

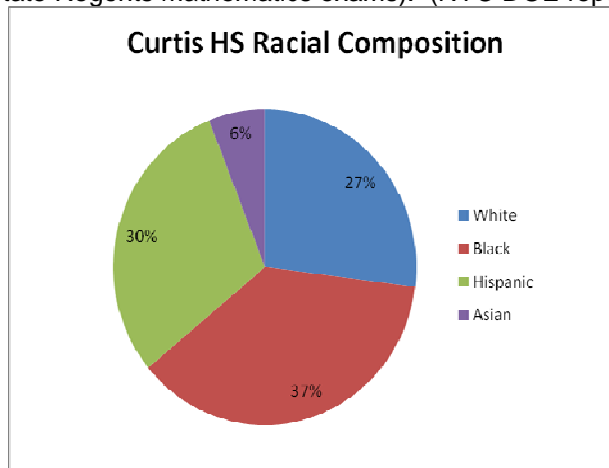
Development of Inquiry Based Mathematics Content by Teachers and
Students with TI-Nspire for Mathematics Teaching and Learning:
Preliminary Report
Case Study 15

Development of Inquiry Based Mathematics Content by Teachers and Students with TI-Nspire for Mathematics Teaching and Learning:
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|---------------------------|--|
| Teacher/Researcher | Dr. Irina Lyublinskaya, College of Staten Island |
| Location | Curtis HS, Staten Island, NY |
| Course | Integrated Algebra |
| Grade | 9 |
| Student Profile | 276 students and 8 teachers in a Title I school |
| Technology | TI-Nspire handheld compared to TI-84 graphing calculator |

There is direct correlation between quality and frequency of use of TI-Nspire in the classroom and teachers' and students' attitudes and proficiency. The quality of developed content was also in direct correlation with frequency and quality of technology use.

Setting. Curtis High School is located in Staten Island, New York City. Its enrollment is 2,856, which is 160% of its planned size. The diverse population is roughly evenly divided among White, Hispanic and African-American students, with a small Asian representation (see graph, below). With 42% of students on free/reduced lunch, the school qualifies for substantial Title I aid. 7% of the students are ELL and 14% of the students are Special Education students. Despite these challenges, 58% of all students achieve passing grades in mathematics (achieve at least a 65 on NY State Regents mathematics exams). (NYC DOE report card 2007-2008)



The study was conducted with 14 sections of 9th grade Integrated Algebra at varying attainment levels:

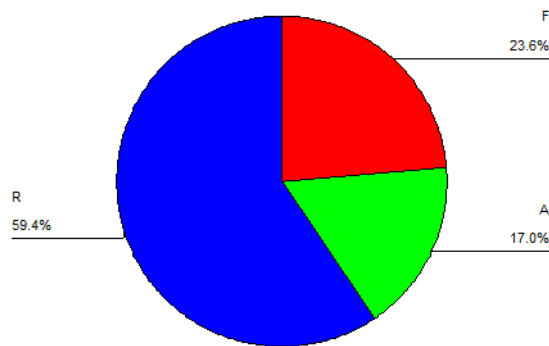
- Code F - regular freshmen integrated algebra, students performed at the grade level (levels 3 and 4 on the 8th grade math city exams) – 1 experimental, 4 control sections
- Code R - reduced size freshmen integrated algebra for students who performed below grade level (levels 1 and 2 on the 8th grade math city exams) – 3 experimental, 2 control sections.
- Code A - repeater section of integrated algebra for students who did not pass Math A Regents exam as freshmen – 1 experimental, 3 control sections

Study Design. In this quasi-experiment, Integrated Algebra classes of 4 teachers who volunteered for TI-Nspire training were compared to 4 teachers using TI-84s. 227 Students were assigned to experimental (TI-Nspire) and Control (TI-84) groups:

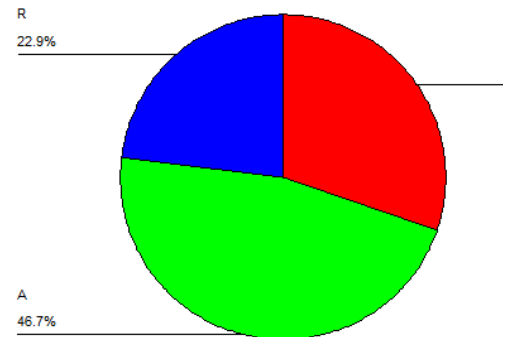
- Experimental group (TI-Nspire): 131 students at registration, 105 students at the end of fall semester, 107 students at the end of spring semester
- Control group (TI-84 calculator): 227 students at registration, 178 students at the end of fall semester, 171 students at the end of spring semester

The charts on the next page show the composition the two groups by level. They show that the experimental group was somewhat lower-level than the control group.

Experimental group composition



Control group composition



Teachers in the study had roughly similar profiles:

- Experimental group: 4 teachers with 1 – 10 years of teaching experience, 5 sections of integrated algebra
- Control group: 4 teachers with comparable teaching experience, 9 sections of integrated algebra

All teachers were experienced TI-84 users.

Treatment: Teachers in the experimental group received training, and both groups received weekly professional development:

- 5-days TI-Nspire summer institute for experimental group teachers –August 2007
- Additional TI-Nspire training sessions – 2 per semester

Weekly PD meetings for both experimental and control groups, for a total of 13 meetings over a year, each 3 hours long with an expert teacher-facilitator. At these meetings, teachers were asked to: review the curriculum, identify lesson topics, develop lesson plan and activity files, and present a lesson to the group at PD, followed by discussion, revision of the developed lesson as necessary, teaching lesson in class, post-teaching discussion, finalizing lesson materials.

Data Collected included surveys, work products, and achievement tests:

- Teachers: Pre-post attitude surveys, TI-Nspire proficiency self-assessment, Developed lesson plans, TI-Nspire activity files, Lesson observation protocols, Evaluation of presentations at PD, Reflections,
- Students: Pre-post content tests (experimental & control) in September and January, semester grades (experimental & control), NYS Regents exam grades (experimental & control), TI-Nspire proficiency self-assessment, attitude survey, reflections
- Achievement: fall and spring semester grades, NYS Regents exams

Results.

There is direct correlation between quality and frequency of use of TI-Nspire in the classroom and teachers' and students' attitudes and proficiency. The quality of developed content was also in direct correlation with frequency and quality of technology use.

Student Overall Proficiency and Attitudes

Student proficiency with TI-Nspire calculator was not affected by gender, race, calculator ownership, or course level. It depended on frequency and quality of technology use by the teacher (based on One-way ANOVA test).

Student Achievement Results

Content Tests: The Control Group Pre-Post Content Test, given in Sept. 2007 (N = 134), and in Jan. 2008 (N = 135) showed increase in performance but *no significant difference for all levels of courses*. The Experimental Pre-Post Content Test given in Sept. 2007 (N = 95) and in Jan. 2008 (N = 98) showed increased performance with **significant difference for students performing at grade level (code F), insignificant increase in other classes**.

This is reflected in the average semester grades, summarized in the tables below:

Average Semester Grades

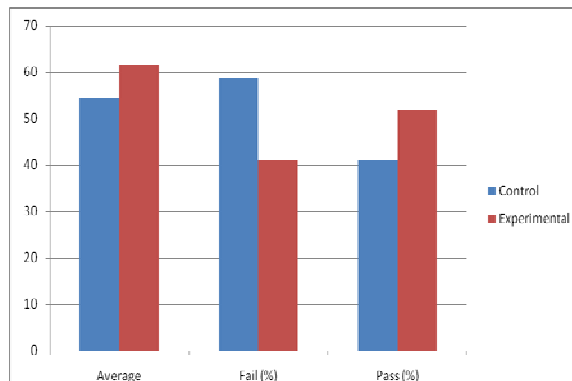
| Group | N | Minimum | Maximum | Mean | Std. Deviation |
|--------------|-----|---------|---------|-------|----------------|
| control | 349 | 31 | 100 | 61.28 | 14.055 |
| experimental | 212 | 40 | 97 | 66.33 | 13.079 |

t-test ($t = -4.238, p = 0.000$) shows that the 5 points difference in average semester grades is significant.

Fall vs. Spring semester grades significantly decreased in both experimental and control groups, however, the decrease in grades was much more dramatic in control group:

| Group | | | N | M |
|--------------|---------------------|----------------|-----|---|
| Control | spring - fall grade | Negative Ranks | 82 | |
| | | Positive Ranks | 37 | |
| | | Ties | 32 | |
| | | Total | 151 | |
| Experimental | spring - fall grade | Negative Ranks | 54 | |
| | | Positive Ranks | 19 | |
| | | Ties | 25 | |
| | | Total | 98 | |

State Test. While grades are subjective measures of students' achievement, NYS Regents exams are standardized measures that allow comparing these two groups with outside independent test. Due to the fact that not all students in both, experimental and control, groups took the exam, the comparison is done as an average of all scores, and frequency of pass/fail. The passing score on NYS Regents exam is 65. Control to experimental comparisons are shown below:



The chart shows improvement in average score and pass rate for the TI-Nspire students vs. the TI-84 students on the June exam.

Preliminary report, February, 2009. Study was performed in 2007-2008; now in data analysis stage.

Reference

Lyublinskaya, Irina (2008) Development of Inquiry Based Mathematics Content by Teachers and Students with TI-Nspire for Mathematics Teaching and Learning. Grant Report. New York: College of Staten Island