integrated Math AB
<b>Grade:</b>	10
<b>Student Profile:</b>	52 Students in 3 Sections, 22 Male, 30 Female, 96% White, No FRL, all native English speakers. 1 student working below grade level at beginning of the year.
<b>Technology:</b>	TI-84 Plus family graphing calculators and TI-Navigator™ classroom learning system with projector and interactive whiteboard. Other software also used. Activities downloaded from TI web site.

**With TI-Navigator, 27% percent more students scored in the 90% range on the New York State Regents Math A for 2007, when compared to the same teachers' non-Navigator class in 2005.**

Setting:

You know you're in a special place when you enter Mr. Morse's math classroom. He calls it "The Raider Room" because of the wall-to-wall Oakland Raider memorabilia. But look again, and you'll see a banner: *Commitment to Excellence*. Photos of students being students line the walls, from Prom and Senior Ball, the teams Mr. Morse coaches, and from various travels – all creating a warm, caring, and motivating atmosphere. The student desks are in rows of four, facing a front table, with Mr. Morse's desks to the side. Students sit with whomever they want. A SMART Board™ complements a TI-Navigator classroom learning system. Two Calculator Caddy III's, and a dry erase sign out board hang from the wall and help Mr. Morse keep track of the handhelds his classes use. The students respond to this warm, caring atmosphere: quite often the students say that math class this year is their favorite subject; substitutes rave about the classes when Mr. Morse is out, and he reports no discipline or security issues. This is a trusting learning community where all students, regardless of academic standing and abilities, feel comfortable contributing answers.

Curriculum & Teaching:

New York State is phasing in a new curriculum that integrates Algebra I and Geometry in Math A, and Algebra II and Trigonometry in Math B. Mr. Morse's class is an integrated Math AB class for grade 10. Understandably, he's created all the materials for the class himself: notes are on canary colored paper, assignments are on cherry, tests on blue and quizzes on pink. Everything is 3-hole punched and goes in each student's binder, which becomes each student's personalized text. Mr. Morse writes the quizzes and tests using item formats that mirror the Regents tests. The New

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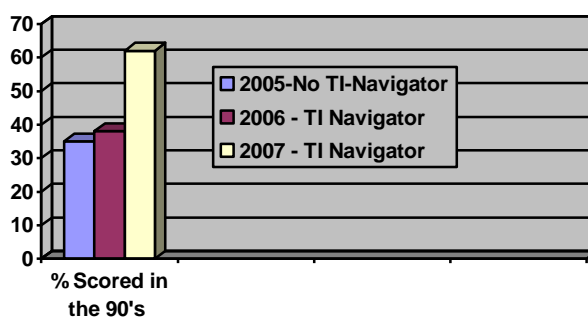
York State Math A Regents is given in January, and in June a local exam that parallels the Math B Regents is administered.

The grading system is based on homework grades of 1-5 and are returned the next day at the beginning of class. Tests and quizzes vary in their weight depending on length and question type, but all assessments are weighted equally. Students write a grade-tracking program in September for their calculators. This allows them to calculate their grade point average daily after each assignment is returned.

In a typical day throughout the year, students use their graphing calculators to compute answers, to compare answers with other students (via the TI-Navigator system), to generate their own examples or make predictions, and to discuss problem solving strategy with other students. Weekly tests and quizzes are also administered via the graphing calculator. Mr. Morse observes that at the beginning of the year he spends some time asking questions to help his students operate the handhelds and to get the right answer. But this kind of questioning becomes unnecessary as the year progresses. Most days throughout the year he focuses on questions that ask for reasoning, problem solving strategy and procedures, and explanations. In most lessons, he finds it easy to switch between representations of graphs, equations, tables, and verbal problem statements – and sometimes, multiple representations. He creates most problems the class works on. Although the students use their handhelds daily, Mr. Morse reports, “I am sure students are able to do work by hand before I show the advantages of technology.”

Mr. Morse considers himself an advanced user of TI handhelds and the TI-Navigator system (he is a T<sup>3</sup>™ instructor, and is a volunteer in The Ohio State University CCMS research project). He found that learning the TI-Navigator classroom learning system was easy, and only took about a week of daily use. Most of his students understand graphing calculator functions and mastered the device within 10 weeks. A few have taken an after-school programming class and graphing calculator workshops Mr. Morse offers.

Results:  
Mr. Morse’s students can be proud of their results on the New York State Regents Math A. In each of the past three years, 100% of the students have passed the test. But closer examination of the percent of students scoring at or above 90% on the Regents Math AB test shows the dramatic impact of the TI-Navigator system: with the TI-Navigator system an impressive 27% more students scored in the 90% range in 2007 – 62% in 2007 vs. 35% in 2005 without the TI-Navigator system.



Mr. Morse is a strong advocate for TI graphing calculators and the TI-Navigator classroom learning system, because he sees the impact daily in his classes. “I am able to offer so many more representations of functions in such short periods of time. Students can absorb the material in different learning modes. Visual, auditory, hands-on learners are all met. The TI-Navigator system brings out the introverted learner and allows for the teacher to become more knowledgeable of their students,” he says.

“Getting your hands on the technology and just being open to the endless possibilities can revolutionize how you teach,” Mr. Morse says. “In Activity Center, I will have students submit equations to mirror functions in everyday life. Students enjoy playing miniature golf, scoring ice hockey goals, making basketball shots and field goals using the TI-Navigator Activity Center. I will upload a picture from a file and then configure the activity so that students can send in graphs that are emulated in the picture. Students get so competitive and engaged that they often forget about the fact that they are learning math.”

Some of Mr. Morse’s best experiences in teaching have been with the TI-Navigator system: “During the review for the NY State Math A Regents, I sent students enrolled in my class Learning Check documents of the previous nine Math A exams. Each day, students would log in and their review exam was collected and scored by the Class Analysis feature within the time it took me to greet students at the door and get to

the front of the room. I then would become a game show host in revealing each answer one by one. We made wagers prior to going over the results. If the class had six unanimous answers of the 30 multiple choice, I might bring in a treat like bagels or doughnuts the next day. This made the spirit of the class really come out. Students were rooting each other on and cheering for one another. They paid close attention to problems which we went over to make sure not to repeat the error on a future review assignment. Of the 30 multiple choice questions, the record high for unanimous correct responses was 15 by the 7<sup>th</sup> review assignment. Class averages on review assignments went from 72% on the first review assignment to 91% on the last assignment.”

“Quick polls are the fastest finger races for my students. They try to beat one another to the answer. Students request quick polls to race. Different classes will compete with each other. We kept track of the fastest an entire class answered a multiple choice factoring question, and the record was 17 students in four seconds of the start of the poll, 13 of which answered simultaneously with the poll details time stamp. The other classes are still trying to beat that record,” says Mr. Morse.

“One of the best days of my teaching career was when I had a student who was very quiet, never talked much and kept to himself, won a quick poll question. The look on his face when the classmates congratulated him was priceless. You could see how proud he felt and your heart goes out to a touching moment like that. I will never forget that moment in my teaching career.”

Mr. Morse also is a strong advocate of professional development: “Have your ETC (Educational Technology Consultant) come to your school to do a demonstration. My ETC, Melody DeRosa, came to my school and integrated the TI-Navigator system into a lesson for my classes. I invited in my technology coordinator, principal, and department chair. The TI-Navigator system changes how you teach. Instead of hearing the same students dominate the questions you ask, every student has a voice. Instead of you lecturing to the students for a period, students and teacher are learning from each other. There is instantaneous feedback as to the comprehension of the material and the pace of the instruction. Quite often as teachers we must adapt to the variables that are thrown at us, and the TI-Navigator classroom learning system helps us connect the unknown to the possible.”