Ready To Teach Algebra Evaluation

A Report prepared for

The Concord Consortium, PBS TeacherLine, and the U.S. Department of Education

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Edcentric
7003 Waxmyrtle Court
Wilmington, NC 28409-4852
voice/fax: 910-796-0632
edcentric@edcentric.org

Hezel Associates, LLC
1201 E. Fayette St.
Syracuse, NY 13210
315-422-3512
hezel@hezel.com

EXECUTIVE SUMMARY

Ready To Teach Algebra is an online professional development program to support mathematics teachers, created jointly by Concord Consortium's Seeing Math Telecommunications Project and the PBS TeacherLine Project, with funding from the U.S. Department of Education (grant # R286A000006-03). The overall goal of Ready To Teach Algebra is "To improve student achievement by developing high quality, standards-based digital professional development to teachers and by developing high quality, standards-based digital classroom content."

The program is built around the major themes presented in today's algebra texts and typical algebra curricula: Ratio, Proportion, and Scale; Linear Functions; Transformations of Linear Functions; Linear Equations; Quadratic Functions; Transformations of Quadratic Functions; Quadratic Equations; and Descriptive Statistics. In addition, an Overview and a Final Project section frame the overall program.

In the past several years, the U.S. Department of Education has established new priorities for evaluation, with a strong emphasis on experimental and quasi-experimental research. This has resulted in Concord Consortium's development of a comprehensive research plan for the overall Seeing Math project beginning with the 2003 – 2004 school year and extending through the 2004 – 2005 school year. This final evaluation report focuses on the research and evaluation efforts conducted by the formative evaluation conducted by Edcentric and the quantitative evaluation conducted by Hezel Associates. Edcentric and Hezel Associates are the external evaluators for the Ready to Teach Algebra project.

The evaluation report focuses on the following two objectives of the Seeing Math Telecommunications Project produced by Concord Consortium:

- Evaluate the quality and usefulness of project materials and strategies.
- Research the effect and impact of the Seeing Math materials.

Quality and usefulness of project materials and strategies: The September 2004 – January 2005 formative evaluation of the pilot test of *Ready to Teach Algebra: Linear Family* served three class groups around the country. These teachers were almost equally divided among middle school and high school math teachers. More than half (58%) had majored in math or math education, and 15% had graduate degrees in math or math education. All indicated they enjoyed teaching math.

From a start-up group of 57 teachers, 41 completed the 14-week course. All the course completers found the online discussions to be valuable in helping them with instructional strategies for teaching algebra and with clarifying their understanding of course content. Most (90%) found the video clips to be valuable in helping them to clarify their understanding of student thinking around algebra content. Most (85%) found the video clips to be valuable in demonstrating new instructional strategies for teaching algebra.

An overwhelming majority of the completers (98%, or 40 out of 41) said they would recommend the course to colleagues. They cited alignment with NCTM standards, new instructional strategies, algebra concepts, self-reflection and collegial sharing as positive elements of the experience. Ninety-eight percent of respondents indicated they were using, or definitely planning on using, strategies and activities they took from the course. The six reflective surveys participants were asked to complete, the online messages, and the comments of the facilitators indicate that the course was a valuable experience and well worth the considerable amount of time they were required to put into it.

These findings indicate that the *Ready to Teach Algebra: Linear Family* course can be an effective teacher professional development experience for experienced middle and high school mathematics teachers in helping them to explore algebra instruction for and with their students.

The *Proportional Reasoning* and *Quadratic Functions* pilot test conducted in spring 2005 indicated that shorter (4 to 6 week) courses within Ready to Teach Algebra could also be beneficial to participating teachers.

Five teachers completed *Proportional Reasoning*. All found the video clips to be valuable in helping them to clarify their understanding of student thinking around algebra content. The majority (60%) found the video clips to be valuable in helping them with instructional strategies for teaching algebra and with clarifying their understanding of course content. Most found the online discussions to be valuable in helping them with instructional strategies for teaching algebra (80%) and with clarifying their understanding of course content (60%).

Sixteen teachers completed *Quadratic Functions*. Eighty-seven percent found the video clips to be valuable in helping them to clarify their understanding of student thinking around algebra content. The majority (75%) found the video clips to be valuable in helping them with instructional strategies for teaching algebra and with clarifying their understanding of course content. Most found the online discussions to be valuable in

helping them with instructional strategies for teaching algebra (94%) and with clarifying their understanding of course content (87%).

In summary, there was a high degree of participant satisfaction with all the Ready to Teach Algebra courses pilot tested during the year, with participants believing they better understood student thinking around algebra content and believing they had new instructional strategies, tools and approaches to use in their classrooms.

Effect and impact of the Ready to Teach Algebra Materials: The quantitative analysis, based on a quasi-experimental design with treatment and comparison groups, looked at teacher and student outcomes related to teacher enrollment in the RTT Algebra: Linear Family of course modules taken in Fall 2004. Additional analyses assessed outcomes for teachers and students from Cohort 1, which took the course in Spring 2004, and Cohort 2, a comparison group in Spring 2004 that became a treatment group in Fall 2004.

Assessments included teacher and student tests created specifically for the project. Teacher tests were open-ended measures constructed to be in alignment with the content and pedagogy material being taught in the RTT modules, and were scored with specially-designed rubrics in two different ways (see Data Collection Tools). Student tests were constructed by an external contractor based on Item Response Theory (IRT) and yielded three different scores—an Overall score, a Target score, and a Non-Target score. Target items related to the content that treatment teachers were exposed to in Spring and Fall 2004.

The primary analyses focused on a group of treatment and comparison teachers, and separately modeled test score gains in teachers and students as a function of teachers' treatment condition and background, including education level, years' teaching experience, etc., using general linear regression. Repeated measures tests were also conducted within Cohorts 1 and 2 to take advantage of Year 1 data. The student data analysis included the student-level variables of gender and ethnicity as well as teacher-level variables and used Hierarchical Linear Modeling to account for the multi-level data structure.

For the teacher assessment, overall differences favored the treatment group, but significant advantages were found only for the pedagogy subscale under the Standard Grading system and the Inferring/Drawing Conclusions subscale for the Balanced Assessment grading system. These cannot be considered as separate findings since the two scales draw largely from the same set of items and are highly correlated. The implication is that the treatment group learned less in algebraic problem solving (the

first three parts of the test) than in being able to intelligently discuss functions, questioning strategies, learning from student observation, learning from the use of calculators, etc. (Part C/pedagogy questions).

In the year after taking the course, a repeated-measures test showed that Cohort 1 teachers (a separate treatment group) gained significantly in some content and pedagogy areas. This analysis was limited to the 16 teachers for whom such data is available, and might be biased by attrition in the sample. That is, the teachers who were motivated to remain in the sample and provide data may also be those more motivated to use the RTT materials available to them and to continue to learn.

Within the treatment group, teacher ratings of the usefulness of each of the RTT Libraries were significantly and positively correlated with various measures of teacher content and pedagogy learning. The correlations between Library elements and teacher learning are weak to moderate, and are based on teacher self-report of perceived usefulness, but nonetheless may give some indication of where RTT resources had their impact.

In terms of the student tests, the treatment had no effect on student learning overall or in Target areas, but had a significant positive effect in non-Target areas in that students of treatment teachers declined less than students of comparison teachers. This finding is difficult to interpret, as it is unclear why understanding in these areas of algebra should decline significantly over the course of the school year in all cohorts. No student and few teacher-level variables influenced student learning. Teachers' possession of a mathematics degree had a complicated influence on student learning, in that students of teachers with a mathematics degree did significantly worse on Target areas than students of teachers without a degree, across all teachers in the sample. Furthermore, an interaction of treatment condition with possession of a mathematics degree was found for student gains in Non-Target learning. Students of treatment teachers did better than the comparison if their teachers had a math degree, but did worse than the comparison if their teachers didn't have a math degree.

Independent of treatment (i.e., across all teachers), teacher learning, particularly as assessed by the Standard Grading system, was a significant predictor of student gains on the Overall score, due predominantly to contributions from the Non-Target areas.

Comparing posttests of successive classes of students from Cohorts 1 and 2, students from the 2004-2005 year did significantly worse than students from 2003-2004, primarily in Non-Target areas. Pre-tests were not available for students in either cohort, so it is impossible to know how the successive classes of students compared in gains. Again,

however, there is no explanation at present as to why Non-Target areas should be differentially affected in this analysis.

In summary, as a result of taking the Ready to Teach Algebra course modules, a mathematically well-prepared sample of teachers was found to learn primarily in pedagogy as opposed to specific content areas. Subsequent to taking the course, a separate and small cohort of teachers—perhaps biased by attrition—continued to learn in pedagogy and in some content areas, possibly using RTT materials and resources. Students of treatment teachers did no better overall than students of comparison teachers, but lost less in topical areas not covered by their teachers' course learning. In addition, the mathematics background of teachers had a complicated influence on these relationships. Recommendations based on these findings, as well as strategies for future research and evaluation, are presented later in this report.

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INTRODUCTION AND OBJECTIVES

Ready To Teach Algebra is an online professional development program to support mathematics teachers, created jointly by Concord Consortium's Seeing Math Telecommunications Project and the PBS TeacherLine Project, with funding from the U.S. Department of Education. The objectives of the project are to develop, implement, evaluate, and disseminate an affordable, scalable online teacher professional development program.

The program is built around the major themes presented in today's algebra texts and typical algebra curricula: Ratio, Proportion, and Scale; Linear Functions; Transformations of Linear Functions; Linear Equations; Quadratic Functions; Transformations of Quadratic Functions; Quadratic Equations; and Descriptive Statistics. In addition, an Overview and a Final Project section frame the overall program.

Each topic or theme is presented via a three-week module that uses interactives (manipulable Java applets), readings, classroom video vignettes, activities, and facilitated online discussions to support teachers in deepening their understanding of core math concepts and strengthening their pedagogy. The course is conducted solely online.

The overall goal of Ready To Teach Algebra is stated in the overall Ready To Teach GPRA indicator:

- To improve student achievement by developing high quality, standards-based digital professional development to teachers and by developing high quality, standards-based digital classroom content.

This evaluation report focuses on the following two objectives of the Seeing Math Telecommunications Project stated in the Project Annual Performance Report, April 2003:

4.) Evaluate the quality and usefulness of project materials and strategies.
6.) Research the effect and impact of the Seeing Math materials.

The external evaluation has been conducted jointly by Edcentric and Hezel Associates. Edcentric has taken responsibility for evaluating the quality and usefulness of the Ready To Teach materials under development, and Hezel Associates has taken

responsibility for researching their effect and impact. The findings of both evaluation efforts are presented jointly in this evaluation report.

METHODS

Both qualitative and quantitative methods were used to evaluate the Ready to Teach Algebra materials. Qualitative methods, involving surveys and phone interviews followed by thematic analysis, were used in the formative evaluation to understand participant experiences and to gauge the quality and usefulness of the materials from the user perspective. Quantitative research and evaluation methods were intended to assess the impact of the materials on teachers and students in terms of content learning and pedagogical change. Together, these evaluation strategies and methods provide a rigorous and thorough assessment of the course materials.

A. QUALITATIVE METHODS

During the fall and early winter of the 2004 – 2005 school year, Concord Consortium and PBS TeacherLine conducted a pilot test of the *Ready To Teach Algebra: Linear Family* course, which it offered to online participants across the country between September 15, 2004 and January 12, 2005. Three classes of participants from around the country, each led by a facilitator or, in one case, two co-facilitators, took part in this pilot test.

Edcentric conducted the formative evaluation of this pilot test. The evaluation team developed six online surveys using Perseus Software Systems to gather background demographic data on participants and to collect information related to participants' use of the course materials in the development of their own mathematical thinking and in their classrooms. We administered these surveys to participating teachers, and then summarized and analyzed data from the completed surveys.

This formative evaluation report presents findings from this pilot test, based on the data collected from participants in the pilot test. Participating teachers were asked to complete the six online surveys during the pilot test and data from those surveys that were received by January 31, 2005 are included in this report. In addition to data collected from the online surveys, the evaluators studied the online discussion boards for the course, which continued through January, for trends and issues related to the teaching of mathematics and the development of learning communities. In addition, evaluators interviewed course facilitators after their courses ended in January to gain additional information and their reflections on the course and the facilitation process.

During spring 2005, two additional Seeing Math Secondary courses – *Proportional Reasoning* and *Quadratic Functions* were pilot tested and formative evaluation data collected through an end-of-course teacher review completed by participating teachers.

B. Quantitative Methods

In response to the US Department of Education's stated interest in quantitative research, the Concord Consortium presented Hezel Associates, Ready to Teach's (RTT) quantitative evaluator, with a quasi-experimental research design to assess the impact of the RTT materials on teachers and students. In addition, the Concord Consortium organized the development of all measures of teacher and student content learning. Other data to be used in the quantitative analysis were collected by Edcentric, the initiative's qualitative evaluator. The charge to the quantitative evaluator was to take the performance data and analyze it to answer the initiative's central research questions:

- What *teacher gains* in math content and pedagogy can be attributed to their participation in Teacher Professional Development (TPD) designed by the Ready to Teach Project?
- What *student gains* in math performance can be attributed to the participation of their teachers in TPD designed by the Ready to Teach Project?

Additional questions, to be addressed if time and data permit, include:

- Are there differences in teacher gains by grade, school, academic background, experience, or implementation quality?
- Are there differences in student gains by grade, gender, ethnicity, school, SES, teacher academic preparation, teacher experience, teacher gains, or implementation quality?
- Do student and teacher gains persist?

The table below schematizes the revised quantitative research design as developed by the Concord Consortium in conjunction with Hezel Associates. "T" represents the treatment—teacher's participation in RtT Algebra 1: Linear Functions, Transformations, and Equations. Cohort 3 consists of a treatment group and a matched comparison group. Based on conversations with The Concord Consortium, for most analyses the treatment group was defined as Cohort 3-T plus Cohort 2, and the comparison group as Cohort 3-C plus Cohort 4. Paired comparison tests within Cohort 3 were also conducted as appropriate. Pre-tests and post-tests assessed teacher and student content understanding as well as teacher pedagogy.

Ready to Teach Treatment and Measurement Sequence

	Year 1, 2004	Year 2, 2004-05

	Spring 04	Fall 04	Spring 05
Cohort 1	**T**; Post-test	Pre-test	Post-test
Cohort 2	Post-test	Pre-test; **T**	Post-test
Cohort 3 T		Pre-test; **T**	Post-test
Cohort 3 C		Pre-test	Post-test
Cohort 4		Pre-test	Post-test

This quasi-experimental design allowed for cross-sectional comparisons (across cohorts within a given year) as well as longitudinal comparisons (within cohorts across consecutive years). This combination of comparisons was intended to provide a close inspection of the impact of the materials in the absence of random assignment to conditions.

General linear regression modeling was used to model teacher gains in content and pedagogy as a function of treatment condition and teacher background variables (years teaching experience, academic background, etc.). We also tested interactions between treatment condition and teacher years of experience and prior math preparation. It was hypothesized, for instance, that the Ready to Teach professional development might show greater effects for those teachers who are either new to teaching or less academically prepared.

For the student data analysis, we used Hierarchical Linear Modeling (HLM) to account for the multi-level data, modeling student test performance gains as a function of student-level variables, teacher treatment condition, and other teacher-level variables such as academic background and teaching experience. The effects on student learning of interactions between treatment condition and teacher-level variables such as level taught (middle school or high school) and possession of a mathematics degree were also tested. Separately, both overall and within the treated group, student performance gains were modeled as a function of teacher learning in content and pedagogy.

FINDINGS

Findings from the formative evaluation of the *Ready To Teach Algebra: Linear Family* are presented first, followed by findings from the quantitative evaluation of the same materials. A summary of the formative evaluation of the *Proportional Reasoning* and *Quadratic Functions* modules concludes the findings.

A. READY TO TEACH ALGEBRA: LINEAR FAMILY FORMATIVE EVALUATION

This section of the evaluation addresses the following:

- Course participation, including issues of retention and attrition, and profiles of course completers and dropouts;
- Issues of time allocation;
- Participants' assessment of course elements, including course navigation and structure, video clips, and technical issues;
- Analysis of online discussions and facilitation, including the timing and logistics of discussion posts, discussion of new understandings and issues, and new communities of learners;
- Changes in pedagogy;
- Participants' overall course satisfaction; and
- Summary.

Course Participation

Retention and Attrition

The formative pilot testing that Edcentric conducted of *Ready to Teach Algebra* in the 2003 – 2004 school year indicated a rather substantial attrition rate among course participants, with more than half the participants dropping out before course completion. We were interested in learning whether substantial course revisions made by the Concord Consortium course developers subsequent to the initial pilot tests had made an impact in terms of retaining participants during the 2004 – 2005 fall pilot.

Fifty-seven participants in the three class groups – referred to as Mango, Guava, and Kiwi – completed the online Teacher Background Survey given at the beginning of the course in fall 2004. Of this cadre, 41 carried through to complete all formative evaluation surveys, including an End of Course Review, by the end of January 2005. This indicates a 72% overall retention rate, which is considerably higher than the pilot

tests of the 2003 – 2004 school year, in which fewer than half of the initial participants continued through to course completion.

In looking closely at the following table showing survey completions for each group, we can see that the number of participants in the Mango group dropped off both dramatically and early, with almost half the initial number dropping after completing the Background survey. At this point, participants would not yet be immersed in the core of the course, so it appears unlikely that the relatively high dropout rate for this group would be tied to dissatisfaction with the materials or the facilitator.

RTT Retention/Attrition Rate based on Survey Completion						
	Background	Ready for Algebra	Functions	Transformations	Equations	End of course Review
Mango	16	10	8	8	6	6
Kiwi	19	15	16	15	14	15
Guava	22	20	20	20	20	20
TOTAL	57	45	44	43	40	41

In interviews with the co-facilitators of the Mango group, each felt that the course might not have been represented to teachers accurately when they signed up for it in spring 2004. According to one, "They didn't really realize what they were getting involved in." The other facilitator agreed and felt the timing was rushed at the beginning of the course, with some teachers not receiving student pretests and other documentation early enough: "They didn't get enough warning…. I didn't get email from [PBS] until the day before the class started."

An email from one of the teachers to the facilitators the day after the course began highlighted some of the problems:

> We are still trying to find out if our computers have the capabilities that you require for this course. We wish that you had given us some more notice on this. I plan to mail my pretest in today so that will be taken care of but [teacher] has not even received his test. **We also were surprised to find that you want 4-6 hours from us per week. I don't think that was outlined in the course offering last Spring.** I guess I am feeling a bit overwhelmed at this point. Can you help us? (Emphasis added.)

Two days later, this teacher emailed again:

> Again, [teacher] has not even received his pretest. We also have not had any time to even see if we have Blackboard 8.0 but we do not think that we do. … **This is very different than what was presented to us in the beginning. There was no mention of doing anything more than problems--discussion was not mentioned.** I am just so swamped that I am not sure I can fulfill my commitment to this class in its present form. (Emphasis added.)

While the facilitators encouraged the teachers to remain in the course and offered technical assistance, both teachers ultimately dropped out.

This points to the importance of accurate representation of the RTT materials to potential participants. With this particular group, the course requirements did not appear to be clear to participants. As one of the facilitators said, "My people jumped into this sight unseen."

A pre-registration preview could be a useful tool to make sure that participants know what is involved in the course, particularly if it is offered through PBS TeacherLine and teachers have had past experience with TeacherLine courses. According to facilitators, Ready to Teach Algebra is "much more complex than other PBS courses….very intense." Another added, "It was a lot more work than other TeacherLine courses."

Course Participants: Dropouts and Course Completers

While misleading course representation may have contributed to a large proportion of the Mango teachers in particular dropping out, our analysis pointed out a number of differences between dropouts and course completers based on their responses to the Teacher Background Survey.

- **Online course experience**: More than half (54%) of the course completers had taken online courses before, and only 19% of the dropouts had. None of the dropouts had taken a course through PBS TeacherLine, whereas 10% of the course completers had.

- **Teaching experience**: The course completers were typically newer teachers, with 68% having taught math *less* than ten years; in the dropout group, half the teachers had taught math *more* than ten years. (There was a range in each group from 1 to 30+ years of teaching). Fifty-four percent of the course completers were middle school math teachers and the rest high school math teachers. Half the dropouts were middle school math teachers, 38% high school math teachers, and the rest were special education teachers.

- **Education background**: The course completers were almost twice as likely (58%) to have majored in math or math education as the course dropouts (31%). In both groups, at least half the participants had masters' degrees or masters' degrees and additional courses. But none of the dropout group listed math or math education as majors for their graduate degree, whereas 15% of the completers had graduate degrees in math or math education.

- In terms of math courses for undergraduate or graduate credit, more of the completers had taken college course in mathematics content than had the course dropouts, and twice as high a percentage of completers than dropouts had taken abstract algebra and linear algebra. Only in mathematics for elementary teachers did the dropout group have a higher percentage of participants.

Course	Completers	Drop-outs
Mathematics for elementary school teachers	39%	56%
Mathematics for middle school teachers	39%	38%
Geometry for elementary/middle school teachers	39%	31%
College algebra/trigonometry/elementary functions	68%	69%
Calculus	76%	63%
Advanced calculus	56%	38%
Real analysis	17%	6%
Differential equations	51%	38%
Geometry	68%	50%
Probability and statistics	78%	44%
Abstract algebra	**46%**	**19%**
Number theory	46%	38%
Linear algebra	**66%**	**33%**
Applications of mathematics/problem solving	42%	19%

In addition, a higher percentage of course completers than dropouts had taken courses in mathematics pedagogy: mathematics teaching methods (85% versus 69%) and supervised student teaching in math (59% versus 44%).

- **Opinion on teaching**: All teachers, regardless of group, reported that they enjoyed teaching mathematics. More dropouts than completers, however, reported that they considered themselves to be "master" mathematics teachers (82% versus 56%).

- **School environment**: Slightly more than half (53%) of the course completers reported that they had time during the regular school week to work with colleagues on mathematics curriculum and teaching. In contrast, only 25% of the dropouts reported time to work with colleagues. Fifty-three percent of course completers reported that most mathematics teachers in their schools contributed actively to making decisions about the mathematics curriculum, whereas only 31% of the course dropouts reported active contributions to decision making. Regardless of group, most teachers reported that the testing program in their state/district dictated what mathematics content they taught.

Participant Summary Profiles

Within our sample of 57 teacher participants in the fall/winter 2004 – 2005 *Ready To Teach Algebra: Linear Family* course, all participants had solid academic backgrounds, with all being certified teachers, and half having at least masters' degrees. The range of length of teaching experience for both groups ranged from one year to thirty or more years. All teachers enjoyed teaching mathematics. Most teachers believed that the testing program in their state/district dictated what mathematics content they could teach.

Course completers differed from course dropouts, however, in that course completers had:

- More experience with online instruction;
- Shorter (less than 10 years) teaching tenure;
- More mathematics content background, based on undergraduate/graduate major and advanced math courses completed;
- More mathematics pedagogy background, based on math methods/student teaching courses completed;
- Lower self-concept as "master" math teachers;
- More time during the regular school week to work with colleagues on mathematics curriculum and teaching; and
- The belief that the majority of mathematics teachers in their school contributed actively to making decisions about the mathematics curriculum.

Time Allocation

Closely interwoven with the earlier pilot testing attrition were concerns that the *Ready To Teach* course demanded far more time each week than most teachers could manage. This was a critical factor in their decisions to drop out of the course then.

During the fall/winter 2004 – 2005 pilot test, teachers completed online surveys at the end of each topic, and were asked to assess the amount of time spent during the week on the materials. The majority of respondents were able to complete the work within the 4 to 6 hour per week time frame. Technical issues related to downloading video were problematic for some people, as was learning how to use the interactives. The online discussions seemed to take the most time for a majority of participants, followed by activities and learning to use the interactives.

Most felt the time was well spent, though hard to manage with all their other responsibilities.

Course Elements

Course participants were asked to provide feedback on a variety of course elements in their end of course reviews, and a summary of this feedback is provided here.

Course Navigation and Structure:

- 38 of 41 completers found it easy to navigate around the course.
- 39 of 41 completers found the introductory Ready for Algebra topic valuable in helping them understand the structure of the topics in the overall course.
- 37 of 41 completers found the topic objectives to be clear to them.

A few respondents indicated that the requirement to post three times a week presented logistics and scheduling problems.

Several people noted the course goals or purpose were unclear at the beginning. One participant suggested more context setting at the outset. Overall, however, the course structure was clear to the participating teachers.

Video Clips:

- 37 out of 41 respondents found the video clips to be valuable in helping them clarify their understanding of student thinking around the algebra content.
- 35 out of 41 respondents found the video clips to be valuable in demonstrating new instructional strategies for teaching algebra.

Respondents liked the videos, but technology issues prevented some of them from seeing them clearly. They appreciated the transcripts, which helped when the audio quality was low. However, they wanted more context as to who the students were and how this work fit into their ongoing curriculum.

Most importantly, thirteen respondents indicated specifically that they wanted to see videos that were taken in "actual classroom settings rather than a group of students who volunteered to be a part of the video and stayed after school to do so" that would reflect more authentically their own learning environments.

CD's containing the video clips should alleviate the majority of the technology and download problems teachers reported from using dial-up access and older computers.

Technical Issues:

- 13 of 41 respondents had technical problems accessing Blackboard and the Ready to Teach Algebra: Linear Family course.
- 11 of 41 respondents had technical problems running the interactive programs.
- 14 of 41 respondents had technical problems viewing the video clips.
- 9 of 41 respondents had technical problems taking part in the online discussions.

Most participants indicated that the technical problems were due to either slow Internet access at their end, or school firewalls that prohibited them from accessing the videos. There were some problems when the course site itself was down or experiencing problems.

Analysis of Online Discussions and Facilitation

The evaluation team read through almost 5,000 online posts from September 2004 through the conclusion of the course in January 2005 to determine particular discussion areas that might be particularly fruitful for closer examination.
In looking for and at substantive content, both of the closing week discussion boards – "Aha! Oops! Whew!" and "Graduation Speech" provided strong indicators of what participants found to be most valuable in the course – both in terms of mathematics content and pedagogy. Oftentimes, the discussion here drew us back to the discussion board for Linear Functions: Week 2, Specialist Commentary, as many found Dr. Kaput's work particularly thought-provoking and a new understanding of functions to be very important to the work of *RTT Algebra: Linear Family*.

We found in the closing week discussion boards and the virtual café evidence of camaraderie and comfort among participants in the development of a "healthy" community of learners.

We were interested in looking at the role of the facilitator in the online discussions and how the facilitator might have contributed to the discussions and to participant growth and looked at how the facilitators led their group discussions.

All facilitators used similar "scripts" for discussion starters, which were provided as part of the RTT Algebra materials themselves. Some of the facilitators added color, pictures, short animations, as well as personal greetings to these communications to add a personal touch and make them more appealing.

In addition to these scripted discussion starters and whatever involvement in the discussion boards they choose to make, facilitators provided private feedback to participants in the Blackboard space. They also may have had email and, occasionally, telephone contact. The evaluation team did not have access to information beyond the discussion boards, but based on the varying amounts of time facilitators put into the course and the kinds of feedback facilitators made on the discussion boards, we are assuming that some teachers got different amounts and depth of feedback, based on who their facilitators were.

While the evaluation team did not have access to the private discussions and emails and phone calls that occurred between facilitators and teachers, the online involvement of the facilitators, as well as the amount of time per week that the facilitators indicated they devoted to facilitating the course each week, was very different. One facilitator estimated spending 3 to 5 hours a week in facilitation effort, one indicated about 5 hours, and two (including one who was co-facilitating the smallest group of 6 teachers) indicated they spent at least 12 to 15 hours a week in facilitating the course.

Facilitators approached their task differently, with the use of the telephone as one example. One facilitator apparently was rather forceful in an email she wrote to participants about their obligation to act like students in this course and to complete their work on time. When one of the teachers wrote back that she was offended, the facilitator immediately telephoned the teacher to discuss the issue, and opened up the issue directly on the online discussion board:

This facilitator further explained that when something wasn't clear in an email dialogue, she would call the teacher for a telephone conversation to clarify the issues and resolve problems. She mentioned one teacher who was having serious professional issues unrelated to the course, and she called him several times during the fall to touch base and try to help him from becoming too discouraged. In contrast, another facilitator indicated that she did not feel it appropriate to call any of her teachers and she preferred to "give feedback only if there was a problem to take care of."

Timing and Logistics of Discussion Posts

The logistics of the discussions themselves, regardless of facilitator, presented problems to teachers, with the requirement of responding to each other on different days. Many of the teachers had a full plate with their teaching schedules, and depended on the weekend to do their course work. Those teachers who posted early and wanted to

respond to their peers had to wait until there were posts to respond to. Most discussion activity occurred on weekends.

In that short time frame of the weekend and end-of-week (the course week ended on Tuesday), teachers completed both their own posts and the required responses to other posts. This may have led to many of the responses to posts that were, as one facilitator put it, "vapid" and primarily of the "I agree with XX" type, done primarily to fulfill the course requirement. (One teacher, in fact, was not even available during much of the fall, and she completed most of her online surveys and many of the online postings themselves in January, after most of her classmates had already finished the course!)

Facilitators offered suggestions to make the posts worthwhile:

> Also, a gentle reminder...No assignment requires more than three posts. No learner should post more than 5-7 posts at the most and each of these should be substantive, should move the discussion forward, and must include sufficient weight and context to reward his/her colleagues for clicking and opening them. Keeping this in mind will save our eyes and our time as we move through Thanksgiving into the Winter Holiday season.

The online discussions show very different styles and input on the part of the facilitators, which reflects on the importance of the facilitator him/herself in these online courses.

In conjunction with amount of time spent in the online discussions was the private discussion as well as a human component that may have come out more clearly with those facilitators who devoted more time to the project. We noted a great deal of discussion variety and depth within several of the group discussions, for example, on issues such as class times, assignments, useful web sites, help for creating web pages, etc. There was an easy familiarity, as in the following exchange:

> Facilitator: If you go to the Navigation bar on the left of your screen, click on RTT Libraries and do some more clicking, you find the transcripts for all the videos we will use! That certainly helps out when the video quality is bad or the @#$* thing just won't work.
>
> Teacher: You took the asterisk right out of my mouth!!! :) And made me laugh.

Discussion of New Understandings and Issues

The closing week discussions summarized for participants their new understandings, with many teachers addressing functions, particularly in relationship to new understandings of how and where functions fit into the overall picture. It is in these closing weeks that the impact of facilitator feedback and input may be demonstrated by

varying levels of understanding of the differences between functions and equations in the groups.

Two of the three groups appeared to receive more facilitator input than the third group, based on the comments of the participants and the amount of time the facilitators indicated they put into the course each week. Participants in the two groups with more facilitator input had comments such as the following regarding functions and what they had learned about them:

- I had a completely reshaped view of functions and how to teach algebra cohesively. It is powerful to view functions as the core objects of algebra. As objects, they have properties that separate them into categories and families within each category. Algebra involves acting on these functions evaluating them (finding the value), or treating them as objects to manipulate. You can manipulate functions in various ways, represent them in symbols, tables, graphs, or words, find equivalent functions, and use them to model real-life situations and to solve real life problems, like buying a cell phone service. On the other hand, we often focus too much on the verb aspects of functions

  The idea of piecewise functions as opposed to the traditional single closed functions is was new to me. It makes sense to use piecewise functions in the classroom because real world economic situations are really made up of multiple pieces of functions! In addition, using the Piecewise Linear Grapher to graph piecewise functions does make the concepts of domain and range, and discontinuity tangible. Students have difficulty grasping and seeing the significance of the concept of domain and range. Creating real-world problems with piecewise functions embedded can powerfully illustrate these concepts and more!

- For me, realizing the power of linear functions was my Ah ha! Moment. While I've worked with functions extensively teaching the upper levels - particularly pre-calc and calculus - I never really thought about how powerful they are when used right from the beginning. While it is important to understand how to manipulate and solve linear equations, once we move into graphs and contextual problem solving the use of functions become apparent and will make life so much easier for students to understand. Heck, it made it easier for me to understand, and I already know this stuff.

- OOPS! I can no longer use the textbook's notion that functions are an afterthought, relegated to the back of the text, nor can I ignore the curriculum in which functions are not taught until algebra 2. I need to introduce functions as soon as that first y=mx+b equation shows up and use functions as a springboard for everything else we do. I pulled out the old algebra 1 book (that teaches solving all types of equations in one variable - including quadratics and rationals) before looking at graphing linear equations and realized that what they were really doing was introducing functions and looking at graphing FUNCTIONS rather than equations. In a way, this was also an Ah ha! and I think that I can use some of that material interwoven with the current text and many of the activities we've used here to rework my first semester curriculum map.

- The very concept that yields real gold is the "function" and how it relates to the linear equation. I am very comfortable using this word in my classroom and will continue for here on in my Algebra teaching career. When students struggle with the concepts of linear equations, I am going to draw them out with some time to explore the input, output, dependent, independent variable and guide them to see how this all relates to the linear equations.

In contrast to the new understandings of functions expressed in two groups, several teachers in another group reflected on continuing problems understanding functions at the end of the course:

- Whew! - I am still struggling to fully grasp the difference between an equation and a function. I think I understand the basic distinction, but I am not sure how to teach equations in the context of functions and vice versa. Hopefully it will come to me soon!
- I also had a hard time distinguishing between an equation and a function but adapting problem in week 3 of linear equations helped me understand functions better. The elevator problems also helped.
- I am still look[ing] at the difference between functions and equations. (I think a lot of us are still wrestling with that one). Maybe it is equations will have one input but functions can have many. How is that?
- Like the others I am still struggling with many things from the course. I too struggled with the elevator problem and also still have trouble explaining the difference between functions and equations.

The contrast between the participants' comments suggests that varying degrees of input on the part of the facilitator can influence the understanding participants have of course concepts, in this case the important role of functions in the approach of this course.

New Communities of Learners

Teachers in all three groups indicated how much they had gotten out of the course discussions with their classmates and the feedback they received from their facilitators in their closing week discussions. They indicated an appreciation for the discussion contributions of the other members in their groups as well as their appreciation for the guidance and feedback from their facilitators. They hoped to remain an active learning community. Their "graduation speeches" to each other demonstrated a comfort and trust among the participants.

In summary, examination of the discussion boards for the three sections of the *Ready to Teach Algebra: Linear Family* course pointed out the following factors relevant to the online discussion in the fall pilot test:

- The importance of course-provided templates for facilitators to serve as discussion starters for the discussion boards. These templates helped to maintain "quality control" and some level of consistency across the class sections, regardless of facilitator's expertise or degree of involvement or time.

- The logistical problems raised by a course structure requiring a set number of teacher posts on different days when the working reality of busy teachers is typically to be able to put the majority of their time into the course on week-ends. This resulted in a "traffic jam" on the discussion boards on Sunday and Monday nights rather than a smooth flow of deep, reflective thought spread out over the entire week.

- The salience of facilitator feedback. Even though we as evaluators did not have access to the "personal feedback" of the discussion boards, individual emails, or telephone records, we believe that those facilitators who provided extensive online feedback and who devoted more time to their work as facilitators were providing additional extensive feedback through the private venues. In understanding the distinctions between functions and equations, an important component of the course content, teachers in groups with more facilitator feedback were more likely to express the belief that they understood this distinction and would be able to apply it in their classrooms.

- Regardless of facilitator or group, participants found the community of learners they developed together in *RTT Algebra: Linear Family* to be a beneficial and supportive learning group.

Changes in Pedagogy

Participants indicated clearly that they would take much of what they learned in the course back into the classroom, and some were already doing so:

> I have already used all of the activities except the elevator problem and the cell phone problem. I plan to use those later in the year. I am especially interested in using the elevator problem to see how they react to the types of possible responses. I have not used piecewise functions in algebra as it is not part the Texas curriculum, but I think that the students can further develop understanding of functions through the piecewise graphs. I did the squirrel problem when introducing functions, and the starburst problem later when we were studying the influence of changes in slope and y-intercepts. The students really liked using that interactive.

Others talked about changes to their overall approach and pedagogy:

> All aspects of the program I intend to incorporate in to my teaching. I am currently rewriting my curriculum to allow for a more functions approach and a more problem solving approach. Incorporating the interactives will be the most difficult for me, but I believe they would help my students in ways I cannot measure at this time. I will take a more hands off approach and allow my students to teach themselves and each other.

Yet others described outreach efforts they would make to share with their colleagues:

> The approach to teaching seems quite similar to or complementary to what I already do, so if anything, I just feel validated. Whether I can say I will BRING that approach to my classroom, I dunno, since I think it's already there. I'll use the interactives some, especially if I'm able to get hold of a computer screen projector, so that the whole class can see what I'm doing. I'll probably also show the other math teachers in my building the interactives, and demonstrate how we can use them in the library for whole classes of students to use. I also already use functions as a primary lens through which to view algebra, so the activities and general conceptual approach fits well. What I'll do more of, as a result of this course, is work with the OTHER teachers in the building on how to do this stuff, since now I'm clearer that this isn't just some kooky idea that I happen to like, but one that is proven successful nationwide.

Overall Course Satisfaction

Forty of the forty-one course completers indicated they would recommend the *Ready to Teach Algebra: Linear Family* course to a colleague.

Participants cited alignment of NCTM standards and thoughtfully moving beyond the textbook in their reasons for recommending the course. They offered the following:

> Great alignment with NCTM standards. Great professional development opportunity and lots of tools and activities to take away.

> This course demonstrates why it is so important to listen to students to understand what they are thinking to guide them to conceptual understanding and application of math ideas. It is not helpful to simply memorize algorithms and answer multiple textbook problems, even if accurate. What do they mean? How will they be used in real life? It shows why our state standards demand thoughtful instruction and learning.

> Many of the math teachers in my building are purely directed at the procedures and algorithms of mathematical processes. The content, and the emphasis on teacher discussions would really help to get them thinking about WHY they do what they do, and what other approaches might also be worth trying. The non-confrontational non-judgmental aspect of the discussion boards make it "safe" to explore new ways of thinking, or to show our weaknesses and ask for help.

> I felt that this experience opened my eyes to alternatives I had not explored previously and helped me to see beyond the textbook. I have seen how using concrete representations can help students develop understanding of mathematical concepts in my other classes but wasn't sure how to incorporate these strategies into my algebra class. This course has helped me to see ways in which I can accomplish this without losing time on "fun" activities that don't necessarily improve understanding.

Overall Summary – *Ready to Teach Algebra: Linear Family*

The September 2004 – January 2005 pilot test of *Ready to Teach Algebra: Linear Family* served three class groups around the country. From a start-up group of 57 teachers, 41 completed the course. An overwhelming majority of the completers (40 out of 41) said

they would recommend the course to colleagues. The six reflective surveys participants were asked to complete, the almost 5000 online messages, and the comments of the facilitators indicate that the course was a valuable experience and well worth the considerable amount of time they were required to put into it.

These findings indicate that, as stands, the *Ready to Teach Algebra: Linear Family* course can be an effective teacher professional development experience for experienced middle and high school mathematics teachers in helping them to explore algebra instruction effectively for and with their students. The one troubling aspect is that those teachers who enrolled in the course, and to an even greater extent, those teachers who remained in the course, were experienced math teachers who already had substantial mathematics content background through formal undergraduate and graduate study.

The materials appear to be a good match for this highly educated group of participants. However, their appropriateness for pre-service and other uncertified teachers – the groups who may have the greatest need for additional close support in teaching algebra – is not known.

B. TEACHER QUANTITATIVE DATA ANALYSIS

The analysis presented here relates to the *Ready to Teach Algebra: Linear Family* sequence described above, and focuses on the same set of teachers that took part in the formative evaluation. However, as described above under Quantitative Methods, it also includes a group of comparison teachers that did not take part in the formative component. It also includes some analyses of other cohorts of teachers who had taken the course materials in Spring 2004. The primary sources of data were content tests created for the quantitative analysis. Surveys developed for the formative evaluation contributed teacher demographic and background data, and were also administered to the comparison group.

Analyses of the teacher content tests were conducted under both of the Standard Grading and Balanced Assessment scoring systems as described below under Data Collection Tools, using first the overall scores and then the subtests or sub-domains as outcomes. However, overall scores between the two scoring systems are highly correlated (.98 between post-tests), and the subscales of the two scoring methods are also very significantly inter-correlated. The implication is that findings for the two methods cannot be considered as separate or independent.

1. Overall Treatment/Comparison

Based on conversations with The Concord Consortium, the treatment group was defined as Cohort III-T plus Cohort II, and the comparison group as Cohort III-C plus Cohort IV (see table in Methods). Pre-test and Post-test means for the Standard Grading system are in the Appendix, and Table 1 shows mean gains for the Standard Grading scoring method overall and by subscale, for treatment and comparison groups. The difference in the total score (4.9 points) favors the treatment group, but the difference is not statistically significant (t= 1.34, p = .186).

Table 1. Standard Grading Gains (Post-test minus Pre-test)

Sub-Scale	Cohort	N	Min	Max	Mean	SD
Linear Functions	Control	28	-7	12	2.7	5.4
	Treatment	42	-7	26	1.1	7.5
	Total	**70**	**-7**	**26**	**1.7**	**6.8**
Transformation of LF	Control	28	-9	9	1.2	4.7
	Treatment	42	-10	17	3.0	5.9
	Total	**70**	**-10**	**17**	**2.3**	**5.5**
Linear Equations	Control	28	-10	10	1.1	4.0
	Treatment	42	-5	12	1.6	3.7
	Total	**70**	**-10**	**12**	**1.4**	**3.8**
Part C	Control	28	-8	14	0.9	5.1
	Treatment	42	-7	20	5.2	6.3
	Total	**70**	**-8**	**20**	**3.5**	**6.2**
Total	Control	28	-13	29	5.9	11.8
	Treatment	42	-16	62	10.8	16.8
	Total	**70**	**-16**	**62**	**8.8**	**15.1**

Table 2 shows the mean gains for the Balanced Assessment system (pre-test and post-test data tables are in the Appendix). As with the Standard Grading system, the mean difference in the total score (5.7 points) favors the treatment group but is not statistically significant (t = 1.37, p = .177).

Table 2. Balanced Assessment Gains (Post-test minus Pre-test)

Sub-Scale	Cohort	N	Min	Max	Mean	Standard Dev.
Modeling/ Formulating	Control	28	-3	6	1.2	2.4
	Treatment	42	-4	9	2.0	3.5
	Total	**70**	**-4**	**9**	**1.6**	**3.1**
Transformation/ Manipulation	Control	28	-7	13	2.6	5.2
	Treatment	42	-6	15	2.5	5.4
	Total	**70**	**-7**	**15**	**2.5**	**5.3**
Inferring/ Drawing Conclusions	Control	28	-9	12	1.8	6.0
	Treatment	42	-7	24	6.4	6.5

	Total	**70**	**-9**	**24**	**4.5**	**6.7**
Communicating	Control	28	-9	14	0.6	5.7
	Treatment	42	-11	24	1.2	7.4
	Total	**70**	**-11**	**24**	**1.0**	**6.8**
Total	Control	28	-16	36	6.3	14.2
	Treatment	42	-16	71	12.0	18.8
	Total	**70**	**-16**	**71**	**9.7**	**17.2**

The same analyses were run with the subscales for both the Standard Grading and Balanced Assessment grading as individual outcomes. None of the subscale gains was significantly different between treatment and comparison groups except for Part C of the Standard Grading (see Table 1; mean difference = 4.26, t = 2.96, p = .004) and IDC for the Balanced Assessment grading (see Table 2; mean difference = 4.54, t = 2.94, p = .004). This suggests that the treatment group learned less in algebraic problem solving (the first three parts of the test) than in being able to intelligently discuss functions, questioning strategies, learning from student observation, learning from the use of calculators, etc. The two subscales (Part C and IDC) draw from many of the same items and are highly correlated (post-test correlation = .87, gain correlation = .77), indicating that these are not really separate findings.

The possible effects of demographic differences between the two groups were also explored. For example, the treatment group has an edge in overall education, has a somewhat greater familiarity with NCTM standards, has a lower percentage of teachers with math degrees, has a higher percentage of male teachers, and has slightly less experience teaching. To eliminate these possible influences, the above analyses were rerun with demographic and experience variables in the model. The following variables were tested:

- Gender
- Years teaching math
- Familiarity with NCTM standards
- Education level
- Possession of a mathematics or mathematics education degree (any level)
- Level taught (middle school versus high school)
- Whether an online course had been taken before

Controlling for these variables did not influence the effect of the treatment. However, independent of treatment group, teachers without a mathematics or mathematics education degree gained significantly more than those with such a degree in the Standard Grading content area of Linear Functions (t = 2.80, p = .007), and in the

Balanced Assessment math action of Modeling/Formulating ($t = 2.49$, $p = .015$). In both cases, having a mathematics degree (as opposed to a mathematics education degree) appeared to be the main contributing factor. Looking at pre- and post-test scores, teachers with a mathematics degree start higher and end higher on the scales, although they move less—perhaps having less to learn. Perhaps for the same reason, middle school teachers across the sample tended to have larger gains than high school teachers, also in the area of linear functions, although the differences didn't reach statistical significance. We also tested interactions between treatment condition and possession of a mathematics degree, as well as between treatment condition and teacher years of experience. Neither was significant in their effects on teacher learning.

Pre-tests restricted by date

Given that a number of teachers took the pre-test after the course started, their learning might be underestimated in the topical areas that were taught first. To investigate this, a follow-up test of the Linear Functions scale restricted the data to teachers who had taken the pre-test before the beginning of the Linear Functions segment of the course (approximately 10/13/04). A separate test restricted the data to tests taken before 11/03/04, when the Transformations of Linear Functions topic began in a typical section. In both cases the treatment group improved its standing, but in neither case did the Treatment/Control difference reach significance at either the .05 or .10 level for those topics. However, in both cases restricting the test date improved score differences in favor of the treatment group in all topical areas, and the mean difference in the total score increased by about 3 points, bringing this in the neighborhood of significance ($p < .10$). This suggests that there was some dilution of the treatment effect due to late pre-test completion.

Overly difficult and easy items dropped

A further analysis of the Standard Grading Total score eliminated three questions with a high proportion of 0 scores (LFA6, TLFB4, and C3), and five items with a high proportion of perfect scores (LFA2, LFA3, TLFA2B, LEA1A, LEA2) to try to increase the precision of this measure of teacher learning. The percentage of perfect scores on the five easy items ranged from 76% to 93% of respondents, and the percentage of zero scores on the three difficult items ranged from 42% to 50%. Dropping these items from the total, however, did nothing to distinguish treatment and comparison teachers.

Within the Treatment Group: End of course feedback

Within the treatment group, a number of questions from the end of course review were correlated with teacher content test scores to see if the perceived value of the course was related to teacher learning. Teachers' possession of a mathematics degree was also examined with relation to these course feedback questions. The following were tested:

- How valuable were the video clips in helping you clarify your understanding of student thinking around algebra content?
- How valuable were the video clips in demonstrating new instructional strategies for teaching algebra?
- How valuable were the initial discussion questions presented in the online discussion for generating discussion?
- How valuable were the online discussions in helping you with instructional strategies for teaching algebra?
- How valuable were the online discussions in helping you clarify your understanding of the course content?
- How valuable was the feedback provided by your facilitator on your progress in the course
- How valuable were your facilitator's efforts to guide the online discussion?

None was significantly related to teacher learning using either the Standard Grading or Balanced Assessment scoring systems. Possession of a mathematics degree was also unrelated to any of the above except the last: Those with a mathematics degree rated the facilitator's efforts to guide online discussions significantly lower than those without such a degree (mean difference = .51 on a 4-point scale, $t = 2.73$, $p = .09$).

Within the Treatment Group: Usefulness of RTT resources

We also correlated the perceived usefulness of RTT course materials with teacher learning. The following questions from the end of course survey were tested against scores from both the Standard Grading and Balanced Assessment scoring methods.

- How often did you use the RTT Libraries to locate course elements?
- How useful was the Interactives Library for you for accessing the RTT interactive and warm-up activities?
- How useful was the Video Library for you for accessing the course videos and transcripts?
- How useful was the Projects Library for you for accessing the For Your Students activities?

Frequency of use was unrelated to teacher learning by any measure. However, ratings of the usefulness of each of the specific libraries were significantly and positively correlated with one or another measure of teacher learning, as shown in the table below. The correlations between Library elements and content learning are weak to moderate, and are based on teacher self-report of perceived usefulness, but nonetheless may give some indication of where RTT resources had their impact.

Component	Measure	Scoring System	Correlation	p
Interactives Library	Part C (pedagogy) subscale	SG	.324	.039
Video Library	-Total score	SG	.348	.026
	-Transformations of Linear Functions subscale	SG	.376	.015
	-Total score	BA	.322	.040
	-Communication subscale	BA	.331	.034
Projects Library	Transformations of Linear Functions subscale	SG	.307	.051

2. Paired Comparison

This analysis is limited to Cohort III-T and Cohort III-C teachers. The comparison group here consisted of teachers teaching at the same schools as the Cohort III treatment teachers, matched as closely as possible on educational level and number of years teaching math. Conducting paired tests on this data is a more sensitive way of testing for treatment effects, and might show differences that the overall Treatment/Comparison analysis would not capture. Although 29 pairs were generated, for this analysis N = 24 due to five members of the comparison group not taking the teacher tests. Tables 3 and 4 show that the treatment group scored higher on both overall scales, with the difference approaching significance for the Balanced Assessment scoring method (mean difference = 8.08, p = .062).

Results of the analysis of subscales for both scoring methods parallel the earlier findings involving the larger sample (which includes these paired data). Significant differences exist between the groups on Part C of Standard Grading and IDC of Balanced Assessment. As noted before, these are not separate findings, since IDC draws a lot of its items from Part C.

Table 3. Paired Comparison Tests – Standard Grading Scales

Standard Grading	Mean Difference	t	df	Sig. (2-tailed)

Scale	(T minus C)			
Linear Functions	-2.04	-1.063	23	.299
Transformations LF	1.50	1.015	23	.321
Linear Equations	1.00	.935	23	.360
Part C	5.58	3.265	23	.003
Total	**6.04**	**1.555**	**23**	**.134**

Table 4. Paired Comparison Tests – Balanced Assessment Scales

Balanced Assessment Scale	Mean Difference (T minus C)	t	df	Sig. (2-tailed)
Modeling/Formulating	.54	.660	23	.516
Transformation/Manipulation	-.29	-.186	23	.854
Inferring/Drawing Conclusions	6.04	4.086	23	.000
Communicating	1.79	1.078	23	.292
Total	**8.08**	**1.958**	**23**	**.062**

3. Cohort 1 Repeated Measures

Cohort 1 lacks pre-test data and was not part of any of the above analyses. Cohort 1 took the test only after taking the course (mostly in the summer 2004), and then again in Spring 2005. We tested stability/growth of knowledge over 9 months based on the two test administrations, using repeated measures, under the hypothesis that either there would be no change or there would be improvement as a result of using the RTT materials and resources provided to the teachers after completion of the course. Tables 5 and 6 below show the gains and associated statistical tests from these analyses, which was limited by the small number of Cohort 1 teachers remaining in the study.

Table 5. Standard Grading Mean Gain

Standard Grading Scale	Mean Difference (Gain)	t	df	Sig. (2-tailed)
Linear Functions	1.21	.885	13	.392
Transformations LF	-.79	-.474	13	.643
Linear Equations	2.21	2.540	13	.025
Part C	2.50	1.949	13	.073
Total	**5.14**	**1.667**	**13**	**.119**

As seen in Table 5, scores on most components of the test increased, and the overall gain of about 5 points starts to approach statistical significance. Among the test components, there was a statistically significant gain in understanding of Linear Equations, and an increase in pedagogy understanding (Part C) that is nearly significant at the .05 level. For the Balanced Assessment scoring method, Table 6 shows significant gains in Inferring/Drawing Conclusions, and somewhat less strong gains in Transformation/Manipulation.

Table 6. Balanced Assessment Mean Gain

Balanced Assessment Scale	Mean Difference (Gain)	t	df	Sig. (2-tailed)
MF	.00	.000	13	1.000
TM	2.21	1.873	13	.084
IDC	3.71	2.319	13	.037
Communication	-.36	-.377	13	.712
Total	**5.57**	**1.585**	**13**	**.137**

The influence of teacher background variables on year-to-year gains in Cohort 1 was also tested. No significant relationships were found, although the small N limited the possibility of finding them.

In summary, as a result of taking the Ready to Teach Algebra course modules, teachers were found to learn primarily in pedagogy (or, alternatively, Inferring/Drawing Conclusions) as opposed to specific content areas. The less mathematically educated teachers learned most, relative to those with mathematics degrees, in the area of Linear Functions. Subsequent to taking the course, Cohort 1 teachers—the only group for whom we have data—continued to learn in pedagogy and in some content areas as they incorporated into their instruction RTT materials and resources provided to them by the program. Due to attrition, this sample of teachers may be biased toward those more motivated to continue to learn as well as to stay in the study. Within the treatment group, teacher learning in some areas is correlated with the perceived usefulness of RTT Library materials.

C. Student Quantitative Data Analysis

Student outcomes included Overall score, a Target score, and a Non-Target score. Target items related to the content that treatment teachers were exposed to in Fall 2004, while Non-Target items related to other RTT materials that were not part of the course modules taken by treatment teachers. It was hypothesized that students of treatment teachers would be more likely to show gains in topical areas that their teachers had studied (i.e., Target areas).

HLM was used to test the effect of the treatment on student gain scores while accounting for student and teacher level variables. Ultimately, since no student-level variables (gender and ethnicity) affected test gains, this was nearly equivalent to modeling within-teacher averages of student gain scores in the various outcome areas (Target, Non-Target, and Overall).

Due to non-completion of teacher background surveys by some members of the comparison group, there is a loss of 5 teachers and their associated students from any analysis that involves teacher background variables. To see what effect the loss of teachers might have had, the analyses were rerun with the 72 teachers that had student pre and post-test data. This eliminated the availability of the survey variables, but this turned out to be inconsequential in terms of tests on the effect of the treatment. That is, none of the teacher background variables other than possession of a math degree influenced student scores, and controlling for this variable did not influence the measured treatment effect.

The main analysis involve a Treatment-Comparison contrast with the groups defined as in the main teacher analysis—Cohort III-T and Cohort II constituting the treatment group, and Cohort III-C and Cohort IV making up the comparison group. Further analyses take advantage of data collected in the summer of 2004 and compare the post-tests of successive classes of students in Cohorts 1 and 2. Finally, there is a test of student gains within Cohort 1 only. Cohort 1 is not a part of the larger Treatment-Comparison test because Cohort 1 teachers took the course in Spring 2004.

1. Overall Treatment/Comparison

Table 7 shows student gain scores by group for the Overall score and the Target and Non-Target subtests. (Pre-test and Post-test data are given in the Appendices.)

Table 7. Student Gains by Group

Scale	Cohort	N	Min	Max	Mean	Standard Dev.
Overall	Control	1234	-44.0	48.0	-1.2	12.2
	Treatment	1234	-65.0	60.0	0.5	13.2
	Total	**2468**	**-65.0**	**60.0**	**-0.4**	**12.7**
Target	Control	1234	-48.9	48.7	0.5	13.8
	Treatment	1234	-74.7	65.6	1.8	14.6
	Total	**2468**	**-74.7**	**65.6**	**1.2**	**14.2**
Non-Target	Control	1234	-50.1	51.5	-3.3	16.3
	Treatment	1234	-53.9	61.5	-1.3	16.3
	Total	**2468**	**-53.9**	**61.5**	**-2.3**	**16.3**

Based on the dataset with teacher background variables (67 teachers), treatment has no effect on Overall gain, or on Target gain. However, it has a significant effect on Non-Target gain to the extent that students of treatment teachers decline less than those of comparison teachers (both groups do worse at posttest). Since no teacher-level variables influenced Non-Target outcomes, the analysis was rerun with the larger sample of teachers (73) who had student test data but not background data. Results were very similar in terms of the effect of the treatment. Table 8, based on the larger sample,

indicates that scores of students of comparison teachers (coded 0) drop 3.23 points on the Non-Target score, whereas students of treatment teachers drop 1.85 points less than this (or 1.38 points total).

Table 8. Estimated Effect of Treatment on Non-Target Learning

Fixed Effect	Coefficient	Standard Error	t	df	p
For INTRCPT1, B0					
INTRCPT2, G00	-3.231458	0.567391	-5.695	71	0.000
TREAT, G01	1.853940	0.788434	2.351	71	0.022

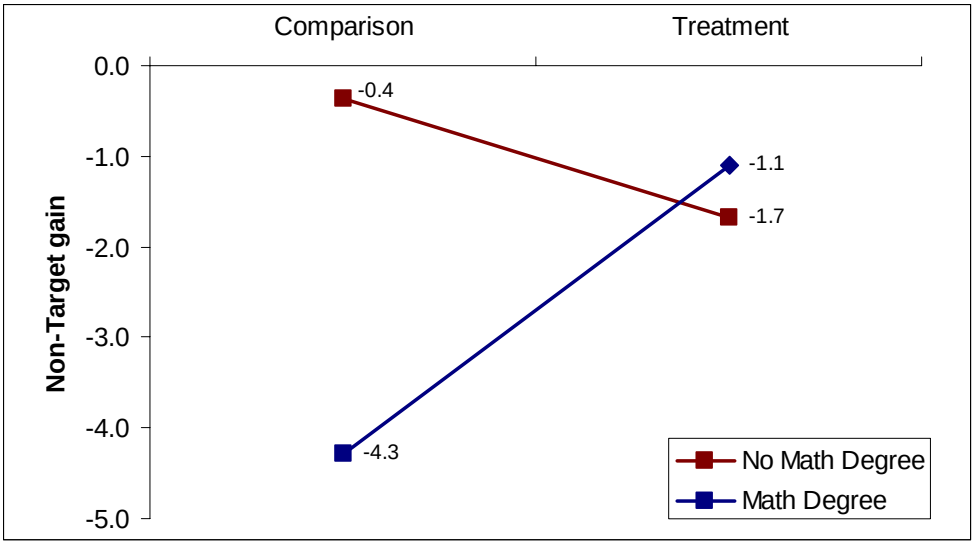
Also, in the sample of 67, it was found that possession of a mathematics degree had a negative effect on Target learning for students, explaining about 20% of the variation in within-teacher mean gains. Table 9 shows that students of teachers without a mathematics degree gain an average of about 3 points, while students of teachers with a mathematics degree average about 2.27 points less.

Table 9. Estimated Effect of Teachers' Math Degree on Target Learning

Fixed Effect	Coefficient	Standard Error	t	df	p
For INTRCPT1, B0					
INTRCPT2, G00	3.007385	0.751618	4.001	65	0.000
MATHDEGR, G01	-2.274749	0.921858	-2.468	65	0.016

Furthermore, an interaction of treatment with possession of a mathematics degree was found for student gains in Non-Target learning (see Figure 1). This suggests that the treatment had a differential effect on students depending on whether or not their teachers had a mathematics degree. In this case, students of treatment teachers did better than the comparison (declined less) if their teachers had a math degree, but did worse than the comparison (declined more) if their teachers didn't have a math degree.

Figure 1. Interaction of Treatment with Possession of a Mathematics Degree



Finally, independent of treatment (i.e., across all teachers), teacher learning, particularly as assessed by the Standard Grading system, was a significant predictor ($p < .05$) of student gains on the Overall score, due predominantly to contributions from the Non-Target areas.

2. Cohort 1

As noted above, Cohort 1 is not a part of the larger Treatment-Comparison analysis because Cohort 1 teachers took the course in Spring 2004. However, they administered pre-tests and post-tests to their students this past year (2004-2005), and this data was analyzed separately to look for student gains. Table 10 shows that over the 2004-2005 year, Cohort 1's students improved their scores from pre-test to post-test on the Target score but did worse on the Non-Target items.

Table 10. Cohort 1 Student Gains in 2004-2005

Fixed Effect	Coefficient	Standard Error	t	df	p
Target	2.718252	1.290050	2.107	15	0.052
Non-Target	-2.245586	0.941362	-2.385	15	0.031
Overall	0.508016	1.029190	0.494	15	0.628

For Cohort 1, the Concord Consortium requested that we compare the post-tests of successive classes of students, comparing Spring 2004 data to Spring 2005 data. The assumption is that over the course of the 2004-2005 school year, teachers will have had more time and opportunity to implement their learning than they did in Spring 2004 while taking the course, and could also take advantage of materials and resources provided to them upon finishing the course. Thus, students from Year 2 should show achievement that is equal to or greater than students from Year 1. The students will be

different, and pre-tests are unavailable, but an argument can be made that with 16 teachers representing a number of different schools, student characteristics both in terms of academic ability and demographics should be comparable between the two time periods. However, as Table 11 shows, Cohort 1's students in the 2004-2005 year did significantly worse than those of the 2003-2004 year, primarily on the Non-Target score.

Table 11. Cohort 1 student post-tests (Spring 2005 minus Spring 2004)

Scale	Mean Difference	t	df	Sig. (2-tailed)
Target	-2.2912	-1.424	15	.175
Non-Target	-10.3885	-12.144	15	.000
Overall	-5.8184	-3.654	15	.002

3. Cohort 2

As with Cohort 1, we compared within-teacher averages of student posttests from Year 1 to Year 2. The difference with this analysis compared to the Cohort 1 analysis is that the Cohort 2 teachers took the course between the two test administrations. Although the *n* of 6 limits the power of any test to find differences between the two sets of students, the students tested in 2005 did significantly worse than those tested in 2004, particularly on Non-Target items.

Table 12. Cohort 2 student post-tests (Spring 2005 minus Spring 2004)

Scale	Mean Difference (Gain)	t	df	Sig. (2-tailed)
Target	-6.4478	-1.985	5	.104
Non-Target	-10.9056	-3.878	5	.012
Overall	-14.5885	-2.773	5	.039

Summary

A number of tests of student learning were undertaken with the various cohorts of teachers. In the overall Treatment/Comparison contrast covering the past academic year (2004-2005), student learning was positively affected by the Ready to Teach Algebra course only in helping stem the decline in Non-Target understanding. Non-Target items assess topics that treatment teachers did not study during the course. Also, students of teachers who possessed a mathematics degree gained significantly less in Target areas, and teachers' possession of a mathematics degree interacted with treatment condition for students' Non-Target learning. In Cohort 1, whose teachers took the course in Spring 2004, this past year's students (2004-2005 year) gained significantly in Target areas from pre-test to post-test and declined significantly in Non-Target areas. Finally, in both Cohorts 1 and 2, students from the 2004-2005 year did significantly worse on post-tests than students from the 2003-2004 year, primarily in Non-Target areas.

D. PROPORTIONAL REASONING AND QUADRATIC FUNCTIONS – FORMATIVE

The spring 2005 pilot tests of *Proportional Reasoning* and *Quadratic Functions* were less intensive than the fall pilot tests and did not involve the collection of student or teacher test data for quantitative analysis. They were designed primarily to evaluate teachers' use of and satisfaction with the materials and involved only the completion of an end-of-course survey or review.

1. *Proportional Reasoning* Formative Evaluation

Five teachers participated in *Proportional Reasoning* and completed the end-of-course review. They found, in general, that it was easy to navigate around the course and that the week one "orientation" helped them understand the structure of the topics. Three of the five found the goals and objectives of the course clear. They found the videos valuable in helping them clarifying their understanding of student thinking around the algebra content, and somewhat valuable in demonstrating new instructional strategies for teaching algebra. Participants wanted more context around the videos so they would know, for example, how the teachers introduced materials or how students developed to the point they did in the video vignette. They needed clarification in teaching techniques and how the video teacher approached the problems given.

There appeared to be some variation in perceived expertise among participants as reflected in the online discussion, as one felt "intimidated" and reluctant to answer questions, and another wanted to see "more depth" in the discussions. Another "consider[ed] the discussion to be perfect as is."

There were some technical issues regarding problems logging on or getting into the discussion area.

Participants were able to complete the work in 4 to 6 hours a week, and spent most of their time doing the activities and final lesson plan. They planned to use the lesson plans the teachers shared with each other.

All five teachers said they would recommend the course to a colleague, citing valuable information and excellent facilitator feedback and questions. One teacher appreciated that the course "caused me to think outside the box and all from the comfort of my own home."

2. *Quadratic Functions* Formative Evaluation

Sixteen teachers participated in *Quadratic Functions* and completed the end-of-course review. Most found it easy to navigate around the course and that the week one "orientation" helped them understand the structure of the topics. Most felt the goals and objectives were clear to them. One participant felt that several key concepts (functions as objects rather than processes and algebra as a mathematical model for physical reality) were mentioned in the orientation materials and then "more-or-less abandoned" for the rest of the course.

Several participants felt that the discussion area could be clearer and easier to navigate. They found the discussion board software to be "unduly cumbersome." It was confusing to figure out which posts a writer was responding to, and some participants recommended that an "add a thread" feature would have been beneficial. Teachers nonetheless found the online discussions to be valuable in helping them with instructional strategies and in clarifying their understanding of the course content. They found facilitator feedback to be valuable. As one teacher wrote, "What can I say? The online discussions are the outstanding part of the course. I learned more through interacting with teachers in our online discussions than I have at any time in my thirty years of classroom teaching. This feature of the course is incredible, and cannot be emphasized enough."

Teachers wanted more direction on how to use tools such as the quadratic transformer, more clarification with assignments, more questioning techniques to use with lost or frustrated students, and rubrics for evaluating group work and class presentations.

While many teachers were able to complete the work within 4 to 6 hours a week, several found that weeks 4, 5, and 6 took longer than that for them, with the final project in particular presenting time problems. Several participants indicated that reading and responding to discussion posts was quite time-consuming, though generally worthwhile.

Most participants felt the video clips were valuable in helping them clarify their understanding of student thinking and, to a lesser extent, in demonstrating new instructional strategies. They wanted more videos, and wanted to see more students working toward problem solutions.

Nine of the sixteen participants indicated they had technical problems running the interactive programs, and half had difficulty viewing the video clips. Several specifically had trouble accessing the Quadratic Transformer, or being able to save or print work from the transformer. The discussion board froze or took a very long time to

load while some posters were trying to post (even using a DSL connection). Most of the participants described at least one technical problem they encountered while taking this course.

Teachers felt that the online discussions, activities, and final project took the most time, and these endeavors were worth their time. Learning the technology was also time-consuming for a few.

Many participants planned on using the toothpick problem and the quadratic transformer with their students. They planned on using the activities they designed in their lesson plans, including the activities/plans they shared with their classmates. New teaching techniques they planned on using included group presentations, better questioning strategies, and alternative problem-solving strategies.

All but one of the participants would recommend this course to a colleague. As one summarized it, "I would recommend this course to a colleague because I was able to learn more about quadratics and as a result I hope my students will have a better conceptual understanding of quadratics in the future. The activities were valuable, and the discussion was interesting and I found it very helpful to know how and what other teachers were thinking." The one teacher who would not recommend the course felt that the technology "kinks" needed to be worked out before offering a favorable recommendation.

Several participants noted and appreciated the "efficiency, helpfulness, and courtesy of the facilitator." An additional suggestion was to include a component on adapting existing materials (texts teachers had to use in their school systems) to incorporate "visualizing" ideas.

DATA COLLECTION TOOLS

A. MEASURES DEVELOPED FOR THE QUALITATIVE ANALYSIS

Edcentric developed six online surveys using Perseus Development Corporation's SurveySolutions Software to gather background demographic data on participants and to collect information related to participants' use of the *Ready to Teach Algebra: Linear Family* course materials in the development of their own mathematical thinking and in their classrooms. These surveys include:

- Teacher background survey
- Ready for Algebra end of topic survey
- Linear Functions end of topic survey
- Linear Transformations end of topic survey
- Linear Equations end of topic survey
- End of course survey

In addition, an online End of course review/survey was developed for *Proportional Reasoning* and *Quadratic Functions*.

B. MEASURES DEVELOPED FOR THE QUANTITATIVE ANALYSIS

As noted, measures of student and teacher content understanding and of teacher pedagogy were organized by the Concord Consortium. Hezel Associates presents here a brief summary of these measures to give context to those sections in the report in which scores are discussed.

1. Student content pre- and post-tests

Concord contracted with the Northwest Evaluation Association (NWEA) to select from their items banks a pool of 80 test items to evaluate understanding of the Algebra 1 content. For feasibility of administration to students, these 80 items were divided into 4, 20-question tests, and one form was administered to each student. Each form of the test addressed the same four Algebra goal areas, but individual items within those goals (representing sub-areas) differed across forms.

NWEA's items have been developed and calibrated based on item response theory, specifically a one-parameter Rasch model of item difficulty. This implementation of modern test theory models the likelihood of correctly answering a question as a function of latent ability. Useful characteristics of this measurement model include invariance of item characteristics to the student sample, and a common scale of

measurement on which to compare students who might have taken different items or test forms. As a practical matter, scores are not calculated as the sum of correct responses, and special software is required. Item response theory offers the possibility of greater precision of measurement, as more of the information contained in an item response is used in comparison to classical forms of testing.

As requested by The Concord Consortium, NWEA developed three different scores—an Overall score, a Target score, and a Non-Target score. Target items related to the content that treatment teachers were exposed to in Fall 2004, while Non-Target items relate to other RTT materials that were not part of the course modules taken by treatment teachers. Usable pre- and post-test data was received from a total of 3035 students across all cohorts.

2. Teacher tests of content and pedagogy

Teacher pre- and post-tests were developed by the Concord Consortium and its consultants. Tests were open-ended measures constructed to be in alignment with the content and pedagogy material being taught in the RTT modules, and were to be scored with specially-designed rubrics.
The Concord Consortium and Hezel Associates agreed on a set of subscales to create from this data for analysis. It was agreed that we would create, and test, summated scales for the four main areas covered by the test (Linear Functions, Transformations, Linear Equations and Pedagogy), called the Standard Grading system, and separately, four primary math skill areas (Modeling/Formulating, Transformation/Manipulation, Inferring/Drawing Conclusions and Communicating) based on the Balanced Assessment scoring method.

The Standard Grading system awarded points for each item on a 5-point scale within the broader categories of Novice (0-1), Competent (2-3), and Expert (4). Associated with each of the three nominal categories was a qualitative description to guide scoring. Items on the test were also grouped in three content areas corresponding to topical areas covered in the course (Linear Functions, Transformation of Linear Functions, and Linear Equations) and "Part C," a pedagogy category. The Balanced Assessment scoring system assigned points on a 4-point scale for conceptually distinct mathematical actions. A single item could contain multiple actions and thus contribute to more than one domain score. At the same time, a domain of mathematical action could draw on more than one of the content areas as categorized in the Standard Grading system. Ultimately, usable pre- and post-test data were received from 84 teachers across all cohorts.

FINDINGS AND RECOMMENDATIONS

A. FINDINGS FROM THE QUALITATIVE ANALYSIS

Finding: The September 2004 – January 2005 pilot test of *Ready to Teach Algebra: Linear Family* served three class groups around the country. From a start-up group of 57 teachers, 41 completed the course. An overwhelming majority of the completers (40 out of 41) said they would recommend the course to colleagues. The six reflective surveys participants were asked to complete, the almost 5000 online messages, and the comments of the facilitators indicate that the course was a valuable experience and well worth the considerable amount of time they were required to put into it.

These findings indicate that, as stands, the *Ready to Teach Algebra: Linear Family* course can be an effective teacher professional development experience for experienced middle and high school mathematics teachers in helping them to explore algebra instruction effectively for and with their students. The one troubling aspect is that those teachers who enrolled in the course, and to an even greater extent, those teachers who remained in the course, were experienced math teachers who already had substantial mathematics content background through formal undergraduate and graduate study.

The materials appear to be a good match for this highly educated group of participants. However, their appropriateness for pre-service and other uncertified teachers – the groups who may have the greatest need for additional close support in teaching algebra – is not known.

Recommendation: Stratify the *Linear Family* course into three levels: basic, intermediate, and advanced so it will be applicable to a larger pool of teachers, including the original target population. The Concord Consortium development team addressed many of the issues raised during the 2003 – 2004 school year related to the high commitment and time level needed in the full 13-week *Linear Functions, Transformations, and Equations* (as it was called then) course. The *Linear Family* course as piloted tested during the 2004 – 2005 school year appeared much more "doable" within the 4 to 6 hours per week time frame as evidenced by the relatively low attrition rate and by participant comments related to the amount of time they spent on the course. Nonetheless, the full course still appears to be most appealing to a relatively advanced group of experienced math teachers with strong math content background.

Participants involved in *Proportional Reasoning* and *Quadratic Functions* found the shorter courses to be satisfying, citing valuable information and activities, useful facilitator feedback, and interesting online discussion among the positive aspects.

Recommendation: Continue to make courses available in shorter (4 to 6 week) topic segments so they are accessible to a larger pool of teachers who may be unable to devote a full 13 weeks to a teacher professional development opportunity.

Finding: Participants in all courses continued to have technical problems accessing the course materials, a problem exacerbated by school firewalls and slow Internet access.

Recommendation: Continue to make course materials available to participants in CD format so that many of the access and technical issues will be resolved. Provide technical support for participants and ample, explicit direction on how to use the technology, particularly the interactive tools.

Finding: As the Ready to Teach Algebra courses are taught exclusively online, the role of the facilitator and the importance of the online discussion are paramount. The 2004 – 2005 pilot tests demonstrated the importance of course-provided templates for facilitators to serve as discussion starters for the discussion boards. These templates helped to maintain "quality control" and some level of consistency across the class sections, regardless of the facilitator's expertise or degree of involvement or time.

Recommendation: Continue to provide, and even expand, the materials available for facilitators of these Ready to Teach Algebra courses.

B. Findings from the Quantitative Analysis

Finding: Overall differences on the teacher assessment favored the treatment group, but significant advantages were found only for the pedagogy subscale under the Standard Grading system, and the Inferring/Drawing Conclusions subscale for the Balanced Assessment grading system. As these two scales draw largely from the same set of items and are highly correlated, these cannot be considered as two separate findings. The implication is that the treatment group learned less in algebraic problem solving (the first three parts of the test) than in being able to intelligently discuss functions, questioning strategies, learning from student observation, learning from the use of calculators, etc. (Part C/pedagogy questions).

Finding: Less mathematically educated teachers tended to learn more than teachers with mathematics degrees. Teachers without mathematics degrees learned the most, relative to those with such degrees, in the area of Linear Functions. This relative weakness suggests that students of teachers without mathematics degrees may be at a

disadvantage in learning linear functions, and points to a possible target for professional development for less mathematically prepared teachers.

Finding: In the year after taking the course, teachers continued to learn in some content and pedagogy areas. This analysis was limited to the 16 Cohort 1 teachers for whom such data is available, and might be biased by attrition in the sample. That is, the teachers who were motivated to remain in the sample and to administer and take tests may also be those more motivated to continue to learn and to use the RTT materials made available to them. However, it does suggest the potential for continued learning after formal instruction ceases, and hence that some level of ongoing support may be useful.

Recommendation: Track usage of RTT materials by teachers and students to establish usage patterns and to correlate with assessment areas. It is hypothesized, but not testable due to the lack of data on such usage, that Cohort 1 teachers continued to learn by using the RTT resources made available to them after course completion, and that those who made greater use of the materials in the following year tended to learn more. Through teacher surveys as well as through the tracking of student and teacher use of electronic resources, it would be possible to test these hypotheses.

Recommendation: Develop longitudinal studies to assess longer-term effects on both teachers and students of teachers' professional development. Because the current findings after one year are equivocal (as with much other research on professional development) and there is a suggestion of continued learning, designing both interventions and assessments to cover two or more years may be informative. In addition to any needed course refinements, design and test various levels of ongoing support, perhaps in the form of additional resources, refresher classes, teacher networking, etc. Changing behavior at any level may take a concerted effort over time, and only through careful study will it be determined what level of intervention is both optimal for learning as well as cost-effective.

Finding: Within the treatment group, participant ratings of the usefulness of each of the RTT Libraries were significantly and positively correlated with various measures of teacher content and pedagogy learning. The correlations between Library elements and teacher learning are weak to moderate, and are based on teacher self-report of perceived usefulness, but nonetheless may give some indication of where RTT resources had their impact.

Finding: The treatment had no effect on student learning in Target areas, but had a significant positive effect in non-Target areas in that students of treatment teachers

declined less than students of comparison teachers. This finding is difficult to interpret, as it is unclear why understanding in these areas of algebra should decline significantly over the course of the school year in all cohorts. No great weight should be attached to the positive effect of the treatment in stemming the decline until the broader pattern is better understood.

Recommendation: Continue to focus assessments on areas most closely associated with the intervention, whether at the student level or teacher level. Assessments in other areas (e.g., the Non-Target areas of the student assessment in this study) can also be useful in offering some level of discriminant validity for findings in the targeted areas. Although the results in the present study are somewhat confusing, the decision to divide the overall score into two sub-scores corresponding to covered and non-covered topics was a sound one.

Finding: Teachers' possession of a mathematics degree had a complex influence on student learning. Independent of treatment condition, students of teachers with a mathematics degree gained significantly less in Target areas than students of teachers without a degree. This is difficult to interpret, but possibly those who understand Algebra very well have difficulty appreciating and addressing the needs of those who are just learning. Also, possession of a mathematics degree was found to interact with the treatment condition in Non-Target areas, such that students of treatment teachers declined less (relative to the comparison) when their teachers had a mathematics degree, and declined more when their teachers didn't.

Recommendation: Consider whether differentially educated teachers need different forms of professional development. For instance, consider if mathematically well-educated teachers need to be sensitized to the conceptions and misconceptions of beginning learners in algebra. The qualitative evaluation from 2003-2004 suggested a stratification of courses by level (basic, intermediate, and advanced) using the same general content. We suggest here that level and content both be examined in the development and refinement of courses.

Finding: Independent of treatment, teacher learning was a significant predictor of student gains on the Overall score, due predominantly to contributions from the Non-Target areas, and particularly as assessed by the Standard Grading system.

DISSEMINATION STRATEGIES

Several dissemination strategies flow directly from the above recommendations (which are already being addressed by the project):

- Make materials available as relatively short (3 to 6 week), single-topic focused courses.
- Make interactive course materials available on CD to alleviate the technical issues many participants have had with Internet downloads.

Another dissemination strategy was presented first in the 2003 – 2004 evaluation recommendations:

- **Position and package the Ready To Teach Algebra materials around the RTT Interactive Java applets.** The RTT Interactives (small, manipulable Java applets running over the Internet) present a new vehicle for understanding algebra content. Teachers found these materials to be valuable for their own conceptual understanding and particularly for their students to be able to visualize algebraic concepts in unique ways possible only through the use of these technologies. As one teacher wrote in the online discussion boards, "My first thought after playing with the function analyzer [one of the RTT Interactives] was, 'what a great way to show students how to solve a system of linear equations by graphing.' I love how this program highlights the intersections of the lines if you move the yellow dot to where you think the lines intersect…. Plus, it is the best graphing program I have seen that relates solving an equation and its graphing representation of the solution. I have never really taught this approach to solving linear equations to my students as time doesn't really permit it, but I think it is really an exciting method."

  Because these interactive applications are unique, cutting-edge materials within the math curriculum area, and because they have been so well received by teachers and anecdotally found useful with their students, we believe that these materials, packaged together, could be an extremely marketable and viable product for widespread dissemination.

  One form of disseminating the Ready to Teach materials would be to align the Ready To Teach Algebra modules with the RTT Interactives as the foci around which activities, student exercises, online discussion, and pedagogical strategies can revolve. This would allow the materials to be parsed into topic or concept-centered units that could be applied directly in classroom settings and used more flexibly than a 13-week course or even a 6- or 3-week module.

Second, "how-to" video tutorials that provide some examples of actually using the Interactives would help teachers move up the learning curve faster and enable them to spend more time using the application in their classrooms rather than learning it.

We believe that implementing any or all of the above recommendations would offer ways to make the challenging and exciting Ready To Teach Algebra materials more flexible and ultimately more accessible to a diverse population of mathematics educators who have varying amounts of time to devote to teacher professional development.

LESSONS LEARNED

There were a very large number of organizations involved in the Ready to Teach Algebra evaluation – with Concord Consortium developing the research design, PBS TeacherLine helping to recruit teachers, Edcentric following a formative, qualitative mandate, Hezel Associates conducting quantitative analysis, and NWEA developing data collection instruments. This is a design fraught with peril, no matter how well-intentioned each of the partners may be, as intensive coordination and communication are necessary to ensure a cohesive effort with a coherent evaluation product. This multi-partner design may not be the most efficient or effective way to conduct a multi-faceted evaluation.

FUTURE EVALUATION STRATEGIES

Based on our experiences evaluating materials developed under the Ready to Teach grant, Hezel Associates suggests the following research and evaluation strategies for future assessment of the Concord Consortium's online professional development materials.

1. Focus future studies on specific elements of online professional development. From the present evaluation, we know that teachers grew in pedagogy—but how, why, and in what specific areas? What aspects of the course modules contributed most to their learning? Did they incorporate this learning into their practice? How? Do the findings imply that more or deeper content knowledge, at least for this group of mathematically well-educated teachers, is less relevant than finding ways to translate their existing understanding to students in meaningful ways, or to understand how students think and solve problems? A finer-grained look at some of these areas may be more informative than broadly assessing if teachers and their students learned as a result of taking a course, and may allow for more focused development of new materials. By testing hypotheses through focused research studies in which the intervention is something other than an entire course, the Concord Consortium may begin to establish principles upon which to build and refine courses and other materials, and at the same time contribute to the knowledge base in professional development.

2. Develop longitudinal studies to assess the effects on both teachers and students. As noted, educational interventions may take time to show their full effects, and some level of ongoing support may be needed to support change in teachers' practice. Designing interventions and research on them using longitudinal designs and analysis methods may allow a better understanding of what works and what period of time is necessary for positive effects to become measurable.

3. Consider a randomized experimental design to test professional development materials.
Recruiting teachers to participate in studies with random assignment is feasible, provides a more rigorous test of materials, and addresses the Department of Education's priorities. If attrition can be controlled, issues of sample comparability can largely be eliminated. Also, adding statistical control to experimental control can increase the precision in estimation of treatment effects.

Appendices

Appendix A:
RTT Algebra: Linear Family Survey Results

(1) RTT Algebra: Linear Family; Teacher Background

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RTT Algebra: Linear Family

Teacher Background - Online Survey Results

57 responses - received between: 9/23/04 and 12/2/04

1 - Have you taken an online course before?

	Count	Percentage
Yes (Please specify)	22	39%
No	35	61%

1 - If Yes – Please specify.

Specifics for Q1 – Previous Online Course
• A Math Class through Arapahoe Community College
• A number of PBS classes also one in my master's course
• As part of a class in my masters program at UIW
• Biology @ Rio Salado College, Tempe, AZ
• Distance learning class through ASU
• Educational Research, Masters Degree
• Educational Technology - for certification
• I took several Mater's level Education courses while completing my M. Ed.
• It was an assessment class at Midwestern State University
• Masters Courses for Curriculum and Instruction through Texas Wesleyan
• Master's In Education Coursework at Northern Arizona University
• NO LIMIT technology grant through Blackboard
• Online classes at ASU (statistics) and Rio Salado CC
• PBS Mathline visual/spatial reasoning
• PBS NCTM Principles
• Several technology classes at Univ. of North Texas
• Teacherline courses: Rational Numbers and Reading in the Content Areas: Mathematics
• Two research classes for my master's
• University of Houston, for my master degree
• University of Phoenix Online Masters
• West Shore Community College

Specifics for Q1 – Previous Online Course
• World History

2 - Have you taken an online TeacherLine course before?

	Count	Percentage
Yes (Please specify)	4	7%
No	53	93%

2 - If Yes – Please specify.

- PBS math line visual/spatial reasoning
- PBS NCTM Principles
- Several math courses and a gender equity class
- Rational Numbers, and Reading in the Content Areas: Mathematics

3 - Please indicate your race/ethnicity:

	Count	Percentage
American Indian/Alaskan	1	2%
Asian	1	2%
Black	3	5%
Hispanic	0	0%
White	52	91%

4 - Please indicate your gender:

	Count	Percentage
Female	44	77%
Male	13	23%

5 - What best describes your current position?

	Count	Percentage
Middle school math teacher	30	53%
High school math teacher	24	42%
Pre-service teacher (undergraduate level)	0	
Pre-service teacher (graduate level)	0	
Other (Please specify)	3	5%

Other (Please specify)

- Special Education- Inclusion Teacher
- HS Math and Physics Teacher
- Special education high school resource teacher

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6a - Are you currently a certified teacher?

	Count	Percentage
Yes	57	100%
No	0	

6b - If yes, what teaching certificate(s) do you hold? Please indicate subject area and grade level for each certification:

Q6b –Teacher Certificates Held
• 9-12 Mathematics
• Middle school math
• Arizona Mathematics 7-12
• 7-12 Mathematics, I am highly qualified
• Secondary Mathematics (grade 7-12) Preparing for Secondary certification in genreal science (grade 7-12)
• Secondary Mathematics 6-12
• Secondary Ed Computer Information Systems Special Education Math 4-8
• Mathematics 4-12 Biology 4-12
• Certification in Secondary Mathematics Grades 7-12
• Elem Ed. 1-8; Secondary Math certification
• Math - secondary
• Secondary Mathematics (6 -12)
• Elementary K-9 math and social studies
• Math 9-12
• Middle school generalist (Massachusetts certification) K-12 Special Ed. (New Hampshire Certification) Secondary Math (Colorado Certification)
• K-8
• K-8 elementary K-12 Reading 4-12 Mathematics
• K-8 Standard with PE endorsement
• Washington State Mathematics 7-12
• BA-Secondary Mathematics Education BA-Elementary Education
• Physical Education - secondary English - secondary Mathematics - secondary
• Elementary self-contained (grades 1-6) Elementary Mathematics (grades 1-8) Secondary Mathematics (grades 6-12)
• Elementary Education Grades 1-8 Math endorsement
• Provisional License in Secondary Mathematics
• Mathematics/ Secondary Education
• Math, secondary grade 6 to 12
• Secondary Mathematics-grades 6-12

Q6b –Teacher Certificates Held
• Grade 6th to 12th Mathematics Business Administration
• 6-12 Mathematics 6-12 French
• Mathematics 7-12; Language Arts 7-12; Reading K-12; Special Education K-12; Elementary Ed. K-6
• 1- Secondary Mathematics Grade 6 thru 12 2- Generic Special Education 3- English as a Second Language
• Primary Residency 5-12 Math endorsement
• 8--12 Math for Texas; 7--12 Math for Alaska
• Elementary Education K-6
• Math 7-12 Music 7-12
• Secondary Mathematics grades 6 -12
• Elementary Education
• Elementary K-6 Middle Level 5-8
• 8-12 Secondary Math K-8 Elementary with Math Specialization Principal ship
• Secondary Mathematics
• HS Math HS Physics
• Math 1st - 12th grades
• Secondary Mathematics
• Secondary General Science and Mathematics both for grades 5 through 12
• Elementary 1-8 math, English, self-contained and Secondary math 6-12.
• K-5 All subjects 6-8 Self-contained
• BA Elementary Ed Elementary Math Certification
• 9-12 math and science
• BA in Education MA in Education
• Mathematics (8-12)
• Elementary regular education k-8 and special education k-12
• Math 1-8; elementary self-contained 1-8; secondary math 8-12; ESL 1-12
• Standard K-8
• Masters of Arts in Teaching: math and computer science (7-12)
• Secondary Math (7-12)
• K-12
• Special Education Cross Categorical Pre school- high school

7- Years taught at the *K-12 level* prior to this school year?

Years Taught K-12	Count	Percentage
9	3	5%
14	3	5%
6	8	14%
5	7	12%
11	2	4%
13	3	5%
8	4	7%
20	2	4%
19	2	4%
12	3	5%
1	7	12%
4	3	5%
(Total)	57	100%

7- Years taught *math* prior to this school year?

Years Taught Math	Count	Percentage
21	2	4%
4	4	7%
14	2	4%
6	7	12%
5	7	12%
13	4	7%
7	4	7%
3	2	4%
8	3	5%
1	6	11%
9	2	4%
18	4	7%
(Total)	57	100%

8 - How familiar are you with NCTM Standards?

Choice	Count	Percentage
Not at all familiar	1	2%
Somewhat familiar	13	23%
Fairly familiar	33	58%
Very familiar	10	17%

9 - Please indicate your highest degree from the following list:

Choice	Count	Percentage
Bachelors degree	3	5%
Bachelors degree + additional courses	23	40%
Masters degree	7	12%
Masters degree + additional courses	24	42%

Choice	Count	Percentage
Certificate of Advanced Graduate Studies (CAGS)	0	
Doctorate	0	
Other (specify)	0	

10 - Please indicate the subject or major for each of your degrees:

Subject or Major	Bachelors	Masters	Doctorate
Mathematics	21	1	0
Computer Science	2	0	0
Mathematics Education	8	5	0
Science/Science Education	4	2	0
Elementary Education	14	5	0
Special Education	4	2	0
Other Education (see next table)	7	16	0

10 – If 'Other Education', please explain
• Technology in Education
• Secondary Education
• Curriculum & assessment
• Electrical Engineer
• Physical Education
• Educational Technology
• Physical Education
• Instruction and Curriculum
• Counselor
• Masters of Education in Instructional Technology
• Master of Arts in Education
• Gifted and Talented Education
• Curriculum and Instruction
• Music Education
• Middle Level Education
• Principal ship
• Curriculum and Instruction
• Teaching and Learning
• Physical Education
• Curriculum and instruction
• Business

Mathematics

11 - Which of the following college courses have you completed? Include courses for which you received undergraduate or graduate college credit. Check all that apply.

Mathematics Course	Count	Percentage
Mathematics for elementary school teachers	25	44%
Mathematics for middle school teachers	22	39%
Geometry for elementary/middle school teachers	21	37%
College algebra/trigonometry/elementary functions	39	68%
Calculus	41	72%
Advanced calculus	29	51%
Real analysis	8	14%
Differential equations	27	47%
Geometry	36	63%
Probability and statistics	39	68%
Abstract algebra	22	39%
Number theory	25	44%
Linear algebra	32	56%
Applications of mathematics/problem solving	20	35%
History of mathematics	19	33%
Discrete mathematics	20	35%
Other upper division mathematics	24	42%

Education

11 - Which of the following college courses have you completed? Include courses for which you received undergraduate or graduate college credit. Check all that apply.

Education Course	Count	Percentage
General methods of teaching	54	95%
Methods of teaching mathematics	46	81%
Instructional uses of computers/other technologies	34	60%
Supervised student teaching in mathematics	31	54%

12 - If applicable, in what year did you last take a formal course for college credit (either undergraduate or graduate level) in *Mathematics*: - Name of Course:

- **In what year was your last course in *Mathematics* (YYYY): (Summary data)**

Year of last Math. Course	Count	Percentage
1996	2	3.5%
(Not Answered)	**7**	**12%**
2002	7	12%
1997	3	5%
1991	3	5%
2001	3	5%
2000	2	4%
2004	**8**	**14%**
1980	3	5%
1995	3	5%
1999	2	4%
2003	4	7%

Year of last Math. Course	Count	Percentage
(Total)	57	100%

- **What Year Last Course *-- Name of Math Course*: (Summary data)**

Name of Last Math. Course	Count	Percentage
(Not Answered)	**7**	**12%**
Geometry	4	7%
Discrete Mathematics	3	5%
Statistics	3	5%
Number Theory	2	4%
College Algebra	2	4%
Linear Algebra	4	7%
Unique responses	32	56%
(Total)	57	100%

12 - If applicable, in what year did you last take a formal course for college credit (either undergraduate or graduate level) in: - Name of Math Course:

Q12. WhatYear LastCourse	Q12. Name of Math Course
1996	Non Euclidean Geometry
2002	Technology in Mathematics
1997	Geometry
2002	Discrete Mathematics
1972	Classical Geometry
2002	Geometry for Teachers
1991	Discrete Mathematics
2001	Standards Based Education Methods
1991	Statistics
2000	Number Theory
1997	College Algebra
2004	Calculus 2
2002	NCTM Geometry Academy
2002	Linear Algebra
1980	Linear Algebra
2001	Introduction to Theory of Numbers
1995	Business Mathematics (Graduate)
1994	Statistics
1996	Geometry
2001	History of Mathematics
2002	Geometric Problem Solving
1998	Numerical Mathematics and Computing/Numerical Analysis
1995	Elements of Finite Math, Advanced Geometry, and Basic Computer Math Literacy
2004	Topics for Secondary Teachers

Q12. WhatYear LastCourse	Q12. Name of Math Course
1995	Mathematics Seminar
1980	Multivariable Calculus
1999	Statistics
2003	Geometry
1991	Various
1985	College Algebra
1986	Discrete Mathematics
1992	Linear Algebra
1975	Statistics for Biology
2003	Problem Solving for the Middle Level Teacher
1988	Abstract Algebra
1997	Advanced Calculus
1999	Geometry
2004	Number Theory
2004	Integrating Mathematics and Physics
1982	Intro. Probability and Statistics
2004	Calculus
2000	Mathematics in Elementary Education
1980	Linear Algebra
2004	Geometry and Trigonometry
2004	Research in Math Education
2004	History of Math
2002	Linear Algebra
2003	Masters Thesis
2003	Survey of Calculus for High School Teachers
1964	College Algebra

12 – What Year Last Course in *The Teaching of Mathematics (*YYYY): (Summary data)

Year of last course Teaching of Math.	Count	Percentage
1996	2	4%
(Not Answered)	**13**	**23%**
2003	**7**	**12%**
2002	5	9%
1997	2	4%
1998	2	4%
2001	2	4%
2004	**7**	**12%**
1995	2	4%
1994	2	4%
1999	2	4%
1984	3	5%
1987	4	7%
Unique responses (see next slide)	4	7%

Year of last course Teaching of Math.	Count	Percentage
(Total)	57	100%

12 - If applicable, in what year did you last take a formal course for college credit (either undergraduate or graduate level) in *The Teaching Mathematics*: - Name of Course:

Year oft Course Teaching of Math	Q12. Name of *Teaching Math* Course
1996	Teaching Problem Solving
2003	TeacherLine Learning Module: Measurement: Surface, Area and Volume in Grades 6-8
2002	Teaching Mathematics to Freshman
1997	Math Methods
1998	Mathematics Methods in Secondary Education
2001	Instructional Strategies for Secondary Mathematics and Computer Science
2004	Geometry for Secondary Teachers
1995	Problem Solving in the mathematics classroom
1994	Math for Elementary
1997	
2003	Visual/spatial reasoning
1999	Methods for Elementary Teachers
1983	Technology for math
2001	Technology in the Mathematics Classroom
1984	Math for Elementary Teachers
1995	Elementary Mathematics Methods
1996	Mathematics in the Middle School
2002	Advanced Methods in Mathematics
2002	Algebra in the Secondary Classroom
2004	Topics for Secondary Teachers
1994	Teaching Methods of Mathematics
1981	Teaching Mathematics at the Secondary Level
1998	Math and Science Curricula: Design and Develop.
2002	Methods of Teaching Secondary Mathematics
2004	Part of the curriculum and instruction coursework
1987	Methods of Teaching Mathematics
1982	Secondary Methods in Mathematics
1992	Math Methods
1999	Teaching Mathematics in Middle School
2003	Math for Students with Special Needs
1987	Teaching Secondary Mathematics
2003	Math for Educators
2002	Topics in Mathematics
2004	Problem solving and algebraic thinking in the middle school
1984	Foundations of Elementary Math

Year oft Course Teaching of Math	Q12. Name of *Teaching Math* Course
2004	Algebra
2004	Lesson Study in Mathematics
1984	Secondary mathematics
2004	Special Topics in Math Education
2003	Problem Solving
1987	Math in the Elem. School.
2003	Student Teaching
2003	Survey of Calculus for High School Teachers
1987	Teaching Math Elementary

13 - In the past 3 years, have you participated in any of the following activities related to math or the teaching of math?

Activity	Yes	No
Taken a college/university course in math.	24	33
Taken a college/university course in teaching of math.	24	33
Observed other teachers teaching math.	48	9
Met with a local group of teachers on a regular basis. to study/discuss math teaching issues.	49	8
Collaborated on math teaching issues with a group of teachers at a distance using telecommunication.	15	42
Served as a mentor and/or peer coach in math teaching as part of a formal arrangement that is recognized or supported by the school or district.	29	28
Attended a workshop on math teaching.	50	7
Attended a national or state math teachers association meeting.	27	30

14 - Please provide your opinion about each of the following statements.

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Students learn mathematics best in classes with students of similar abilities.	1 2%	26 46%	4 7%	24 42%	2 3%
The testing program in my state/district dictates what mathematics content I teach.	0	5 9%	1 2%	33 58%	18 31%
I enjoy teaching mathematics.	0	0	0	8 14%	49 86%
I consider myself a “master" mathematics teacher.	2 3%	12 21%	7 12%	23 40%	13 23%
I have time during the regular school week to work with my colleagues on mathematics curriculum and teaching.	4 7%	26 46%	2 3%	22 39%	3 5%
Mathematics teachers in this school regularly observe each other teaching classes as part of sharing and improving instructional strategies.	18 32%	27 47%	5 9%	5 9%	2 3%
Most mathematics teachers in this school contribute actively to making decisions about the mathematics curriculum.	4 7%	22 38%	5 9%	20 35%	6 11%

15 - Think about your mathematics class this school year. How much emphasis does each of the following student objectives receive at this point in time?

	None	Minimal Emphasis	Moderate Emphasis	Heavy Emphasis
Increase students' interest in mathematics.	2 3%	8 14%	33 58%	14 |25%
Learn mathematical concepts.	0	0	10 18%	33 81%
Learn mathematical algorithms/procedures.	0	8 14%	25 44%	24 42%
Develop students' computational skills.	0	21 37%	21 37%	15 26%
. Learn how to solve problems.	0	0	13 23%	44 77%
Learn how to reason mathematically.	0	1 2%	19 33%	37 65%
Learn how mathematics ideas connect with one another.	0	6 11%	25 44%	26 45%
Prepare for further study in mathematics.	0	6 11%	29 51%	22 38%
Understand the logical structure of mathematics.	3 5%	19 33%	25 44%	10 18%
Learn about the history and nature of mathematics.	19 33%	32 56%	5 9%	1 2%
Learn to explain ideas in mathematics effectively.	1 2%	9 16%	33 58%	14 24%
Learn how to apply mathematics in business and industry.	3 5%	27 47%	20 35%	7 13%
Learn to perform computations with speed and accuracy.	4 7%	30 53%	17 30%	6 10%
Prepare for standardized tests.	1 2%	12 21%	20 35%	24 42%

16 - About how often do you do each of the following in your mathematics instruction at this point in time?

Topic	Never	Rarely (e.g., a few times a year)	Sometimes (e.g., once to twice a month)	Often (e.g., once to twice a week)	All or almost all mathematics lessons
Introduce content through formal presentations.	1 2%	5 9%	6 10%	26 46%	19 33%
Pose open-ended questions.	1 2%	4 7%	9 16%	24 42%	19 33%

Engage the whole class in discussions.	1 2%	0	11 19%	22 38%	23 40%
Require students to explain their reasoning when giving an answer.	0	0	5 9%	25 44%	27 47%
Ask students to explain concepts to one another.	1 2%	1 2%	12 21%	30 52%	13 23%
Ask students to consider alternative methods for solution.	0	1 2%	12 21%	26 46%	18 31%
Ask students to use multiple representations (e.g., numeric, graphic, geometric, etc.).	0	4 7%	20 35%	17 30%	16 28%
Allow students to work at their own pace.	5 9%	9 16%	18 32%	11 19%	14 24%
Help students see connections between mathematics and other disciplines.	0	5 9%	25 44%	19 33%	8 14%
Read and comment on the reflections students have written (e.g., in their journals).	14 25%	10 17%	25 44%	5 9%	3 5%

17 - What do you hope to learn from the Linear Functions, Transformations and Equations course?

Q17HopeToLearn
• I hope to become a more effective teacher for my students. I struggle to get them to talk and/or write about mathematics. I would appreciate ideas to help me that area of teaching.
• I hope to improve my teaching of algebra. I want to get more ideas.
• I hope to learn what other people are doing that works and adopt them into my own teaching.
• new ways of looking at teaching algebra and to gain a better understanding of it myself
• How to help my 7th grade algebra students make the transition from concrete thinking to abstract thinking.
• A new approach that will "hook" the students into at least liking/understanding mathematics and not being afraid to try.
• Better ways of presenting material to students to keep them engaged in learning
• I am hoping to be re-inspired with a new approach. I think I am a good teacher, however, I know I tend toward the traditional approach (the way I was taught). I would like to move the learning more towards being student centered instead of being funneled through me. I do like group activities and projects, but when it comes to open-ended questions and tough problems I jump in and help them too much.
• I want to increase my knowledge of Linear Functions, Transformations and Equations so I can teach these concepts to my students in a more informed manner.
• I hope to learn some new ideas that will work with this new group of kids coming in the world.
• How to be a better teacher and find new methods for presenting material to students.
• 1. To acquire another perspective in considering functions, transformations and equations. 2. Hopefully a better and more interesting approach to helping students to learn the these important concepts
• Various ways to present the algebraic concepts to my students.- and to help build my confidence in teaching algebra.
• I would love to learn new ways of teaching these topics. It seems like my students really struggle with these concepts and I would love to see all of my students succeed with this.
• To a great degree, I hope to learn new ways to teach and CONNECT my functions/equations teaching with other areas of my math teaching. I hope to learn ideas new enough to me that I can't

Q17HopeToLearn
really conceive of them, let alone describe them yet. I also hope to be able to take away discrete activities that I can share with my less adventurous colleagues, who won't try a new idea unless it comes in a pre-explained, ready-to-use package.
• Always looking for more ways to present and teach math. Searching for methods with high interest and connection to the real world.
• Better integrate algebra into general math course, to recognize opportunities to do so, and to better understand student work and thinking.
• I hope that my learning will deepen my understanding of the math that I teach.
• New approaches to teaching Algebra to students with different learning styles and ways to let them discover the ideas rather than lecture
• Different ways to teach Algebra. It is easiest to be traditional and use direct instruction.
• Connections between Algebra and today's real world
• I hope to learn how to help kids make connections that will give them ownership of their learning.
• I hope to refresh my teaching and learn some new more affective ways to facilitate learning.
• Gain a better conceptual understanding of functions that I can share with my students. Utilize technology to enhance student understanding and problem solving skills. Help students develop a deeper understanding of slope. Use interactive software to aid in exploring the connection between functions and equations and the processes used to solve equations.
• I hope to increase my understanding of what students see and do when they see a math problem for the first time. As a learner I need time to think through a process, but as a teacher am not always able to offer my students the luxury of seeing a problem then having ample "think time" before actually beginning the problem solving.
• Some new and innovative ways to teach mathematics.
• I hope to learn of new ways to communicate Algebra to my students that will help them be successful in my class.
• I want a fresh approach to learning linear functions.
• How to be a better algebra teacher for my students.
• New and better ways of presenting Mathematics to my students
• more examples that will help me to create a connection with real life situations
• How to teach the connection between the slope intercept equation and other forms of the equations of lines and the actual graphs of lines more effectively
• The teaching of Algebra is changing, and I want to have a better view of how to reach my students.
• I feel like I should be more knowledgeable regarding linear functions (as well as other aspects of algebra). I don't have a solid understanding.
• 1. I have been out of the algebra classroom for several years and am looking forward to learning some of the latest ideas for teaching algebra in ways totally unlike I learned several years (decades?!) ago. 2. I am interested in research and hope to contribute something to the body of knowledge about how students learn algebra.
• I'm not really sure, perhaps a better, more meaningful way to present some of the material I am currently teaching.
• I would like to have better ways of asking open-ended questions in math.
• How to better teach algebra.
• Techniques to encourage students to be more successful.
• Better methods for teaching functions and a better understanding of the connections
• I hope to be able to teach these concepts and have the students fully understand them.
• How to help students better understand Algebra
• How to be a more effective teacher. How to increase student involvement in the lessons other than a passive attention. Insights into student thinking and reasoning.

Q17HopeToLearn
• How to help students better understand that there cn be more than one right answer and more than one way to solve a problem, not just in math, but in life as well.
• How better to teach functions so that ALL of my students will be able to learn and apply their learning
• How others overcome problems related to teaching math and new ideas to present to my class.
• 1) New methods for presenting this subject matter. 2) An opportunity to increase my own understanding of the material.
• How to be better teach these concepts to my Algebra students
• New ideas and methods to engage students in Algebra!
• Better student engagement in mathematics.
• I really don't know hat to expect
• I want to learn how to provide an education that the students will remember next year.
• To continue to education myself with new, different ideas, content, methods of presentation so that I can continue to improve myself as a teacher.
• How to teach conceptual math more effectively. How to teach in a way where learning, not the teacher is the center of attention.
• I am not sure that I am hoping to learn something as much as I am looking to provide insight and to see what other math teachers are doing.
• Different way of teaching math.
• I want to gain a better understanding for math myself so I can answer student questions better

edcentric

(2) RTT Algebra: Linear Family; Ready for Algebra

edcentric

Ready to Teach  Algebra 1

RTT Algebra: Linear Family

Ready for Algebra

45 responses - received between: 10/13/04 and 1/24/05

Consider the broad themes of this topic:

- **graphing;**
- **time versus distance graphs;**
- **the nature of algebra.**

1 - Please list two aspects of these themes that are new to you.

Q1. Two New Aspects
• Understanding that a process is also an object and vise versa was something I did naturally, but never but those names to it before. Although understanding that a graph of time versus distance does not represent true motion, I was surprised to see that so many students and teachers saw it that way.
• Viewing functions as objects and processes. All of the interactive tools we have been able to use.
• 1. I found the idea of path of an object verses the actual graph of distance verses time is very important and alerted me to the idea that my students may be getting the 2 confused. So, I learned to be aware of the possible confusion and point them out to my students. 2. I have never thought of Algebra as noun and object relationship. This was very new to me and it was an eye opener for me. I loved the comparison to Language Arts.
• The idea of process vs. object
• I had not thought much about time versus distance graphs and the difference. The language of algebra was new to me.
• Looking at functions as objects and processes.
• Using the Q grapher was new for me. Thinking about algebra in terms of verbs, nouns etc.
• Time-versus-distance graphs were new to me, or, at least, I don't remember them from high school algebra! The Q Grapher was new to me, as I don't use technology much in the classroom.
• I had never used a Q-grapher. In fact I never even heard the term before so that was new to me. The second is even though I treat functions as objects, I had never really thought of presenting it quite like you did when looking at 2x+4 from different views.
• 1- While I know that the foundation of algebra is recognizing patterns; I have always taken that for granted. Looking at algebra from the perspective of functions is new for me, but one that makes sense. 2- Time vs. distance is familiar to me, but, although somewhat familiar, the misconceptions of time vs. height were an eye-opener.
• Time versus distance graphs and the nature of algebra
• There was nothing new for me but I feel that one has to careful with regards to the trajectory of an object and plotting the distance versus time graphs.
• The whole idea of trajectory confused the issue for me.
• The q-grapher the difference between a time vs. distance graph and the trajectory of a ball
• Thinking about math as nouns and verbs. Teaching students about functions at the very beginning of their algebra experience
• The q-grapher and the idea of functions as nouns and verbs.
• The consideration of functions as objects or operations is new to me. I also have not really emphasized the difference between trajectory and time/distance graphs.
• 1. Thinking of algebra in terms of nouns and verbs 2. Q-Grapher
• The nature of algebra, thinking of algebra as nouns and verbs
• Using the q-grapher. Discussions of trajectory and how to help students understand the subject better.
• Functions versus objects
• 1. Viewing Algebra as a process and as a function 2. The grapher
• All of it--graphing; algebra as process/object; even my current pre-algebra textbook does not reflect any of these concepts

Q1. Two New Aspects
• 1- The conceptual frame of functions as objects and processes. 2- Q-grapher.
• Using the q-grapher and thinking of fractions as an object or a process was new for me.
• The idea that we as teachers interchange the nouns with verbs and vice versa in the language of mathematics
• I have not really learned anything new, just a refinement of what I did at ASU in their Modeling Physics courses.
• The fact that we as teachers view expression and functions as objects and processes.
• Viewing all mathematical operations from a function point of view. Something mathematical being both an object and process at the same time.
• The idea of process vs. object; noun vs. verb. Time versus distance graphs were not new to me, but I see them in a different light.
• Process and object. Piecewise graphing.
• The problem of trajectory in the time vs. distance problems was a topic I had not adressed when teaching this. The idea of a function as an object vs. a process was new to me.
• The nature of algebra, by using graphing is new concept I did not learn algebra that way, and is somewhat difficult for me to reference too.
• The concept of time versus distance graphs in and of themselves is not new to me, but the confusion they create was definitely new. I got just as confused as the students do concerning trajectory. Using the Graphing interactive was a new tool for me and it helped with the above mentioned confusion.
• The piecewise functions are not really new, however, I have not used them very much as I have enough trouble teaching them regular linear functions. The cell phone plans are a good way of presenting this content. As far as the nature of algebra, I have not previously thought about the idea of objects vs. operations. This is definitely something I am thinking about now each time I have the students solve a problem or equation.
• 1. The idea of algebra as process vs. object. I think that a part of the way I approach say linear equations is object oriented but I had not thought of that approach as an object. 2. Using the graphing tool was new to me and might help the students better relate the variables.
• nature of algebra - noun versus object and visualization of time and distance graphs
• The new technology that you guys created was great. I've only used basic graphing calculators before. I also really enjoyed the film clips, both of the students and the expert commentary. I learned a great deal from the commentary of my classmates as well, as to what some people might find confusing, and how students other than my own, react to different tasks. The actual mathematical content was not new to me.
• I am not certain that there are things regarding these that are "new" to me.
• 1. The great misunderstanding of distance time graphs 2. The Quality Grapher
• I thought the nature of algebra section was the most eye-opening to me. Especially the ‘why algebra’ section.
• The emphasis of function. The use of graphing for the exploration of point-slope.
• Using the Q-grapher Different ways of looking at problem solving
• Teaching graphs first & talking about time versus distance so early
• Object vs. process and how students have difficulty with time vs. distance graphs.

2 - List two ideas about teaching that you found useful.

Q2. Two Useful Ideas
• Do smaller activities that lead and support to the larger activity. Using the P-Grapher and Q-Grapher to aid student learning about the relationship between functions and their graphs.
• Using the interactive tools to help students understand and visualize a concept. Many of the ideas expressed by the other teachers in our discussion boards.
• 1.I really enjoyed teaching the student activity from week 2. My students loved it. It was great having the lesson plan done for me. 2. I like to relate the transfer from math to science to Language Arts so the noun, object lesson really helped me to convey that transfer.
• The optional student activity will be useful when I reach that stage in my curriculum. The importance of clarifying trajectory as opposed to the time/distance relationship.
• The q-grapher and the language of algebra.
• 1. Students need different points of views to make connections
• The Q grapher will be a great interactive way to look at graphing in my classroom. I also think I will implement some type of algebra dictionary into my class.
• Incorporating more real-world problems and helping students see expressions in more than one way, for example: as both an object and as process
• I liked the noun/verb in math presentation very much and will use that with my classes. I also like the idea of teaching Algebra from a function standpoint and I am anxious to see how the rest of the course develops. I have definitely gotten some good ideas that I can use in the classroom.
• 1 - Using interactive graphing tools rather than the more static graphing calculator seems like a cool idea. 2 - I definitely want to take a step back (or is it forward) and start looking at functions and making the connection between functions and equations.
• Allowing students to "talk" through problem solving Process verses Product
• The q-grapher was a nice tool to visualize the graphs. Also, the questioning technique used in the video was very impressive
• The Q-grapher is a useful tool both in the classroom an d to help increase my understanding. I liked the noun/verb approach, even though I had been informally been using this approach it helps to put a name on it.
• Using language arts as an analogy for the language of algebra viewing functions as objects and processes
• Using the Q grapher in the classroom. One possible problem, I haven't checked into it, but is it possible to have 25 students using the q grapher in a computer lab? Teaching the idea of math as product vs. process, noun vs. verb.
• The idea of functions as nouns and verbs The Q-grapher
• I can't think of anything new in the way of teaching ideas that I learned other than the ones mentioned above.
• 1. "Talking out loud" 2. Understanding that the shift between the two viewpoints (procedure or object) may be natural to me, but this is not a necessarily a natural shift in the minds of my students
• Using the q-grapher when teaching about time versus distance and terms to use when teaching how to read the graphs.
• Discussion about mathematical objects vs. mathematical actions. It helped to make myself stop and think what I was doing. The questioning suggestions for student's thinking were great.
• Analyzing graphs thinking between objects and functions

Q2. Two Useful Ideas
• 1. Modeling the equation as both a function and a picture 2. Clarifying vocabulary
• Functions as nouns/verbs; the relationship of CHANGE; how to have students create graphs based on data--to see the relationship between the two values; to move back and forth from data to graph to language to keep the students focused on the relationship of the values, and that the graph, problem, and language are all different versions of the same data.
• The application of structure of nouns and verbs in language of algebra. Seeing numbers, points, expressions, and function as mathematical objects; and mathematical operations such as addition, subtraction, multiplication, and division as actions.
• This would have to be with the concept of functions as objects or process and getting the students to see that. Another idea was the function machine that someone mentioned.
• The q-grapher and bringing up common misconceptions on purpose
• I really did enjoy the graphing program and will use this in my algebra class.
• Using objects and processes. How to further classroom discussions.
• Using the vocabulary of object and process to represent one operation and using the q-grapher.
• To talk about functions as both process and object and to make that distinction clear to students. Not only that, but to tell them when we are moving from one to the other and encourage them to be aware of their own thinking in this regard. When I talked to my algebra students, I was able to use what I learned when we discussed real world graphs. What I emphasized was the importance of thinking deeply about what we were graphing. We talked about graphing distance from home over time; total distance traveled over time and speed over time. I think it opened some students' eyes.
• Process and object Piecewise graphing Q grapher
• The idea that if a graph involved money, it got rid of the trajectory confusion. The lesson where the kids threw the paper in the air and considered the height vs., time in this way was a good hands-on, "constructivist" approach.
• I am still trying to use the new ideas in my class
• Questioning strategies are always useful and it is nice to be reminded of how to question effectively. Also, using the graphing tool will definitely be something I use in my class.
• In question #1, I answered that I found the objects vs. operations concept new. I have been using this and have found it somewhat helpful. It will probably be more helpful as I continue to refine my teaching concerning this aspect.
• 1. Being made aware of the process of operating on an equation is different from the equation as an object and what it can tell you - if I understand what was presented. 2. Engaging students through questioning strategies.
• Use of the technology sharing ideas
• The enduring focus on having students discover the relationships, and on them being able to describe/defend the ratio shown by slope confirmed my own teaching beliefs, and reaffirmed my efforts in that direction. The emphasis on the value of the visual graph, as being equally worthy as the symbolic function was a useful reminder.
• I found it interesting to see what other teachers are doing in their classrooms, but other than interesting way to look at situations, I did not find a lot of it useful to me.
• 1. Developing ideas from the big picture.
• I liked the time vs. distance graphing. The technology was useful here. I thought this was a good addition. Also, I liked being questioned about the difference of change over time and how a graph represents that. These two items were both useful to me.
• I found the approach the problems took to be useful. I also found the explanation of the point-slope very useful.
• Looking at questioning techniques and strategies.

Q2. Two Useful Ideas
Examining my problem solving and trying to think like the students think. • After exploring with the activities I truly found that they would help a new algebra student • The Q-grapher was great in visualizing time vs. distance graph. Video of actual class discussion and student answers was helpful in explaining misconceptions.

3 - What areas do you feel need further clarification?

Q3. Areas Needing Clarification
• None
• I could still use some more help on clarifying object versus process. Maybe some examples on ways to teach these differences to my students.
• I am not sure what graph B in week 2 activity stands for because I don't know of a distance over time that will lose distance over no time as in the vertical line drop in this graph. I am still learning to negotiate around Blackboard Learning but am feeling more confident as I do each activity.
• The idea of process vs. object
• I need to work on understanding the language of algebra better so I can implement with my students.
• How to respond to others and start a discussion about something
• I found the videos particularly helpful...I am a visual learner and need to see some of these discussion topics in action.
• I can't think of any.
• Nothing so far.
• 1-Ways in which to use the Q-grapher for linear functions 2-approaches to functions in relation to the traditional textbook and how to integrate the two
• Time verses distance graphs
• Navigation and Posting in the forums.
• Trajectory.
• The difference between a function as an object and a process the difference between a time vs. distance graph and the trajectory of a ball
• Maybe some more ideas about the nature of Algebra. Some more examples, I thrive on examples.
• Is the order of the course what they suggest be the order of a typical Algebra Class?
• I'd like to know how all of the squirrel graphs were supposed to look. I'm not sure we all came to the same consensus.
• I would maybe like to see more examples of how to use the Q-Grapher.
• Maybe more information on viewing algebra as objects and its process, it was new for me.
• None so far
• Nothing.
• The nature of algebra
• I have the NCTM standards and another excellent math book on all the standards by Van de Walle, which helped clarify any confusion I had.
• None at this point
• So far so good.
• My time and details on the nature of algebra--nouns and verbs
• I don't think I need any at this time.
• How to implement the computer programs into classrooms missing technology.
• None at this time
• I think the object vs. process approach might be better off as object and process. When discussing functions, there are many ways of representing them: ordered pairs, mappings, graphs, input/output, tables, function rule, etc. Which of these we chose depends upon what we intend to do with the information. The same is true I believe for object vs. process.
• I don't necessarily need clarification on anything, just more practice probably.
• The function as an object vs. a process. I thought I knew what it meant, but I'm not sure that it was clearly taught. I think the exercise where we made our own homepage left a lot to be improved upon. The

Q3. Areas Needing Clarification
teachers who had had a class on homepage construction made nice pages and the rest of us who just followed the prompts had messy ones.
• The whole concept is so new; I will need to continue to grasp it.
• None of the actual math topics need clarification, but the set up of the course seemed confusing to me. A lot of questions that I had have been answered in Linear Functions, but I don't know why they weren't addressed originally. Many people asked me the purpose of the course and I was having a hard time telling them.
• None, really. I just need more time to use them.
• None
• None
• Hmmm.... nothing springs to mind. I need to practice a lot more with the technology, both the little RTT programs, and the simple tasks of embedding images, etc. so that I can use them fluently in my classes!
• Nothing
• None
• N/A
• I'm still a little shaky on function versus equation but I think i got it now.
• None
• How to get a student to grasp the difference between a projectory graph and the time vs. distance graph
• How to explain functions to students.

4 - Were you able to complete the three-week topic within the suggested timeframe of four to six hours per week? If not, what assignment(s) took longer than expected?

Q4. Able to Complete Within 6hrs
• Yes
• Yes.
• I spent more than 4 - 6 hours during week one just learning to negotiate around the class sites and requirements. Week 2 and 3 were more manageable time wise. Thanks for a good 3 weeks.
• Yes
• Yes
• I spent about 4-6 hours on it
• Yes
• Yes, I was able to complete in the suggested time.
• Yes, I was.
• While I did not keep track of the time spent, I think that I did. The only difficulty I had was responding to other participants. I had to find time to return quite often to the discussion board. Sometimes, I had to go back and rethink the original activity/question in order to be able to respond intelligently.
• Yes. Not a problem
• Yes, I was able to complete the assignments on time.
• There was no problem in completing the assignments.
• Yes - it's just difficult to start the assignment before the weekend
• Yes, I was able to do that. The last section on the nature of algbra took a lot of thinking time, but I found the time to do it.
• Most of the time. Except for the week the computers were acting up.
• Yes I was.
• Yes
• Posting in all three areas three times a week, takes time to think of new thoughts to share. But four to six hours is not too bad.
• Yes
• Yes.
• Yes
• Yes; I just took longer to clarify the new ideas.
• The timeframe of the assignments is fine. i had some challenges at the beginning due to personal issues.
• Yes, the time was good
• Yes
• The timing was not great as we had fall break during the last week. The time assessment seemed about right.
• No things have taken less time. However I find it more effective to do all my work at once and I'm having trouble getting motivated to sign on an additional time a week when I think I could be more efficient posting just twice a week.
• Yes
• I think the timeframe is adequate. My challenge is to find that much time to devote to the project. I know I agreed to do so, but for example, week 3 coincided with our homecoming week-float building every night, activities every day, etc.
• I was able to complete the assignments in that time frame.
• The whole idea of having to respond to discussion groups on three different days is difficult for me. As a full time teacher, when I was originally told that this class would require 4 hours of homework

Q4. Able to Complete Within 6hrs
per week, I figured I could handle that and would do most of the work on the weekend, but with logging in to read and watch the assignments and then responding on different days, I find it quite time consuming and probably wouldn't recommend it.
• I have been able to complete the assignments in the time frame, it is just finding time in the day to do them./
• Everything about this course has taken way more time than suggested. The technology (getting both of my computers compatible with the program requirements) probably took a good 4 hours. Creating the SMF spreadsheets for the pre-test took 2 hours. Taking the pre-test myself took 2 hours. All of the first and second week activities took more than the 4-6 hours timeframe. Now that I have gotten rid of all the hang-ups and understand the course better, I seem to be getting things done in a better time. Part of my initial stress was thinking that this was supposed to take 4-6 hours and other people were only spending that time and what was wrong with me.
• I could have finished these in that timeframe, however, I am short of time when I am not interrupted so I struggle all the time to find the time to work on this without being interrupted. I also had server problems and illness. I do think that 4-6 hours should ordinarily be enough time.
• Yes
• Majority of the time, sometimes technological problems created delays
• Yes, I was able to complete my assignments within the advertised timeframe. My biggest frustration comes with the requirement to respond to others' postings. Since many of my classmates don't post until the very end of the week, and I have all MY free time set aside at the start of the class week, it's frazzle making for me. I'd love it if the class "weeks" were able to overlap: if I could still "legally" respond to the previous week's postings till, say, the following Friday. Maybe we could all have to have our MAIN postings in by Tuesday evening, and have all our RESPONSES in by Friday evening?
• It is difficult some weeks to find the time to sign on as much as we are expected to. As important as this class is, sometimes there are things that come up and make it near impossible to get it done in a week.
• Yes
• Yes
• Yes.
• Yes
• Yes
• Yes.

(3) RTT Algebra: Linear Family; Linear Functions

edcentric

RTT Algebra: Linear Family

Linear Functions

44 responses - received between: 11/3/04 and 1/31/05

Consider the themes of this topic:

- **using real world models to strengthen problem solving skills;**
- **distinguishing between functions and equations;**
- **using piecewise linear functions;**
- **and interpreting slope and y-intercept in context.**

1 - Please list two aspects of these themes that are new to you.

Q1. Two New Aspects
• Distinguishing between functions and equations. Using piecewise linear functions
• 1-Usage of piecewise functions in representing real life examples 2-Symbolic approach to such problems
• Using piecewise linear functions to discover discontinuity and using the linear transformation to discover translating lines
• 1 - looking at real world models from a function perspective as opposed to an algebraic equation only. 2- the importance of using point-slope form to represent these models rather than slope-intercept
• Using piecewise linear functions, using real world models to strengthen problem solving skills
• I had not taught piecewise functions before, so everything about them was new. I gained several real-world problem ideas to use in my classroom.
• I don't deal with piecewise functions so this activity was new.
• Graphing piece wise functions
• Distinguishing between functions and equations, and interpreting slope and y-intercept in context
• 1. The difference between functions and equations. 2. Using piecewise functions
• Using real world models to strengthen problem-solving skills. Using piecewise linear functions
• All of it, including interpreting slope and y-intercept in context

Q1. Two New Aspects
• Using piecewise linear functions. Using real world models to strengthen problem solving skills
• Distinguishing between functions and equations. Using the Piecewise Linear Grapher.
• Piecewise functions with the grapher, interpreting slope. Interpreting slope and y-intercept in context, distinguishing between functions and equations.
• Using the piecewise linear function. Using real world models to strengthen problem solving skills
• Using piece wise linear functions is new for me to teach. In Texas is not a topic taught in Algebra I, but I think it will be a good extension for the honors 8th Grade Algebra. I have been aware of the on-line interactives, but have not used them do to the complications involved in getting my students to a computer.
• Distinguishing between functions and equations. Some of the extensive piecewise-linear discussion.
• Using piecewise linear functions in Algebra 1 is something I have not done before. Using these would help students that do not really understand the idea of a linear function in that they could see the difference in the graphs as the situations and equations change. Distinguishing between functions and equations is not new to me; however, I may not be making this distinction well enough with my students.
• Piecewise functions (the whole thing is new to me for Algebra I. Processes and objects are new also.
• I had never really thought about the difference between functions and equations. Also using piecewise linear functions is new to me.
• I needed not to focus so much on slope intercept form.
• 1. Distinguishing between functions and equations. 2. Using piecewise linear functions
• Distinguishing between functions and equations and using piecewise linear functions
• Using piecewise linear functions is new to me...not as a student, but as an Algebra I teacher. Also, using the PLG to visualize real-world problems is a new way to do this.
• Distinguishing between functions and equations - what is the difference. Using real world models - problems that have not just one right answer
• 1) Piecewise linear grapher. 2) Thinking about the real difference between functions and equations
• Using piecewise functions. Interpreting slope and y-intercept in context
• None of these were new to me.
• It was the first time I had used a special grapher in order to represent a complex real-life problem. It was a bit difficult to use at first, but now that I'm more comfortable with it I understand the benefits--having something that you can easily adjust to make comparisons and have students meet their misunderstandings.
• Distinguishing between functions and equations. Using piecewise linear functions
• Distinguishing between functions and equations and using piecewise linear functions
• New approach to piecewise functions and using slope and y-intercept in different context.
• Distinguishing between functions and equations and using piecewise linear functions.
• 1.I had little experience with functions before this class. I knew f(x) but had forgotten really how to interpret it. 2. Using the piecewise grapher was a new experience for me. Since I am teaching a beginning algebra class, I do not use graphing calculators because I find the students depend too much on calculators as it is - but this one has some unique characteristics that I think would be very helpful to students.
• The piecewise tool for looking at linear functions was new to me. I really enjoyed learning some technology-based tools aside from the graphing calculator. Also interpreting slope, as a function is a new concept, I had not made that connection before in my teaching.
• Drawing a distinction between functions and equations. Interactive tools provided during this part of the course.
• The interpreting slope and y-intercept as slope and point. The using of piecewise linear functions

Q1. Two New Aspects
• Using the piecewise grapher was a new topic for me as well as really defining the difference between functions and equations.
• I don't think there was anything in these topics that were brand new for me.
• The extensive emphasis on making the distinction between equations and functions was new to me. I was used to sliding pretty seamlessly between terminologies depending on what I wanted to do with a function/equation. Making the distinction clearer will help me when I have kids struggling with the different concepts. I had also gotten rusty on writing piecewise linear functions, and enjoyed revisiting them.
• Distinguishing between functions and equations using piecewise linear functions
• Distinguishing between functions and equations and using piecewise linear functions.
• Making the distinction between function and equation and using piece wise functions to teach linear functions I have not done before.

2 - List two ideas about teaching that you found useful.

Q2. Two Useful Ideas
• Reflecting on how I can formulate an understanding of distinguishing between functions and equations. Point out more of the interpretations of real world models to strengthen problem solving skills
• 1- The instruction for adapting questions for my own use was very helpful. It helps to determine the necessary aspects of the question in creating them. 2- Dr. Kaput's comments on students' perspective of slope were very helpful.
• Using the great technology tools. Sharing ideas with individuals who desire to improve upon their craft
• 1 - I liked the idea of piecewise functions and the use of technology such as the piecewise grapher. I feel the grapher is much more powerful than a graphing calculator would be in this case. 2 - Use of problems such as the cell phone as a teaching tool rather than simply a supplement to a lesson.
• Piecewise linear functions, Interactive tools
• The list of extension questions in the discussion groups was great. Discussions with others about whether or not to introduce a topic or just jump and teach a topic.
• The phone problem and using piecewise functions.
• Modeling discontinuities. Use of point-slope and slope-intercept form at appropriate places in a real world example
• Students are smart enough to figure it out on their own. Just ask a limited amount of question to lead them and ask for clarification when they think they are done.
• Using functions instead of just equations
• I like the use of the graphing interactives to help students understand functions visually. I liked the questioning techniques the teacher used in the cell problem videos to keep students on track yet not answer questions for them.
• Using real world problems, though messy, stimulate interest, mathematical thinking, and a reason to study and learn math. Technology can enhance learning--especially with those who may give up trying to evaluate and graph problems; they can make mistakes and continue without stress.
• Beginning at a large picture and teaching several concepts through this one example. Describing the various functions through the piecewise approach.
• Using real world models to strengthen problem-solving skills. Distinguishing between functions and equations.
• the grapher, open-ended problems with more than one right answer. Using the piecewise grapher makes this idea very understandable; interpreting the slope in terms of the rate of change reinforces what I already do in class
• Writing problems for students that were based on real world models. Interpreting the slope and y-intercepts within the real world models
• I like the emphasis on separation of trajectory from the function being graphed. I hadn't really pinpointed that difficulty and addressed it appropriately.
• Using the PLG and manipulating the cell phone promotions was a good way of connecting the concepts of domain, range. The discontinuities in graphs as seen on the PLG. The graphing calculator does not have the ability to have different "windows" for different graphs and so does not demonstrate the piecewise as nicely
• Found it useful to use a problem like the last one on the cell phone where the plan is not a function and let students explain why not from the difficulty encountered in having two different prices for the same minutes on the same plan. Also, making the difference clear between functions and equations is something I will use more deliberately.
• Piecewise functions now that I am more comfortable with them. Real world models in any form are always useful in teaching.

Q2. Two Useful Ideas
• Presenting real world problem to students and having them work on them in groups and introducing piecewise.
• That I really need to focus not on just slope intercept form and using the grapher to show the piecewise functions.
• How to change textbook problems into more useful problems & working with piecewise functions
• Piecewise linear grapher. Using real world problems (not so much to strengthen problem solving skills but to make connections between Real World and Math.)
• The PLG for that whole unit was useful and helpful and I will use in my class. I already use real-world models in my classroom, but I will continue to now.
• Coming up with ideas about real world problems
• 1) Dr. Kaput's commentary discussing "Math is About Something" 2) Adaptation of problems to fit our needs
• Adapting problems to meet the needs of my students as well as other criteria for open-ended ness. Evaluating students' work as basis for improving instruction
• I found the linear grapher to be useful at looking at different types of functions, and the real-world models were interesting.
• The idea that you would purposefully give the students a problem which would help them understand what equations are and which equations are Not functions.
• I think the most useful idea for me was to remember to clarify students' use of vocabulary when it is inaccurate and to use effective questioning to guide students toward answers rather than directly instruct them or even answer the questions for them before giving them the opportunity to self-discover. I also think using the interactives has been extremely valuable for me and will be great classroom tools.
• Distinguishing between functions and equations using piecewise linear functions
• The manner in which we look at the piecewise functions. Very helpful to see a new approach. Watching the way students approach a problem (without having to be the teacher) and being an objective observer helps me focus on exactly what my students need. Having a new way to look at slope and y - intercept has been very helpful to me when thinking about how to approach teaching these concepts to my students.
• Using piecewise linear functions and interpreting slope and y-intercept in context
• This lesson has made me think about how much I stress slope intercept form when the intercept isn't always useful As in the cell phone problems. I really liked the problems other students came up with. I will try to incorporate some of them next semester. The lesson also reminded me about how important it is to make sure students understand that there may be more than one right answer, you need to reread the problem and be sure your answer makes sense.
• Connecting functions and linear graphing. Using tools like the piecewise grapher.
• Helping student see the difference (and importance) between equations and functions. Using piecewise grapher to represent real world situations.
• The use of the piecewise linear The ideas about slope and y-int. The idea about change in x and y as slope not just rise over run.
• I thought the piecewise grapher was helpful and a quick way to find solutions. A great idea for a classroom. I also like the cell phone problems and the different ways to solve them. I tend to look at one way to solve and enjoyed seeing this problem solved in several different ways.
• I found it interesting that piecewise functions were introduced and used at this level. The teacher's questioning techniques were useful.
• I feel very strongly about math being "about something" in terms of student understanding and valuing concepts and connections. I thought this was expressed very clearly and convincingly in this unit. I liked also the emphasis on "discovery based" learning, where the students do most of

Q2. Two Useful Ideas
the defining and exploring themselves, with occasional redirecting and Socratic questioning by the teacher.
• The discussion on slope as a rate of change. The discussion about over learning slope-intercept form.
• The real world problems are very valuable. The idea of introducing functions before equations is very useful.
• Making the distinction between equation and function has made me more aware of different views on what happens in a function and how students view functions. Having students use piece wise functions helps them deepen their understanding if functions and function vs. equation.

3 - What areas do you feel need further clarification?

Q3. Areas Needing Clarification
• Distinguishing between functions and equations
• None
• Using the q-grapher, are there any shortcuts to changing equations other than using the slow increments of the up and down arrows?
• I feel comfortable with all the material covered and do not need any further clarification.
• None
• none
• none
• Interpreting y-intercept and its role
• How much, if any, should I be teaching in a traditional style? It seams like there are advantages to both but the class never acknowledges this.
• Using the piecewise function grapher
• I am still not sure I understand discontinuity in the cell phone problem. It takes a lot of practice to learn the graphers.
• I am still playing with the PWG to understand y-intercept and when that fits into the real world problem.
• None at this time.
• n/a
• More real world problems. Making the distinction between functions and equations. Curriculum alignment with standards
• Setting up and using the piecewise linear for the functions.
• Did you intend to use piecewise graphs in algebra I? Do other areas of the country teach that in Algebra I?
• The idea of the difference between functions as objects and procedures. Supposedly this next transformation unit is going to help clarify this
• none
• I need more work on piecewise graphs.
• I could use a better understanding between function and equation. I know what they are but I have a hard time explaining them.
• Every thing was clear to me.
• How to fit these new themes into an already overcrowded curriculum that does not allow us to deviate
• Linear transformations and relationships to functions
• I'm fine
• Nothing
• none
• None
• Nothing
• Can’t think of anything.
• For me, I am still unclear about the difference between an unknown and a variable. They seem to be the same thing to me.
• Interpreting slope and y- intercept in concept
• Exactly how the point-slope form relates when doing activities like the diamond within a diamond.
• I found it to be a very straightforward unit.
• I thought this group of lessons was pretty well clarified by the time we were done talking about them.

Q3. Areas Needing Clarification
• I would like to see more videos and have more handouts modeling how lessons might look.
• What options exist (if any) for situations where access to computers and related software is limited?
• The difference between slope and y-int and slope and point
• N/A
• None.
• None really, this was one of the better units of the course.
• Functions vs. equations. They are so similar most equations are functions, at least in the class I teach.
• none
• None

4 - Were you able to complete the three-week topic within the suggested timeframe of four to six hours per week? If not, what assignment(s) took longer than expected?

Q4. Able To Complete Within 6hrs
• Yes.
• Yes, I was able to complete the assignments within given time framework and I really enjoyed it.
• Yes, proficiency with the tools improved over time and finding a set time to work helped a great deal. If more time was spent, it was to consider what I did and why I did it in that particular manner.
• With the exception of developing my own model, all assignments were doable in the time frame allotted. I feel that, due to my current overbooked schedule I did not devote sufficient time to this problem and was not able to work through the problems posed by others.
• Yes
• For the most part yes I enjoyed the discussion groups and spent extra time there
• No. Working with the grapher took longer than expected.
• Yes
• Yes
• I think so
• I am spending a lot more time than 6 hours on this class weekly. I get overwhelmed on Wednesday's when the weekly assignment comes out. It takes me a lot of time to learn how to use the graphers even though I do go to technical help for help. I also have to do some research in math books to get background help on some of the assignments. However I do feel I am learning a lot and I love all the videos.
• Creating my own problem took longer because the textbooks we use don't have any real world problems. Unbelievable! It was therefore more difficult for me to create--too few examples in my experience from which to draw. That's a main reason why I am taking this class.
• No. The problem is not in the work but in the required contact with other students. Frankly, the work on the material is beneficial and interesting. The required contacts with other students are for the most part a waste of time. I view them as busy work and really intrude in the meaningful nature of the course. I know that the response will be that we need this interaction of ideas, however, I believe that if most participants would be candid, they would say that the mandatory three contact for two or more topics per week are really causing me to give second thoughts to course work for this program. By the way, this is not my first on line course. I have taken an entire Master level program online through a major university. Please give thought to allowing us to interact in a coffee house environment if we need to collaborate.
• For the most part. However, it is frustrating when I am not able to access the web site because of technical difficulties. (I get an error message that the page I am requesting is unavailable.) This happened to me two nights in a row, so I was not able to complete the assignment on time.
• I did not complete the assignments. I'm having difficulty committing 4-6 hours every week to these assignments.
• No, I had to get the assignment and work offline then go back online. Writing a model based on the real world situation took some time to think about what I wanted to do.
• I had some trouble doing the piecewise graphing. I am having trouble staying with the suggested time frame due to my schedule rather than yours I guess, since it seems to be ok for everyone else.
• Since I could not access the PLG for the first few days and finally got help from fellow cohorts as to how to do this. it set me back and then the logging in on three different days runs out of days. Also, I had tried to work ahead on Week 2 since I was going to be on vacation a few days and the week was not available any earlier than the Tues., or sometimes Wed. of its week
• No, it took me longer. The assignments using the piecewise grapher took longer because I had to go back and find how to save them, etc. because I had forgotten how to. Had to print stuff out, go home and read it, then try again the next day. Also, getting interruptions causes me to have to restart many times.
• Mostly. The piecewise graphs took a really long time for me since it was so unfamiliar.

Q4. Able To Complete Within 6hrs
• Yes • I had trouble with the last one in which we needed comment on other real world problems. I need a couple more days to complete that one. • Yes, just finding those 4 to 6 hours in my schedule has been hard • The diamond in a diamond and designing my own problem took longer than expected. • Yes • Yes • Yes • Yes • yes. • Yes... but at the time, when I was frustrated with the grapher, I didn't think I'd finish in that time frame. • NO!! Most weeks have been okay, but this week (Linear Transformations, Week 2) took an exceptionally long time for me. I also was slow in learning the Liner Transformer, at least to the point where I was comfortably able to complete the assignments. So maybe that is something to take into consideration - teacher-learning time for new interactives. • Yes • No problem. • I did not finish in the time allotted due a hand surgery that proved to be much more difficult than I anticipated. I will complete the final postings this weekend. Time spent on task has been about what was suggested. • Yes I did. • Yes, It is hard to find the time to log on everyday. Some days allow for much more time to sit down and write a lot while other days I log on read some responses from colleagues but then do not have time to post myself. • Yes. • Yes after I had got to the course. • yes • The time frame for this topic was fine. • yes • Yes. • yes • yes

(4) RTT Algebra: Linear Family; Linear Transformations

edcentric

RTT Algebra: Linear Family

Linear Transformations

43 responses - received between: 11/27/04 and 1/20/05

Consider the themes of this topic:

- **using transformations to make connections between symbolic and graphic representations of functions;**
- **using translation and reflection of a linear function about an axis as a strategy to aid in the understanding of slope and axis-intercept;**
- **and using point-slope format form as a tool to increase student understanding.**

1 - Please list two aspects of these themes that are new to you.

Q1. Two New Aspects
• The whole idea of using transformations to represent a change and how we would use translation to understand slope and intercept of a line
• I had looked at transformations as another process and had not really made the connection between graphic and symbolic representation of functions. I had used the students understanding of slope and y-intercept to interpret and understand functions but I had not turned that around to use translation and reflection of a linear function about an axis as a strategy to aid in the understanding of slope and axis-intercept.
• Using transformations to identify the nature of m and b in the slope-intercept form of a linear equation. The value of the point-slope form as a format for translation of a linear equation.
• 1. - Using transformations on linear equations in the manner described was new for me 2. - Looking at transformations in terms of point-slope form. While it makes perfect sense, it is not something that is addressed in the resources I normally use.
• Using transformations to make connections and using point-slope extensively are somewhat new strategies to me.
• The importance of point-slope form and the way you can use that to make the transformations easier for students.
• I have used point-slope format, but not really to increase understanding. I always thought the

Q1. Two New Aspects
students could see more using the slope-intercept form. I have only used translations to help students discover the influence of a change in the slope. I'd like to try working from the graph of an object like the starburst. It is a new approach for me.
• Using transformations to make connections between symbolic and graphic representations of functions and using translation and reflection of a linear function about an axis as a strategy to aid in the understanding of slope and axis-intercept
• None of these things were new to me.
• The idea of transforming a line as opposed to transforming a geometric figure Equations as a particular point on functions
• 1. The usefulness of transformations in helping students to get a deeper understanding of graphs and equations. 2. Using pt-slope form to make activities easier to understand.
• The use of point slope format, translations
• 1. Using point-slope to increase understanding of transformations. 2. Using reflections to increase understanding of slope and intercepts.
• Using technology to graph Using point-slope format
• Translating linear functions rather than quadratics!
• Definitely using point slope as a tool and using the transformations. I had never done that before.
• Most of this was not really new, but I did not ever realize how useful the point-slope form was, especially to translations
• 1. I have never taught translation of linear functions before. We have traditionally worked on translation of quadratics. 2. The connection between translation and reflection and slope and intercepts was new to me
• Linear transformation point-slope format
• Teachers need to verify student understanding of vocabulary (slope, y intercept, constant, function, equation, etc.) and provide students with practice and discussion so they can clarify misunderstandings. By translating and reflecting the graph of a line using visual, tabular, and symbolic representations, students may obtain a deeper understanding of the concepts.
• The use of translations to make connections between symbolic and graphic representations. The use of translations and reflections to aide in the understanding of slope and intercepts.
• None of this is new to me. What IS new, is the idea of using much of it with beginning algebra students. I enjoyed finding a new understanding of the value of point-slope form in terms of showing lateral shift in transformations. I'd used that in describing lateral shift in QUADRATIC functions, but had missed the connection with linear functions. I'd only used point-slope as an entry point for getting to the "real meat" of writing a function in slope intercept or standard form.
• I have never done translations or reflections (that I remember anyway). Looking at a function, equation, tiles and an evaluation at the same time.
• Making strong connections between symbolic and graphic representations has been lacking for me prior to this class. Using translation etc with linear graphing is also new to me.
• Using transformations to make connections between symbolic and graphic representations of functions. Using point - slope format as a tool to increase student learning.
• Actually transforming a line, not a parabola.
• 1-comparing functions vs. equations 2-the ease of using point-slope form in certain situations
• Using translation and reflection of a linear function about an axis as a strategy to aid in the understanding of slope and axis-intercept
• 1) Using point slope to translate a line 2) what each step represents when solving an equation
• 1. Using point-slope to transform a line

Q1. Two New Aspects
2. Working with a family of functions rather than an individual function
• Function analyzer and area models
• Point-slope was a huge new issue as was translation within the context of lines.
• Most was new to me, especially using the point-slope form
• Using transformations to make connections between symbolic and graphic representations was new to me, as was using point-slope format
• I have used translation extensively in teaching slope and y-intercept but had not previously used reflection. I have also used point-slope quite a bit, but not in conjunction with something like the starburst problem. The only thing really new is to use the starburst and move it to another point not on the origin or on the y-axis.
• using transformations to make connections between symbolic and graphic representations of functions; using translation and reflection of a linear function about an axis as a strategy to aid in the understanding of slope and axis-intercept;
• We do not use the point slope form in the same way, we take a point and the slope and plug them into the slope intercept formula and find the y intercept, then rewrite in slope intercept form
• Point-slope format, and using translation and reflection to understand slope
• I haven't used point slope form very much. I discovered how much easier it would be to translate lines using the form.
• Using more of the point slope formula to complete the problems. Moving the center point of the starburst successfully.
• The graphing tools were new to me and very useful. The importance of using point slope format to help with student understanding.
• All of them.
• Using transformations - translations and reflections - to aid in understanding slope and y-intercept

2 - List two ideas about teaching that you found useful.

Q2. Two Useful Ideas
• The use of point slope instead of slope intercept. The understanding of why we used slope intercept instead of point-slope.
• Using point slope to graph a line. Using the function analyzer to help develop and understand the big ideas.
• Allow students to play with the software in order to give them a sense of comfort with it. Integration of technology and curriculum was expanded.
• 1 - Using the starburst challenge to stress the relationship between graphical representations and transformations of linear equations 2 - looking at the difference between functions and equations
• I liked the starburst worksheets to help students see the relationships between lines and slope. I liked the Linear Transformer software for it's area models of slope and intercept and connections between the graphic and symbolic representations.
• To make sure to use the point-slope form as much as slope-intercept form.
• I like using the interactives after students do an assignment with pencil and paper. They can verify their work and extend it with the interactive.
• I really like the Idea of using the transformations to discover relationships between slopes and intercepts and I totally agree that point-slope is a very important tool that students need in their toolbox.
• Remembering that all forms of linear equations are important and that students need to be able to work with all of them equally.
• Including the transformation of lines Graphing the solution of an equation on graph of a function
• Learning that students might understand a concept but be lacking the articulation skills to communicate that they do. The teacher can give the answer or a formulaic way to solve the problem. As long as the teacher does it right and doesn't do it often.
• Using point slope more, and the technology
• 1. The starburst problem as a way to deepen understanding about slopes and intercepts. 2. The confusion that students may have about variables and unknowns and how they come to be confused.
• Instant clarification on concepts by using technology to graph Sliding up and down and sliding back and forth
• Having students tackle the problems without being given the functions... having to make their own functions, translate them and then look for patterns to translate them again.
• Seeing the teachers in the videos is great. It gives an idea of how the lesson is to be presented and how to handle the student activity. Having the students put their findings on the board really was helpful.
• I would like to mimic the teacher's questioning strategies. Also using dynamic software would be great.
• 1. Exploring all 3 representations for any topic in algebra. 2. Looking for the real-world connections.
• Point-slope needs to be addressed in Algebra 1
• 1 verifying student understanding of vocabulary and clarifying student understanding of concepts; 2 provide students with families of functions to graph, connecting tables of real world data with both forms of linear functions (slope intercept and point slope form). Students must understand the meaning of these forms--the rate of change--instead of a trick ("rise over run"). Even students in middle school need to discuss the relationships among tables, graphs, and equations so they will understand functions later in high school.
• As stated above, using translation and reflections to aide in understanding. Using these tools to allow students to see functions and their graphs differently and more completely is the major idea I got from this section.

Q2. Two Useful Ideas
• Hmmm... Not so sure here. We had some valuable discussions about how the teacher in the video force-fed the concept of point-slope, and through that GOT to some good ideas about teaching, but they were not explicitly introduced in the course itself. Seeing the teacher really blunder in his leading the students to discover how to describe a lateral shift drove home the importance of planning CAREFULLY the discovery experiences you'd like kids to have, and imagining the leading questions I MIGHT need to have ready if kids aren't making the connections I'd like. This segment was far LESS useful to me than the others. The lack of connection to math being about real world THINGS made this much more abstract and "nerdy" than the way I like to teach my classes. I ALWAYS need students to be able to make immediate links between what they are doing, and some sort of real-world situation, and to be able to see how they might apply their math knowledge outside the classroom. Your resident video expert routinely mentions the need for math to be "about things" but in this unit, that concept was completely dropped.
• The linear transformer has already made an appearance in my classroom. I used it to show the slope and the y-intercept work in a function. The idea of using the point slope form of an equation to move a starburst around was a breakthrough for me.
• Using translation etc. with linear graphing was new. I will use that this year and seeing the connections between symbolic and graphic representations.
• I now have a better understanding of functions and can teach them to my students in more depth. I plan to use the Linear Transformer, Function Analyzer and student worksheet in my classes.
• I enjoyed the starburst problem and moving it not only horizontally, but horizontally and vertically.
• 1-refreshing my memory on point-slope form, which I haven't used in a while 2-discussion about constants vs. variables in a linear function
• Starburst problem - with adaptations
• 1) Having students graph each steps solution 2) providing students with more wait time to allow them to process without giving too great of a hint
• 1. Do not focus on rote memorization of formulas. 2. Let students discover on their own and question along the way. 3. The video showing how point-slope works in transformations. 4. Using the interactives to work through each problem and taking notes on my experiences.
• Linear transformations that have not been much emphasized in our curriculum
• I liked the starburst activity and I like the big concept from Dr. Kaput about what the students infer about variable and constant and what it really means. His story about his daughter playing the game, but not knowing what the "little x's and y's" were very enlightening.
• Using translation to understand the reflection of linear functions
• I thought it was useful to learn the function analyzer and other technology. I hope to include them in my own teaching. I also found it helpful to make connections between the graphic and symbolic representations of functions.
• I found the different ways of thinking about how to change the equations when the starburst changed to a new point interesting. Also, the use of the Graphing tool rather than just the paper and pencil activity will be very useful. That point slope should be emphasized more and the other thing I think would help my students is the use of the graphers to reinforce or clarify their understanding after using the graphing calculator.
• Again, I found the strategies of using geometry concepts to aid in slope useful. I also liked the computer program and thought it could be very useful.
• Using the point slope form the starburst problem
• Making the symbolic to graphic transformation
• The slope-point form
• Using the point slope formula to help them. Using the interactives to help do the problems because you can see right away if you are correct.
• Clarifying algebraic language. I knew that using correct mathematical terms was important but did not realize how students might confuse constant, variable and unknown. The different definitions of the equals sign were new to me.

Q2. Two Useful Ideas
The use of the graphing tools. I would like to use these or something like them with my students.
• The use of point-slope and ways to look at transformations.
• The importance of point-slope form. Using the interactives to experiment with transformations.

3 - What areas do you feel need further clarification?

Q3. Areas Needing Clarification
• I am not sure I am confident enough to use point-slope yet. I will have to work on it
• All in all everything is clear.
• Videos used show students in small groups with a teacher who can be "on the scene" a great deal of the time. This is not the way it is in the "real-world classroom." How do we know that the all of the students are learning what we want them to?
• None, I felt comfortable with all the material presented in this unit.
• Would like more teaching on the point-slope concept when using it to get the equation of a transformed line.
• All was good.
• I thought the second starburst video was not extensive enough to really show learning on the part of the students.
• None
• Nothing
• None at this time
• Should I teach transformations even though it isn't in my curriculum or standards?
• None
• 1. Knowing how to explain a translation of a linear function - one that has both a horizontal and vertical component - when graphically it looks like either a simple vertical or horizontal translation.
• More application to the use of point-slope format; how, why, when?
• I could spend more time on the topic to get a deeper understanding of it, before trying it out on my students
• I got more from the starburst than the diamond. At first I really didn't know what I was looking for. Probably if I went back and did it again.
• How to get the student to understand and use point-slope
• None
• Clearer objectives, I am not sure what I need to be getting out of this lesson
• No, these weeks helped me learn what I can include in my general math classes to advance their concepts of rate of change.
• None
• How we can connect translation of functions to real-world situations so students have a context into which to fit their new understandings. I can do this on my own, but what about all my classmates?
• We are all still struggling with the difference between a function and an equation, but it seems within my grasp.
• ?
• I am feeling pretty confident now with my knowledge of functions. This class has already clarified and challenged me to further understand functions
• Transitioning from point-slope to slope intercept. More time to think this unit through. One week was not long enough to process the learning.
• None
• Nothing

Q3. Areas Needing Clarification
• None • None. • None • Point-slope format for translation is still going to need more practice so that I feel comfortable explaining to students. • How to put equations into the line transformation. • I don't think I need any further clarification. • It was pretty clear. I am still not sure why it is Dr. K feels that slope - intercept is overemphasized. • I think that some clarification on how to explain the concept through the computer program would be useful. • None • Using point-slope • I need to work with the point-slope form more. • Nothing I can think of. • None • This section was pretty clear to me. I realized how much point-slope could really be used, when I hadn't thought of it that way before. • None

4 - Were you able to complete the three-week topic within the suggested timeframe of four to six hours per week? If not, what assignment(s) took longer than expected?

Q4. Able to Complete Within 6hrs
• Once I completed the other things I had going on I was able to complete the assignments.
• YES
• Yes.
• Yes, although I find that it takes at least an extra 30 - 60 min each time I log on just to wade through all of the responses that have been posted.
• Yes, the hours are not a problem. What continues to be difficult for me is logging on three different days. I also have to plan ahead whenever there are videos or interactive programs because my home computer doesn't have the memory to do these and at my school I have to move to a room that has a high end computer.
• The time was enough but it was just getting difficult to complete around the holiday schedule.
• The time frame recommended is appropriate for the assignments given.
• Once I got my computer fixed I was able to complete them in the suggested time frame.
• I think that the function analyzer was difficult to work with and took more time than the other things. Also, it seems that they consensus is that it was confusing for a lot of people.
• Yes, I have completed all assignments on time and I think I had adequate time frame.
• yes
• yes
• yes
• Yes.
• Pretty much--the diamond within a diamond took me quite a while.
• Yes
• It was just hard with the holidays coming up and I personally had the flu
• Yes
• I was able to complete it in the time allotted
• I spent some time working with ideas peers presented to help myself understand more.
• Yes
• It took longer just because I wasn't very excited or interesting. Doing the activities and the required postings often felt like drudgery. Responding to other classmates was still interesting...
• NO, Learning to use the function analyzer took a long time. Thinking about what we were doing took even longer. This was one of the densest lessons I have ever done in any course. I am still thinking about it.
• Yes
• Week one took longer than the 4 to 6 hours. I sometimes get overwhelmed when the new module opens. Weeks 2 and 3 were very manageable
• Watching the videos took forever to do, especially when combined with activities. The videos take forever to load and then I only get pieces at a time. It took over 30 minutes to watch a video that was listed as 3.5 minutes long. This unit was the first time I had difficulty completing it in less than 5 hours. I spent almost 15 on week two and still have not completed week 3 because of time constraints. This unit would be better if it was 4 for 5 weeks long.
• Yes
• Yes
• I had difficulty receiving the video clips...time would continue to count while the video stood still
• Yes.
• yes

Q4. Able to Complete Within 6hrs
• Yes...it has all become so much easier to fit in and complete. The hardest part is when you really have nothing to say, but you are required to say something for your assignment. I try to think out of the box, but sometimes you just want to say "yes...I agree" and be done :)
• Using the line transformation and responding to others
• I was able to complete in that time allotment.
• It wasn't that the assignment took longer, it was problems like server downtime, a professional development absence for 5 days out of 10 and then the catch up time required to do regular schoolwork cut down on the chances I had to work on the program.
• yes, I was able to complete the assignments in time.
• yes
• yes
• Yes
• Yes.
• Yes
• Yes
• yes

(5) RTT Algebra: Linear Family; Linear Equations

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RTT Algebra: Linear Family

Linear Equations

40 responses - received between: 12/18/04 and 1/23/05

Consider the themes of this topic:

- **the role of letters in algebra;**
- **the meaning of the equals sign; and**
- **approaching linear equations from the perspective of linear functions.**

1 - Please list two aspects of these themes that are new to you.

Q1. Two New Aspects of Topic Themes
• The role of letters in algebra, the meaning of the equals sign
• Not necessarily "new" but it was a different perspective of looking at the differences between equations and functions and approaching them from a different way. It was also new to look at the meaning of the equal sign in algebra.
• 1. Interpreting the differences in use of letters to represent variables vs. unknowns. 2. Using the underlying function in setting up and solving word problems that one normally thinks of in terms of linear equations.
• 1. Being specific with vocabulary (variable, unknown) 2. Functions/equations--a function is an equation with a particular value
• The dual meanings of words and symbols in mathematics and the idea of approaching linear equations from the perspective of linear functions.
• 1. The difficulties students may experience in interpreting the equals signs under different circumstances 2. Letters as variable when evaluating functions but unknown when solving for x given a function value
• A new way to look at balancing the equal sign; interchanging linear equations and linear functions terminology and concepts

Q1. Two New Aspects of Topic Themes
• The themes in this section were not new, however they definitely gave me a stronger understanding and deeper view of these concepts. In the first two themes, roles of letters in algebra and the meaning of equal signs, I learned some new ways to help my students gain a deeper understanding of these two concepts.
• Distinction between variable and unknown
• I had not considered how in a linear function, the X and Y have a very different meaning from the M and the B. (or the A, B and C in standard form) My students have never had a problem with this, but now I feel more prepared for the moment when someone DOES. That said, I found this section the least interesting of the course.
• The meaning of the equal sign and using linear equations from the perspective of linear functions.
• Approaching linear equations from the perspective of linear functions
• Approaching linear equations from the perspective of linear functions and the meaning of the equal sign
• 1. Differentiating among meanings of equals signs 2. Thinking in any depth about functions and related linear equations (although my students have used related functions to solve linear equations with the graphing calculator, I did not really get into why it works much.)
• That the equals sign represents a relationship between two things not just an answer and showing that it is a statement of equivalence for each side of an equation.
• The many ways to interpret both letters and the equals sign were two new ideas for me. When I read the different roles, most made sense and thus I understood how they changed jobs for various situations, but obviously I can't assume the students recognize this.
• Variables vs. Unknown confusion Distinction between functions and equations
• The concept of the multiple meanings of the equal sign and also looking at equations as functions.
• Different meanings for the equals sign functions vs. equations (defined)
• The meaning of the = sign approaching linear equations from the perspective of linear functions
• In the role of letters in algebra, the idea of unknowns vs. variables was a new way of thinking about things for me. As the meaning of the equals sign, I had never thought about it having different meanings in different situations. I am still not sure that I agree that it has different meanings, but I am thinking about it.
• 1. How a letters usage in algebra can be confused with being an unknown or an object 2. That each step in solving a linear equation represents an equivalent function
• 1. The meaning of the equals sign; and 2. Approaching linear equations from the perspective of linear functions.
• Letters representing variables is not new, however, I had not previously thought about students thinking about the y-intercept as never changing because they called it a constant. Another aspect I had not thought about before is an emphasis on the difference between linear equations and linear functions. I have my students use the function to answer a linear equation without really making certain they see the connections.
• I never really thought about vocabulary as we have in this study. I have not explored much with my classes the differences in the meanings of equal signs or the differences in functions and equations.
• The difference between an unknown and a variable the meaning of the equals sign
• The thought that traditionally when we are solving linear equations we are in fact actually finding all possible ordered pairs that solve linear functions.
• Variables versus unknowns the meaning of the equal sign

Q1. Two New Aspects of Topic Themes
• The meaning of the equals sign and approaching linear equations from the perspective of linear functions
• 1) Variable vs. unknown. 2) Actual definitions of the equal sign
• I really don't know. It has been too long.
• Linear equations as functions use of point=slope form
• The different meanings of equal. The function approach.
• How students view letters as variable vs. constant. Using linear equations to evaluate and analyze linear functions
• Approaching linear equations from the perspective of linear functions
• The difference between variables and unknowns; solving equations like 3x+5 = 4x-2 by graphing the lines y=3x+5 and y=4x-2
• The meaning of the equal sign and functions vs. equations.
• The different roles of letters and the different meanings of the equals sign.
• Thinking about the equals sign in a new way was useful. Linear functions were really completely new to me. I know I had this in HS and college, but that has been so long ago it was like I never learned it.
• The meaning of the equal signs and the role of letters in algebra.

2 - List two ideas about teaching that you found useful.

Q2. Two Useful Ideas
• To make learning the center of the classroom
• Looking at the terminology of math again and how to be more accurate in defining terms, and looking at the function role and describing situations with functions vs. equations.
• 1. Broadening the interpretation of word problems to introduce/reinforce the concept of linear functions. 2. Approaching word problems from a more graphic perspective, allowing students to use pictures, diagrams, and graphs to help them determine the appropriate function/equation to use.
• 1. Introduce functions with equations to bring the beauty of math as a language explaining similar or different sets of data. 2. Bring the "big idea" of functions and graphing earlier in the curriculum while finding patterns of data, graphing the data, interpreting the data, explaining the data in numerical, verbal, symbolic, graphic form --if possible with the interactive graphing tools. To understand math and make sense of it, students need real world problems that bring the concepts out through student solutions that incorporate all representations (verbal, tabular, symbolic, graphic). Students need guidance in moving between the representations so they understand them.
• (1) By approaching linear equations as functions students can get a "bigger picture" of the mathematics involved rather than learning a set of isolated skills. (2) Students come to us with different mindsets regarding the terminology and symbolism of mathematics. In my classroom I need to open them up to the ideas of multiple meanings, just like they will experience in language.
• 1. Adapting simple problems to meet specific students' learning needs. 2. Using non-conventional problem (like the elevators problems) to emphasize reasoning with graphs as a valid algebraic activity.
• Expanding the questions to include open ended questions; finding questioning techniques to enhance student learning
• Getting students to view an equation and function in multiple formats and multiple uses. And ways for teaching the concept of relationships and in equations beyond just solve and check.
• Making the connections between equations and functions
• Frankly, I was a bit bored here. But as usual, I think one of the most useful teaching ideas is having students explain to each other and to me, what THEY see as the meaning of the equals sign, and the variables and constants, and then experimenting, and then refining their concept definitions. I enjoyed reading others' activities and interpretations, but I did not find this unit as interesting as the other ones. There was far less emphasis on the math being ABOUT something, which was a big focus earlier in the course, and a mantra of mine.
• The way people explained their process of solving equations was helpful. I like the idea of dividing the equation at the equal sign so there is a visual for students to see the center of the balance.
• What does the equal sign mean. Using the function analyzer.
• How to explain the role of the letters and the equal sign.
• 1. I like the idea of working further with clearing up the concept of linear equations vs. functions and how they relate. 2. I think that the interactives will be useful in helping with the above concept.
• That I as a teacher can make and learn from the same mistakes that my students do and that through those mistakes, I can learn to teach in a way that the students will understand since I had the same difficult time that they did.
• Variables, unknowns, and constants...I will make sure to use these terms carefully in my classroom.
• Using a dynamic model to include word problems that are related to real world Making the connection: the graphical representation of linear functions while solving word problems
• I need to focus on looking at equations as functions and how students looking at the terms variables and unknowns and other terms like that.

Q2. Two Useful Ideas
• I loved the interactives and being able to try using them with my classes. Having to adjust a problem out of the textbook and make it apply more to the format/concepts we were learning about was educational for me.
• I now look at regular problems involving linear equations and know I can extend them to apply linear functions to help my students have more experience and understanding of functions. Linear equations gave me the opportunity to explore further the function analyzer along with the other interactives. When I created my 2 problems during week 3 of linear equations, I experimented with each interactive to see what would work better to graph my problems. I decided on the function analyzer.
• The "aha" about students perceptions or lack thereof between unknowns and variables. I have been teaching linear equations from the standpoint of their related functions for several years. I felt validated in my approach by the inclusion of this theme in the course.
• 1. Allowing technology to show equality 2. The use of point slope form to promote translation of lines
• I enjoyed the connection of problems to real world aspects. I also thought that the meaning of the equals sign was an interesting topic that doesn't typically get introduced or covered the way that this class did.
• 1. Making certain students have the understanding needed to explore a topic more in depth and 2. Rather than just substituting a value in for linear equation, to have the students use the graph to find this value.
• Really exploring vocabulary and beginning the study with functions instead of equations
• Understanding the difference between an unknown and a variable learning the different interpretations of the equals sign, especially as a statement of computation and a statement of equivalence (used to solve equations)
• Being clear on the use of vocabulary in distinguishing between equations and functions
• Distinguishing between equations and functions Ways to solve equations
• I have found everything in this course to be very useful
• 1) adoption of word problems 2) defining the different meanings of the equals sign to my students
• Same as above.
• Understanding student thinking and then teaching accordingly. Discussing the various meanings of the equal to sign and balancing equations
• The ways that questions are asked and the types of problems used.
• Using tables more.
• Vocabulary of using equations and functions
• Visualizing the piecewise linear graphs Using the area model to solve the equations
• The various roles of letters in algebra, I knew that most of these ways were out there I just didn't ever classify them the way the lesson did. Reading through the dialogue in the classroom helped me "listen" to the students to see what they are really saying.
• Realizing how he students viewed the role of letters and the equals sign.
• The graphers were extremely interesting and useful. The piecewise grapher, allowing me to use the slider to find answers was great. The linear transformer and the pushpin was the other great tool. I plan to use both of these tools in my algebra class.
• The meaning of the equal signs and the role of letters in algebra.

3 - What areas do you feel need further clarification?

Q3. Areas Needing Clarification
• How to deal with standards that include things that waste time and don't include helpful conceptual standards
• Nothing
• The discussion of function vs. equation was a lively one. I'm not sure that the distinction was ever fully clear to all participants. I think I understand it better now, though, than I did.
• I think I have a much clearer understanding of slope, function, and graphing now than before I started.
• If I were to teach linear equations from the perspective of linear functions, what prior knowledge should students have? Should I continue to introduce the concept of functions as "a set of ordered pairs where no two elements have the same first coordinates?" How can effectively take the approach offered in class if my students do not have daily access graphing calculators or to the interactive tools offered by this course?
• None
• Finding applications for equations and functions, my book is not very helpful
• This section I felt was pretty good. It was work, but very important to be able to apply what we have learned into our own curriculum and textbook.
• How to adapt this new information to my curriculum
• Why the writers of the course found this topic so valuable. It seemed the least related to the key concepts outlined in the course.
• ? It made sense to me.
• None
• Some of the explanations assume you prior knowledge and if you don't the understanding is difficult.
• I'm not sure I understand why it is important to differentiate among the various meanings of equal signs.
• None
• I still have a hard time knowing when to use the term function and when to use the term equation.
• None
• None
• I still am unclear about the differences between meanings for the equals sign. It seems there are similarities between the definitions we received - so much so that I hope I can make them clear to my classes.
• I think participants should do their assignments early in the week to allow the rest of the class time to respond to their contributions.
• As I mentioned in #1, I am not convinced that the equal sign means different things in different situations. If it is the intent of the course to suggest that it does, this idea definitely needs further clarification.
• I don't think I need clarification, I think I need more practice so that I will feel comfortable relaying that information to my students
• N/A
• I thought all areas were pretty straightforward in this unit.
• I can not think of anything
• The difference between equations and functions and how to approach linear equations from the perspective of linear functions with students
• More, more, more---some of the ideas presented are just beginning to sink it
• Everything was clear.
• Nothing
• None

Q3. Areas Needing Clarification
• I would like more clarification on all aspects of "did I do this correct?" In other words, once a problem or an activity is presented, maybe let us view the "answers" to see what we did right or wrong.
• None
• I don't really think there is one at this point.
• None
• None
• Transformations of linear equations graphically
• Functions and equations are still a bit fuzzy. I see them as nearly the same just a different way or writing an equation.
• None
• This lesson just needed some thinking time. I did not find things to need further clarification after using all the tools available.
• Linear equations and linear functions and what the difference is.

4 - Were you able to complete the three-week topic within the suggested timeframe of four to six hours per week? If not, what assignment(s) took longer than expected?

Q4. Able to Complete Assignments Within 6hrs. ?
• Yes
• The problems that we needed to create I think needed more time. I felt I had to rush to come up with a problem that was useful. I think that this module may have needed more time in order to come up with a more quality product.
• The time frame seemed pretty reasonable, although finding problems to adapt took a little time.
• Yes.
• Yes.
• Yes
• Yes
• Yes.
• Yes
• I got bogged down mostly because I wasn't very interested, and my school duties got busy. I think if I'd just sat down and done the work, I would have done it well within the suggested timeframe.
• Yes. It probably took me about 4 hours.
• Yes
• yes, but links to the curriculum took some time to find examples to use.
• Yes the time frame was ok.
• Yes
• Yes...time has not been a problem since the first section.
• Yes
• Yes, the time would have been ok but I just ran out of time due to the holidays and going out of town.
• Having to adapt a problem and then also solve two of my colleagues' problems was too much, I think. It took me quite a bit of time to come up with my own problems and then solve others'.
• Yes, however the most time consuming was developing problems from my curriculum to extend to include functions. We were given great examples so it was not too hard just time consuming to get them just right and make sure they worked. I liked that we had to include the solution.
• The assignments in week 1 took longer to comeplete. Perhaps those challenges should be spread over two weeks.
• Yes, enough time was allotted
• Yes.
• Yes. It was just hard to find the time on separate days to do the assignments when things happen, like server problems, illness, family illness, etc.
• I had problems making time with everything going on at school during final week
• No because the first topic was not posted in a timely manner, and there was miscommunication as to when the assignments were supposed to be completed. Luckily the facilitator was flexible.
• Yes
• Yes
• I was not able to complete these but it was due to personal problems on my end
• For the most part, yes. I did take longer than 4-6 hours for the week because of the word problems involving the elevators. Also, the one of the problems that I chose to adapt took longer to do than I anticipated.
• Yes.
• Yes

Q4. Able to Complete Assignments Within 6hrs. ?
• Yes • I had personal and work concerns that put me behind, otherwise I would not have any troubles with the time line. • Yes • Did finish it in the time and thought that I also did this survey at that time??? • Yes. • Yes • It took me longer to learn how to use the graphers. Otherwise the class went according to schedule. • Yes.

(6) RTT Algebra: Linear Family; End of Course Review

RTT Algebra: Linear Family

End of Course Review - Online Survey Results

41 responses - received between: 12/28/04 and 1/31/05

1 - Please provide your opinion about each of the following statements.

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Students learn mathematics best in classes with students of similar abilities.	1 2%	22 54%	2 5%	15 37%	1 2%
The testing program in my state/district dictates what mathematics content I teach.	0	8 20%	0	18 44%	15 36%
I enjoy teaching mathematics.	0	0	0	9 22%	32 78%
I consider myself a “master" mathematics teacher.	2 5%	9 22%	6 15%	19 46%	5 12%
I have time during the regular school week to work with my colleagues on mathematics curriculum and teaching.	1 2%	16 40%	1 2%	19 46%	4 10%
Mathematics teachers in this school regularly observe each other teaching classes as part of sharing and improving instructional strategies.	14 34%	22 54%	2 5%	2 5%	1 2%
Most mathematics teachers in this school contribute actively to making decisions about the mathematics curriculum.	4 10%	11 27%	3 7%	18 44%	5 12%

2 - Think about your mathematics class this school year. How much emphasis does each of the following student objectives receive at this point in time?

	None	Minimal Emphasis	Moderate Emphasis	Heavy Emphasis
Increase students' interest in mathematics.	1 2%	11 22%	22 54%	7 17%
Learn mathematical concepts.	0	1 2%	7 17%	33 81%
Learn mathematical algorithms/procedures.	0	3 7%	20 49%	18 44%
Develop students' computational skills.	2 5%	15 36%	13 32%	11 27%
. Learn how to solve problems.	0	1 2%	12 29%	28 68%
Learn how to reason mathematically.	0	3 7%	16 40%	22 54%
Learn how mathematics ideas connect with one another.	0	4 10%	24 59%	13 32%
Prepare for further study in mathematics.	0	2 5%	24 59%	15 38%
Understand the logical structure of mathematics.	1 2%	8 20%	25 61%	7 17%
Learn about the history and nature of mathematics.	14 35%	24 58%	3 7%	0
Learn to explain ideas in mathematics effectively.	0	12 29%	18 44%	11 27%
Learn how to apply mathematics in business and industry.	7 17%	20 49%	12 29%	2 5%
Learn to perform computations with speed and accuracy.	7 17%	18 44%	13 32%	3 7%
Prepare for standardized tests.	0	5 12%	16 40%	20 49%

3 - About how often do you do each of the following in your mathematics instruction at this point in time?

	Never	Rarely (e.g., a few times a year)	Sometimes (e.g., once to twice a month)	Often (e.g., once to twice a week)	All or almost all mathematics lessons
Introduce content through formal presentations.	0	4 10%	2 5%	23 56%	12 29%
Pose open-ended questions.	0	3 7%	8 20%	17 41%	13 32%
Engage the whole class in discussions.	0	1 2%	6 15%	15 37%	19 46%

Require students to explain their reasoning when giving an answer.	0	1 2%	6 15%	16 40%	18 44%
Ask students to explain concepts to one another.	0	1 2%	15 37%	17 41%	8 20%
Ask students to consider alternative methods for solution.	0	0	9 22%	23 56%	9 22%
Ask students to use multiple representations (e.g., numeric, graphic, geometric, etc.).	0	0	13 32%	20 49%	8 20%
Allow students to work at their own pace.	0	9 22%	20 49%	9 22%	3 7%
Help students see connections between mathematics and other disciplines.	0	6 15%	17 41%	18 44%	0
Read and comment on the reflections students have written (e.g., in their journals).	11 27%	12 29%	13 32%	3 7%	2 5%

4 - Are you aware that Texas Instruments recently introduced freely downloadable software application packages for the TI-83 and higher model calculators call TRANSFRM and GEOMASTR? (They allow the user to "grab" and move the graph as the symbolic form changes accordingly.)

Choice	Count	Percentage
Yes	7	17%
No	34	83%

5a - Have you used the TRANSFRM or GEOMASTR software on TI calculators in your algebra classroom?

Choice	Count	Percentage
Yes	1	2%
No	40	98%

5b - If yes, describe briefly how you have used them.

- We use it to look at and study transformations.

6 - How difficult/easy was it for you to navigate around the course?

Very difficult 1	2	3	Very easy 4
1	2	21	17

7 - How valuable was the introductory 'Ready for Algebra' unit in helping you understand the structure of the topics in the overall Ready to Teach Algebra: Linear Family course?

Not at all valuable 1	2	3	Very valuable 4
1	1	22	17

8 - Were the topic objectives clear to you?

Not at all clear 1	2	3	Very clear 4
0	4	11	26

9 - What suggestions do you have for improving the course structure? Please be as specific as possible and provide examples when you can.

Q9. Suggestions: To Improve Course Structure
• At the beginning of the course be sure to tell participants that they must post 3 days a week. When students have an unresolved questions not answered by other participants, facilitator should answer the question.
• The parts of the course I found most valuable were those that made math and specifically the use of functions meaningful in a real life way. As your expert is quoted "Math should be ABOUT something." I was alternately frustrated and bored with the various assignments that strayed from that pronouncement, such as the starburst and diamond activity. I kept putting myself in the students' shoes and thinking "So what?" I would also like to see the weekly assignments have a day or two of "overlap" (perhaps requiring the initial postings during the first week, but allowing the "response" postings to go into the next week...) so that I would feel less stressed about making my deadlines. I liked to do the assignments early in the week, just because that was where my schedule was loosest, but I couldn't complete everything, since there were no other postings to which I could respond. If I had been able to continue responding into the next week, I would have been that much more active in the course. I'd also like to see more class videos and discussions around those. While we didn't always stick to the assigned topical questions, I thought our dialogue around the teaching and learning we saw was the richest in the course.
• Although it may have been technical issues on my side, I found that I could not open multiple windows during a session, as was often suggested. Otherwise, I felt that the structure and progression of topics in the course were very well defined and logically sequenced.
• For full time teachers, the time constraints were difficult. Logging in on three different days was hard.
• Having the lessons more clear in what the purpose was. Some lessons I wasn't sure what I needed to get from it.
• The online interactives were somewhat difficult for me. A step-by-step example would be helpful. Since most of us had different levels of algebra knowledge.
• This is the one section I disliked. The course goals weren't part of this section...we just dove in to this math problem out of the blue. Also, this was the hardest section to get done in time. I think that Linear Functions should have come first or Ready for Algebra shouldn't include the "Great Misunderstanding". I don't know how else to arrange it...but it just felt out of the blue...I had a hard time telling people what the purpose of the class was, etc.
• None; the readings, activities, discussions are all relevant and adequate for learning.
• Somehow getting the menu list on the left to display completely, it was 3/4 of the way through the course before I realized that there was a Roster icon, or a syllabus icon
• None. Good as is.
• I think that the course structure was excellent
• I think that it was great.
• None
• At the very beginning of the course - the initial log-on instructions were a little confusing.
• it was a little bit unclear where to start from. so i think it would be helpful if there was some guidance in initiating the course requirements. For those like me who used RTT for the first time, they may get lost at the beginning. Directions like "click on this menu and follow such

Q9. Suggestions: To Improve Course Structure

and such directions" might help.

- I took this course over two semesters, but the work required of me each of those semesters was as different as night and day.
  In the spring of 2004 I simply created an Excel spreadsheet with my students' ID codes and sent that in. In the fall of 2004 the actual course work was completed. I received half of the stipend after the first semester and expect the second half soon after the completion of this course.
  I expect that many people who signed up for the course did not finish it. I feel that the stipend reflect the work load completed. For example perhaps 5-10% be paid after the class roster is submitted and the balance spread over the bulk of the coursework. I think that would have insured a greater degree of participation on the part of the teacher-students.
- The class structure was great. I only have concerns about the video usage...there were technical problems.
- Instruction was great - lots of help when needed
- More practice problems
- I think the course was well structured.
- I think the course was structured fairly well. I cannot think of any way to improve on it.
- As the course went on, the objective of this course and its content became clearer. I think so that at the beginning you have a better idea of what you will be doing and where the course will be taking you would be to have a video that shows some of the examples we will be working on or of students who seem to struggle with certain algebra and function concepts.
- Provide an interactive checklist to enable student to keep track of completed assignments.
- My biggest problem was the equation and function difference. I confused myself but the discussions helped clarify.
- I liked the structure.
- The "Post New Thread" was not available on the discussion board. Thus, discussions were sometimes very random.
- Since this is my first time doing this it was difficult for me at first to find my way around and I didn't know what I needed to do. So, for me, it is to take another class.
- More exploration time
- The time allowed for each topic was too short. Too many times, something would happen during the week, such as the server being down, absence due to out of town meetings, illness, school duties, etc. to get it all done in 1 week.
- I really liked the private feedback. I would like to have more frequent updates on my progress...however since I have 100 students myself I do understand that could be difficult.
- I thought it was great...no suggestions.
- I think it was great
- Make it clear from the beginning that participants are expected to post to the discussion board at least three times a week (not just log on 3 times per week). Also ensure that the instructor posts the weekly assignments and discussion board items in a timely manner.
- I would have students respond to only one other student in the discussion forum. Sometimes it was hard to respond to two.
- I like the way it was done. The layout and timing were good. The content, examples and problems were excellent.
- Provide more time in the course to learn how to use the graphers. I found trying to do a lesson on top learning to use the grapher was very stressful. Perhaps having one of the weeks learning the way around the graphers would be good. I really liked "talking" to the other students in the class
- Posting on 3 different days was difficult at times. It would have been nice to get all the work done on a Saturday or when it was convenient for me.
- After a problem is introduced, at some point and time give us the answers.
- I think that allowing for more time on some modules would help teachers give more thoughtful

Q9. Suggestions: To Improve Course Structure
answers and feedback.
• None
• None

10 - How valuable were the video clips in helping you clarify your understanding of student thinking around the algebra content?

Not at all valuable 1	2	3	Very valuable 4
0	4	18	19

11 - How valuable were the video clips in demonstrating new instructional strategies for teaching algebra?

Not at all valuable 1	2	3	Very valuable 4
0	6	17	18

12 - What changes would you make to the video clips? What would you keep the same?

Q12. Video Clip Changes
• If clarity of the picture and sound could be improved it would be helpful. I also had a hard time distinguishing one students name from another. A student introduction would be nice.
• I'd like to have more of them to view. It would be neat to see more videos, even if imperfect, of full-sized classes, since otherwise it's too easy to believe that WE couldn't replicate that teaching, since we have many more students to deal with... It would also be great to have a few "comparison study" lessons to observe, where different teachers effectively got students to the same understanding place, but through different, quality approaches.
• In some cases the video clips appeared a little choppy. It also seemed as if they stopped randomly at times. Some were very helpful, while others provided interesting examples of student thinking, but almost appeared staged.
• Maybe seeing a teacher teaching a full class a lesson would be more realistic.
• They were fine although difficult to view on a dial-up
• None, but continue to offer the transcripts.
• I liked the video clips but often the technology I was using didn't allow them to run smoothly. They would jump in and out or not work at all. Also, though I set the volume as high as possible it was difficult to hear. Again...those are probably my problems, not yours. I was grateful that the RTT Libraries had the scripts available so that when they didn't work, I could just read.
• Thanks for having the transcripts--I would have misunderstood some aspects without the transcripts.
• Very helpful, very knowledgeable, I had trouble loading the Java onto my pc, but it was a local problem
• Keep everything the same
• Keep them the same
• I think it would be nice to see what students are doing on their paper even if that means cuting from the video to show a simulation of what the wrote or drew.
• You might try to get a class size more realistic to actual size. I know that was a topic at first when we first started watching the videos.

Q12. Video Clip Changes
• Use a more realistic classroom setting.
• -The group discussions were held in small group settings. it was hard for me to relate such discussions with my own instructional setting. -I liked the diversity in terms of students' competence in math. Students on the clips were a very good representation of general student population. -Dr. Kaput's interpretations and suggestions were very useful -The length of videos was appropriate.
• The video clips were valuable but I often had to refer to the written transcripts. I don't know that I would change anything except to perhaps improve the sound quality if possible. I also feel that the videos reflect something other than the reality of most mathematics classrooms. As you pointed out, students in the videos agreed to be open to talking about their mathematical thinking. I found few of my students would be so inclined. In addition, the teacher was able to give immediate feedback to students in those small groups. This also is not indicative of most mathematics classrooms.
• I would like to see the clips be a little longer and with larger classes.
• Fine
• More videos of what teachers do to introduce lessons
• They did not always show enough of the lesson for me to see the student thinking clearly. The teachers did a good job. I know there was some complaint about the unrealistic setting, but I'm not sure that it mattered as far as seeing the student thought processes. I'm sure it did make a difference in the teaching style, but my impression was that teaching style was not the reason for the videos. If it was (as some others in our group thought), then the class sizes needed to be closer to 30.
• Keep the same
• How to do this with a large class. Most of the videos have the ideal students and small class sizes.
• Keep it the same.
• I enjoyed them and would not change a thing.
• I thought the length was good. I was glad to be able to go back through and watch them over again. I can't think of anything I would change.
• It just seemed that there were too many video clips.
• Better quality.
• Film the clips in whole class discussion rather than very small sample groups
• I would make the video clips of a classroom during school hours with at least 5 groups working at the same time. It was a little artificial to have two small groups meeting after school, because the teacher was able to devote much more quality time to the group than would be possible in an actual classroom setting.
• I really liked the videos. I especially liked hearing the expert commentary after I made my comments.
• I didn't learn any new "teaching strategies", but listening to the students was helpful. I would include even more of the students' conversations.
• I liked the clips, not too long, not too short
• The video clips were very useful and effective for demonstrating how the topics can be carried out in a classroom setting. It was helpful to observe students working through the problems; teachers coaching their students and asking great questions; and "experts" sharing their insight. I would suggest providing more guidance as to how we can modify these situations for a class of 35 students in 50 minutes!
• Make the volume louder and enlarge the picture.
• Longer clips and a better explanation of the situation behind the clips. Who the participants were and how they were selected, etc.
• I thought the video clips of the classrooms were quite useful. In a couple of instances I would have like the clip to go on a little longer to see how the students finished their thinking. Dr.

Q12. Video Clip Changes
Kaput's commentaries were thought provoking and useful. • Some of them I wish we could have had follow-up or more information on. • More than just one person giving comments. • I liked them. I wouldn't change them. • It would be nice to see actual classroom settings rather than a group of students who volunteered to be a part of the video and stayed after school to do so. • It is helpful to have the dialogue in a printable form

13 - How often did you use the RTT Libraries to locate course elements?

Choice	Count	Percentage
Never	4	10%
Sometimes (1-2 times a month)	23	56%
Often	13	32%
Almost every day or every day	1	2%

14 - How useful was the Interactives Library for you for accessing the RTT interactive and warm-up activities?

Not at all useful			Very useful
1	2	3	4
2	6	15	18

15 - How useful was the Video Library for you for accessing the course videos and transcripts?

Not at all useful			Very useful
1	2	3	4
3	6	15	17

16 - How useful was the Projects Library for you for accessing the For Your Students activities?

Not at all useful			Very useful
1	2	3	4
2	9	17	13

17 - What changes would you make to the RTT Libraries navigation? What would you keep the same?

Q17. Libraries What Changes
• Everything worked well for me. The RTT Libraries were easily located and identified for downloads I wanted. • I'm just not very comfortable with the technology... I'll have to keep practicing. Wherever possible, I used the week's listings to access the technology I needed. I never did get comfortable pasting in my own graphs, or creating links to them. But at least now I've DONE it once or twice. Baby steps, but still steps! • Since links to require activities were in the lesson content, I did not make much use of the libraries. Perhaps I just missed where it said that everything was there, or perhaps I just didn't have the time to explore the libraries fully. I'll have to go back and go through them.

Q17. Libraries What Changes
• I didn't even know that I could access the interactives through the library until another classmate told me. Maybe it was me, or maybe these directions could have been clearer for those of us who have never taken an online course before.
• They are fine
• None
• The navigation was fine. I didn't use the For Your Student activities, but not because they weren't helpful...just not enough time. I will go check these out now, before the course ends.
• The libraries were easy to find and navigate. I like that the interactives could also be accessed from the main home page.
• Everything here was good
• None
• Keep them the same
• What is the RTT Libraries?
• I really didn't use it much. I normally would just go to the assignment to look up what was needed.
• I thought they were great.
• I often times needed to open libraries during the assignments. i had to open it in a new link. i would prefer to have that as a default setting (i.e. once you click on it, it opens as a new window)
• No suggestions here.
• None. I thought it worked well as it is.
• Same
• None
• I did not have any problem using it. I wouldn't change it.
• no changes
• The library was just fine.
• Keep them the same.
• None.
• Libraries were very easy to negotiate. Easy to access activities and interactives. My only comment would be that I was no longer able to save my work on the interactives at the end of December, even though the class was still in progress. (Or was it the beginning of January??)
• I wasn't aware of the Libraries until the last day. Perhaps, an assignment to "explore" the website would be appropriate.
• None.
• None
• I would keep it the same. It was easy to use.
• They are a fine resource...I should have taken more advantage of them.
• No changes.
• Liked it
• I would keep it all the same. It was easy to find and access the tools that I needed.
• I wouldn't change anything.
• Leave it the way it is.
• I didn't realize there were For Your Students activities available there. I have the feeling I did not have the time to look around this library enough. I plan to look there later today.
• None.
• I never used them much.
• I would keep it all the same
• No changes

Q17. Libraries What Changes
• None - it was easy to use

18 - How valuable were the initial discussion questions presented in the online discussion for generating discussion?

Not at all valuable 1	2	3	Very valuable 4
0	1	17	23

19 - How valuable were the online discussions in helping you with instructional strategies for teaching algebra?

Not at all valuable 1	2	3	Very valuable 4
0	0	19	22

20 - How valuable were the online discussions in helping you clarify your understanding of the course content?

Not at all valuable 1	2	3	Very valuable 4
0	0	19	22

21 - How valuable was the feedback provided by your facilitator on your progress in the course?

Not at all valuable 1	2	3	Very valuable 4
0	4	16	21

22 - How valuable were your facilitator's efforts to guide the online discussion?

Not at all valuable 1	2	3	Very valuable 4
0	4	16	21

23 - What changes would you make to the online discussions? What would you keep the same?

Q23. Online Discussion Changes
• I would like more prompt feedback as each week's work is completed.
• I really enjoyed them just as is. Sometimes we got off-topic in terms of the course goals, but nearly always it was still of value to us as teachers finally able to interact with colleagues with similar interests regarding teaching and learning. So I'm glad we weren't too strongly redirected!
• I was very impressed with Frances and Jenny. Their involvement with the discussions and their addition of questions to guide the discussion, along with providing additional information was extremely helpful. I also appreciated their detailed feedback each week. I have taken similar

Q23. Online Discussion Changes
courses and received little, if any, feedback. In this type of virtual environment, I feel that good feedback is critical.
• I think Tuesday was a good day to change to a new week as many of us would finish up on the weekend or at least have Monday.
• More guidance when the discussion is not happening or is just "that's a nice thougt"
• I would change the timeline, some topics required more time to think about them.
• I think the rule that postings need to be done on 3 different days is very forced. Sometimes nobody says anything that makes you want to respond, then the next day you have 3-4 people that say great things. There were times that I wanted to say something to somebody on Saturday, but saved it to respond on Sunday to satisfy the rubric.
• All the components in this section helped me to understand the concepts. I read almost all of my peers' responses, which helped me clarify and verify my thoughts. The discussion questions helped focus the responses to the concepts, and the facilitator helped maintain and drive the focus. The weekly individual feedback kept up the momentum and focus.
• This is the heart of this kind of class, very helpful
• None
• Keep them the same
• Two due dates. One for initial posts, two days before the final two responces.
• Our facilitator was great. I would keep it all the same as she did.
• It was excellent! Change nothing.
• The deadlines helped me to keep on track. So did the continuous feedback from the facilitator. i am not sure if it is technically possible but it would be nice, I think, if there was an option for personalizing the discussion postings. After posting an idea on discussion board, people may ask questions and you may never get back to them because you are done and the discussion board is crowded.
• No suggestions here. The nature of any online discussion is that you have to wait for a response and you hope that your point is understood as intended. If my students had to wait like that for a response they might lose interest. I just wish there was a way to do a real time video conference at some point in the course for the opportunity to have instant feedback. I just don't know if that is possible.
• None. Keep it the same.
• None
• Sometimes I wanted more time to focus on the activities without the burden of having to spend time on a good post in the discussion board. I think that the only negative thing about the online course is we can't have verbal discussions. I'm quicker with those, they help me clarify understanding... wish I could've chatted with my classmates rather than always typing to them
• I would have liked to open everything at once to read, but I never figured out how. I had to click on each message to read it and that was a bit annoying.
• I cannot think of any changes
• Usually pretty clear.
• I would like to see more content related responses. Many of the responses were directed to specific participants about their specific tests and state testing.
• None.
• I think the online discussions helped me the most, since there wasn't an actual classroom to go to with questions. Colleagues helped me clarify many concepts in the course. The instructor didn't participate in the discussions, which was fine.
• I thought that we were required to discuss a little to much (3 times per topic on 3 different days). I wouldn't require the 3 separate days - maybe just 2 or 1.
• Maybe a little more feedback from the facilitator.
• Yes

Q23. Online Discussion Changes
• I would keep the format basically the same, but I often forgot where some of the class members were from and it would be useful to know if they are from your state or not. If you could color code all of the ones from the same state or somehow have a quick way of indicating where they are from, I think it would be helpful. Our facilitator was excellent and the discussions were good.
• I understand why there were requirements as to how many times we should post on each discussion board, however it did make my postings more contrived. When I knew I had another posting to do on one board I would focus on reaching my quota rather than getting all the comments I wanted to post on a board I'd already completed for the week.
• The online discussions, I believe, were the most valuable aspect of this course. I would definitely keep them the same. The only suggestion I can think of is to maybe require participants to post comments within a certain number of days (i.e. the beginning of the week), then go back to read and comment on others' postings at a later date (possibly even early the following week) to allow every one a chance to post their original ideas. The feedback by the facilitator was very helpful and appreciated. It let me know that what I was doing was on track.
• I really enjoyed the discussions
• Once again, I would make sure that the discussion questions are posted in a timely manner and communicated clearly to participants. It was frustrating when this did not happen, and when I was unable to access the RTT web site because the "web page was not found". These obstacles made it very difficult - if not impossible - for me to complete my assignments on time. Aside from that, weekly discussions with other participants were very insightful.
• No changes
• I gained a lot from the discussions. How it is set up is good. I just wish we could open a thread in discussion; however, being able to see everyone's response (the whole list) was helpful. Did not have to jump from thread to thread.
• I thought it was great, can't think of any improvements.
• Many people just agreeing with others comments and not adding to the discussion.
• I often looked for my facilitator's comments and thought about those the most. I knew this was were I needed to focus my attention.
• Nothing, I liked that we interacted with one another; I just wish that we had more time in some parts of the course.
• Real time discussion would have been helpful. If I had a question, I posted it and had to wait until someone else was on, read it, and responded.
• I would not make any changes - I thought they were very valuable

24 - Did you have any technical problems accessing Blackboard and the Ready to Teach Algebra: Linear Family course?

Choice	Count	Percentage
Yes	13	32%
No	28	68%

25 - Did you have any technical problems running the interactive programs?

Choice	Count	Percentage
Yes	11	27%
No	30	73%

26 - Did you have any technical problems viewing the video clips?

Choice	Count	Percentage
Yes	14	34%
No	27	66%

27 - Did you have any technical problems taking part in the online discussions?

Choice	Count	Percentage
Yes	9	22%
No	32	78%

28 - Please describe any specific technical problems you had while taking Ready to Teach Algebra: Linear Family.

Q28. Describe Any Technical Problems

- I had none.
- I think it's just about my various internet connection speeds, but I was never able to view the video's straight through. I'd get to see a few seconds, and then there would be a long pause before the next few seconds would load up and play. It made it hard to follow the flow of the lesson or the lecture at times. Still, it was better than NOT having the video clips.
- Occasionally the Blackboard RTT course failed to load. I think that it was in part due to lack of memory in my computer. I would reboot, or come back to it later and it would be fine.

  The Online discussion board was difficult and time consuming to navigate. There was no easy way to move from one discussion to the next and no way to mark my comments as read without actually reading them. I like to check for new messages - other than my own. I was also not able to get the equation editor to work and couldn't find any type of instructions for its use.
- My home computer didn't get the video clips so I had to rely on the computers at school. I searched out several computers until I found the best program to view with and where the headphones were kept. During the first weeks my video clips of 3 minutes would take me 15 minutes to get through because the programs would keep going to a Buffer?? - every 30 seconds or so.
- I accessed using a dial-up and the videos did not work well enough to watch them
- At times I could not get the video clips to load or I could not heard them. Sometimes it took two or more attempts to get some of the interactives to load.
- I had two computers to use...one at work and one at home. I thought my work computer would be no problem because we are a very technological district. However, I couldn't pass the RTT check because my computer had so many firewalls. It took me a while to get permission to get JAVA allowed. Once that happened, my school computer was fine for the interactives and the course in general. I had a hard time with the video clips during working hours...I think because so much interruption on the network. However, when I came in on the weekends, the videos worked fine. My home computer I was never able to get JAVA to work so I couldn't do any interactives at home...this made it difficult to get the assignments done by the timeline...I really had to plan ahead. The video clips at home worked fine, though. Online discussion was great from both computers except for that one time fluke when we couldn't access and my postings were erased.
- The technical problems were minor--just not able to get on or I think once the tech crew was working on the sight. I received two error messages, but they cleared up later in the day. Sometimes the RTT course seemed to run slowly, but that's technology. I had always copied each week's requirements so I could work offline if needed.
- Downloading of the Java virtual machine, again the problem was with my pc
- None
- None

Q28. Describe Any Technical Problems

- Once the server was down, no big deal
- I know at one point I wasn't able to log in but there was a problem with all the programs and not just mine. So, that was taken care of. I did have a problem with my computer at home with installing the Java program. I was able to get it to work at my school so it wasn't much of a problem. I just wasn't able to use any of the graphing programs at home.
- Making sure my computer had all programs needed to run everything.
- I didn't experience any difficulties. I had DSL connection and it worked very well for me. (except during the time when it the system was done for one or two days which didn't cause any trouble for me).
- My home computer had some problems with that interactive programs and some of the video clips. The interactive programs did not run and some of the videos were very "choppy." I chose not to try to troubleshoot those issues and instead I did the great majority of my work at school using my school computer and internet connection.
- While viewing one of Dr. K's videos, the timer kept counting and the video stood still.
- We could not log on at the beginning but it was corrected and did not happen again
- None
- I had none except for my previous comment about navigating the online discussions.
- No problems from your end. I had personal computer problems which I have since fixed.
- It would be very nice to get an email when the site will be shut down or when there are problems, this way, people can rearrange their schedules to prepare for their classes earlier if needed.
- My technical problems were all related to my own computer not the Blackboard system.
- N/A
- There was one time I wasn't able to log on from home for the entire weekend, but I've forgotten why. It was something at your end though, not mine.
- "New Thread" was not available on the discussion board.
  A small window of days the website was down.
  Some video clips would not play in their entirety.
- Just my slow computer at home took a lot of time to get the videos!
- None
- The problems I had were technical problems, but not related to RTT. Our server was down a few times when we had bad weather or technical problems in the district. Another personal tech prob. was that when I was out of town at school meetings I did not have access to internet (at a hotel where I would have had to pay). These are tech problems but not something RTT can control other than by allowing extra time.
- None
- I only had trouble accessing the course once, and apparently everyone else had difficulty at the same time.
- None
- Often (almost once a week) I was not able to access the course assignments or the discussion board. I received an error message that read, "page not found." This was very frustrating and made it difficult for me to complete my assignments on time. One time, the instructor did not open the discussion board on time, and she provided misinformation about when it would be available and when the assignments were due. As a result, I was not able to complete the assignments on time. Fortunately, she was flexible in this area, but it was still aggravating that I had to do additional work during a very busy week (the holidays and the week before school got out).
- I couldn't hear some of the videos.
- Only real problems was with the different servers I went through. I did the course from home and at school. I had some difficulties accessing from school, but that was a server problem, my schools security is haphazard in allowing permitted sites through. Depends on volume of traffic.
- There was a period of time when Blackboard just wasn't working. Sometimes I worked on the course and then discovered that my work did not get posted. This may have been due to my ignorance, but I do know the Blackboard was down for a while and very slow another period of

Q28. Describe Any Technical Problems
time.
• One time the system must have been down. I did a lot of work and then the work was not there the next day on the discussion board.
• NONE
• None.
• Other than the site being down occasionally, I had no problems.
• I had trouble getting in to the program initially. I had trouble accessing the video clips at school Because of the firewall, but eventually managed to get them at home.

29 - What were your expectations for the Ready to Teach Algebra: Linear Family course when you enrolled? Was the reality different than your expectations? If so, how were your expectations and the reality of the course different?

Q29. Your Expectations For RTT Algebra Course
• I wanted to understand functions better. I was amazed at the depth of the instructional opportunities and very pleased with the content of the course.
• I'd already taken another PBS Teacherline course, so I knew to expect some interactives, and lots of teacher discussion. This class met those expectations, and I really enjoyed the time I spent on the discussion boards "doing my homework."
• I was looking for new ways to teach linear equations and to spark interest in algebra. I have gone to a more constructivist approach in my regular 7th grade math classes, but still felt stuck in a traditional direct instruction mode in algebra. I was impressed with the ideas gleaned from this course and am excited to try some of these activities with my students. I am reviewing the structure of my algebra course and plan to teach linear equations quite differently next year.
• I was told to expect about 4 hours of homework a week, but i didn't know about the logging on three different days part when I signed on to the course. I realize why this is done, but had I known upfront, I probably would not have volunteered, as finding the time at the end of a busy day was tough.
• I really didn't know what to expect. A bit more time consuming than I thought. Some of the activities were unclear at first
• My expectations were that I would learn how to teach algebra better. No, not really, but some of the concepts were more advanced than I expected.
• I thought that I were being learning how to teach Algebra differently, but I wasn't sure how functions would play in that. The reality is that functions played a huge role, but also did meet my expectations in how to teach better.
• I hoped to understand graphing functions and the underlying concepts so that I could better prepare my students for their upcoming algebra courses; I am required to teach algebraic concepts for state standards.
• The course exceeded my expectations from the amount of interaction that I got to do with other teachers
• The reality of the course, in terms of quality of content and delivery far exceeded my expectations
• Didn't know what to expect! Reality--I learned how to more efficiently teach my students
• No expectations, never taken this kind of course before
• I really had no idea what to expect with the class. I had never done anything like this before. I didn't expect to get much out of it but I ended up getting much more out of it that I thought I would.
• I had no expectations - I had no idea what to expect. It exceeded anything I could have imagined.
• My greatest expectation from RTT course was to see other teachers' opinions on teaching algebra. Since I came from another country just to teach mathematics, I thought it would be helpful to experience that. My second expectation was to gain some instructional strategies on teaching

Q29. Your Expectations For RTT Algebra Course

algebra. I thought initially that I would be able to learn about some interactive tools that i can use in my classroom.
All my expectations were met very well. I was able to read about what other teachers struggled as well as what they found useful.

- I was drawn to this course because of the stipend offered.
As I mentioned before I earned the first half of the stipend with very little work. The work for the second half of the stipend was considerably more.
The course was very worthwhile but had I been fully aware of the time requirements (even though I was warned) I don't know that I would have continued, especially since I had already been paid half of the stipend.
- I really didn't know what to expect other than the topic was algebra.
- I was looking for some new ways to teach the Algebra students. A different approach or ways to enhance what I already have access to. In reality, I got what I was looking for and more - the on-line discussions where insightful as well as helpful and many times enlightening. Where is spell check????
- To review algebra concepts in preparation to teach it more effectively. The reality was I learned things I didn't even know existed really-and what I did get out of the course was perhaps more useful then what I thought
- It was as I expected pretty much. I have participated in many technology education online courses before, but not math related courses.
- I did not really have any specific expectations of the course. I think the progression of the course and the content of the course was well put together
- I had no idea what the course would be about. No expectations. The course obviously went beyond my expectations. It reaffirmed some of the things I do in my classroom and also gave me a newer perspective a deeper understanding of what I teach and how I teach.
- I thought that there would be more about actually doing the exercises with our students.
- I expected more computational type problems. The reality was that the students worked in groups and our goal was to understand their learning.
- I expected to learn more algebra content, as I'm "rusty" at it. I teach PRE-algebra, so some concepts I haven't thought about since college. My expectations were met here. I also have taken a couple of on-line courses before, so my expectations for how that goes were met as well.
- I wasn't sure of my expectations, but I found the course to give a lot of good problems.
- I wanted to learn some new things. And I did.
- I hoped to learn more on functions and I did so.
- I wasn't sure what to expect. The content was not a huge surprise, however, I was surprised at all the interactives available. Something that was different was the amount of interaction with other teachers. I had assumed that I would mainly be submitting to a facilitator. I enjoyed the interaction and reading others input.
- I had none. This was my first on line course - I was lured in by the stipend. I was surprised and pleased at how easy it was to navigate.
- As far as the structure of the course, it's what I expected from an online class. I've taken several before while working on my Master's degree. As for content, I wasn't sure exactly what to expect, other than it involved Algebra.
- I expected to see new methods and new approaches for teaching Algebra and that is what I got. However I thought there would be more activities for the classes.
- This course exceeded my expectations in terms of learning how to teach algebraic concepts (equations vs. functions) and providing technological tools (interactives). This course took up more of my time than I expected. I knew it would be 4-6 hours per week, but it seemed to be longer than that, especially when I experienced technical difficulties.
- I was hoping for new ways to teach some of the topics that give students difficulty. That is what happened.
- I was anticipating another course on teaching algebra much like all the others I have been too. A rehash of old techniques with a few new twists. This course opened my eyes to another way of

Q29. Your Expectations For RTT Algebra Course
viewing algebra. Its fundamental approach was not really new, but how it viewed functions and equations and how students view equations, variables and functions was enlightening and fresh. Gave me plenty to work with and digest.
• I really didn't have much expectations; I just hoped it would give me some new skills in teaching algebra for both my algebra and pre-algebra classes.
• My expectation was that I would need to spend 4 to 6 hours a week on the coursework. In the past, the expectations I have experienced with other courses like this, it hasn't taken as much time as they say it will. Once I started the course I learned that I had to post on 3 different days in the week and the week started on Wednesday. It was difficult sometimes to get 3 valuable posts in. There were so many messages to read if you hadn't checked in a few days also. It became frustrating to get a little bit behind or be away from a computer for a while. It felt like there was so much to do and I couldn't sit down and do it all in one sitting. I would have to wait until the next day or the day after to post.
• My expectations were to explore another way to teach linear equations. I saw many new ideas and felt confident to share mine.
• My expectations were to learn some new tools and to interact with other teachers on new concepts. We pretty much did that.
• I had no specific expectations, as I had never taken an online course before.
• I expected to gain new ideas for teaching algebra and was very pleased that the course offered this. It lived up to my expectations.

30 - What elements of the Ready to Teach Algebra: Linear Family course took the most time? (i.e.., learning the technology, time spent doing the activities, time in online discussion, etc.) In your opinion, was the time well spent in terms of what you learned?

Q30. What Course Elements Took The Most Time
• The assignments using the interactives and solving problems took the most time. I was able to learn the technology but sometimes had trouble applying it to my assignments. It took lots of experimenting. Time was well spent and I had a great feeling of accomplishment when I was able to get the graphs to work.
• The discussions took the most time, simply because there kept being more postings to read and respond to, but I really enjoyed it. I probably chose to spend more time than I had to, because I kept wanting to see what else other people had to say!
• For me, time spent in the online discussion took 1-2 hours per day, depending on the number of messages from other participants. I found the process slow and cumbersome. While I did gain from the experience, I found that it was more in solidifying and extending my own thinking. There were times when I felt as if I was the only person who understood the concept being discussed and that was a bit disheartening, but I realize that I do have my undergraduate degree in mathematics and that could make a difference.
• I took the most time when solving the problems with the interactives because it was interesting. I liked being able to go to the discussion board to check other students' work on the same problems.
• Learning the online tools
• Time spent doing the activities and time in the online discussions. Yes, I learned a lot.
• At first passing the RTT tech course and the first assignments about making a homepage seemed the hardest. The technology from then on did not take too much time. The cell phone activity took a long time, but I liked it. The time was well spent most of the time.
• I spent time doing the activities to really understand what the concepts were; the online discussions also took time. Both of those were very useful in order to meet the goals--and I learned so much from the course.
• The time spent on the activities was enormous. I'm a visual learner and trying to read and decipher myself was challenging.
• Using the Function Analyzer to solve the problems posed. But it was well worth the time. In my

Q30. What Course Elements Took The Most Time
opinion, the best tool.
• Learning how to use the graphers
• learning how to post
• Most of the time it was in the online discussion. Tyring to read as many as possible of the entries was time consuming. I didn't read all of them because I just didn't have time. But the time I did spend was well spent.
• Reading & participating in the on-line discussions. Time was well spent.
• i didn't spend my much time on learning the technology or interactive tools. I felt very comfortable. Completing the assignments (i.e. writing for discussion board) took some time, but it was enjoyable and efficient.
• The time spent doing the activities took the most time. I do think the time spent was worth it in terms of what I learned. The online discussions provided much needed give-and-take, which resulted in some valuable resources.
• The most time was responding to discussions. Taking time to formulate your own thoughts and then reading others and considering what they were saying and if you had something of substance to contribute.
• Each week was different, sometimes it was exploring the new technology and other times formulating discussion points. All the time was well spent
• Reading through everyone's post in the discussion board. Often I felt compelled to read them all because I knew everyone had something to share, but that would bog me down since there were SO many posts!
• I think doing the activities myself and with my students took me the most time, but it was the most valuable time spent.
• I spent most of my time was spent doing the activities. Yes my time was well spent on this course. I have learned many things that will help me be a better teacher
• Most of the time was well spent. However it would be nice to have had a week off during the holidays or, not so many long and detailed posts to do in the last week.
• Online responses seemed to take me the most time. I learned a lot about myself and my teaching style which was very beneficial.
• The most time spent was doing the activities. I think it was time well spent although difficult at times considering my other responsibilities.
• Learning to use the interactives took me a lot of time, and so did solving a couple of the problems presented to us. The time WAS well spent, but it was hard to take this course when my grades at school were due, etc., because I had a lot of homework from this class AND from my teaching.
• The online discussion overall took the most time. On occasion, the activities were sometimes lengthy. I felt the time was well spent.
• Most of the time was spent online discussing.
• Time spent doing the activities and it was well spent
• I spent most of my time learning how to use the technology, followed by activities, and finally by online discussion. Overall, it was time well spent. I would have liked someone standing over my shoulder pushing me through the use of the interactives, though.
• Reading all the postings. There were a lot of members in this class and new postings to read all the time.
• I think most of my time was spent in doing the activities and deciding on how I would respond to the questions. All of my time was well spent.
• Having to go back on 3 different days was kind of annoying since there are some days I didn't have time at all to go online even for a few minutes.
• All of the above! Learning the technology, time spent doing the activities, and time spent preparing my responses took the most time. And yes, I do think it was time well spent.
• Everything took about the same time. Yes it was time well spent.
• Reading the on line discussion took the most time. The time was well spent. I learned so much

Q30. What Course Elements Took The Most Time
from the activities and the other participants.
• Learning how to use the graphing programs. Yes, the time was well spent. Actually I think all of the time was well spent.
• Time spent doing the activities took the most time, especially creating your own problems or adapting ones you already have. The time was well spent for those who felt their curriculum was lacking. The curriculum that I use fits the RTT model already and I don't think I will use many of the problems that were created.
• Learning the technology I am not convinced that this new technology is great because I feel we need more paper and pencil BEFORE we use the technology. The technology is great AFTER you have a firm foundation to build on.
• The online postings and some of the materials and problems we went through were very time-consuming if the proper thought was put into them. It was time well spent, but sometimes I felt rushed and didn't always think I was putting enough into it because of the time constraints.
• Some of the activities were rather time consuming but in the end they were worth the time.
• Learning how to use the interactives took the longest time. I thought it was time well spent as I learned a lot from them.

31 - What elements of the Ready to Teach Algebra: Linear Family *research component* took the most time? (i.e., student master files, teacher test, planning for student tests, etc.) Do you have any suggestions for change in the research component?

Q31. Which elements of RTT Research took the most time
• The teacher pre test took the most time but was very doable and I would not change it.
• This really didn't bother me much. For earning the stipend associated with the class, this seemed pretty minimal work on my part.
• I found that none of these elements took that much time, and felt that it was a necessary part of the process. I did have trouble with the student pre test in that I had given a post test last spring and used the same student id numbers this fall. Somehow the test code got pre-slugged as a result and I didn't realized this ahead of time so there was a bit of a mix-up.
• None of these were very time consuming. My district has a statistician who got together most of the data I needed for my student files.
• The student master file and the teacher test.
• Preparing the students master files. No
• The student master files took a huge amount of time. A suggestion would be to do all of the research stuff way before the actual class starts...there was just way too much to do at first.
• I don't think any of those took too much time.
• No changes here
• They were just fine
• Student master files
• Understanding what the students were thinking
• Planning for the post test. I had to give mine in December due to block schedule. It didn't seem real organized for a little bit but then I did receive an email about giving the test early. I didn't have much time to plan it out with all the end of the course things I needed to do in my class. I might suggest to get that organized a little earlier than what was done this time.
• The actual test - finding time to fit it in.
• to put them in order, the student master files took the most time and then teacher test and then planning for student tests. i think it all worked very well.
• The teacher test took the most time. I would like to get a copy of it now that I have competed the

Q31. Which elements of RTT Research took the most time
course and wonder if I would answer the questions differently. I also think it would be a valuable resource for teachers in a school's math department to take and later discuss their responses.
• None of the components took a great deal of time. I have a small class and used the roster to number and identify students.
• Student Master Files - JUST DO IT!!!
• Not a problem... perhaps the student master files took the most time but nothing serious.
• The student master files were difficult for me. That would be much easier next year because we are adopting a new record system that would provide that information for me.
• Student master files. No suggestions
• Looking at my own curriculum and how to make the modifications I need for my classroom and posting this information on the discussion boards.
• It appears to me that anything worthwhile takes time and effort. In comparing time spent to benefits received, I definitely came out ahead on knowledge and skills gained versus time spent.
• I think the teacher test took the most time. I really have no suggestions.
• I think both the master files for students and my taking the pre-test took an equal amoung of time. I have no suggestions for how to change that. It was good for me to take the pre-test because I really saw that I had a lot to re-learn.
• Student master files. I don't know how this could be simplified.
• No
• Planning for student tests
• Finding an appropriate day to give the tests was a big problem, as we had so much going on in the fall. Again, this is not an RTT problem, just a difficulty in my situation.
• Planning for the student tests took the most time and effort because it is difficult for me to give up a class period when I feel like I have so much to cover!
• I would say the Student Mater File. I had to get a lot of information from the school counselor (demographics). I wondered if all of that was really necessary information (for example, whether the student received free/reduced lunch).
• no problems
• Waiting to receive the student tests took the most time. I was also waiting on my master teacher so that we could administer the pre-tests at the same time. Unfortunately, between her and RTT, we did not get our pre-tests until November. Thus, I am afraid there might not be much of a difference between the pre- and post-tests.
• None
• The students' tests took the most time. I had some trouble getting them back in a timely manner.
• This really didn't take that much time; I did it in a morning. The biggest problem is fitting another test into my students' timetable.
• The research component was easy. I was surprised that one teacher receives $500 for simply administering a test and the other receives $1000 for giving the test AND doing the coursework. If I would have known the time commitment and work involved I would have wanted to administer a test and be done with it.
• Student mater files No suggestions. It needs to be done, but takes a lot of time.
• Most of that was OK. I didn't have too much trouble.
• Making the master files and the teacher test took a great deal of time. No suggestions for change.
• The teacher test took the longest. It would have been more valuable if I had received it sooner. I was already well into the course by the time I took it.

32 - What elements of the course (i.e., an activity, interactive, math concept, approach to teaching) do you plan to take back to your classroom and try out with your students? Please describe what you plan to use, and how.

Q32. Elements of RTT Course You'll Take Back To Class

- I want to take all I learned to my classes. I especially want to show my students the real life applications of functions and the interactives.
- The approach to teaching seems quite similar to or complimentary to what I already do, so if anything, I just feel validated, whether I can say I will BRING that approach to my classroom, I don't know, since I think it's already there. I'll use the interactives some, especially if I'm able to get hold of a computer screen projector, so that the whole class can see what I'm doing. I'll probably also show the other math teachers in my building the interactives, and demonstrate how we can use them in the library for whole classes of students to use. I also already use functions as a primary lens through which to view algebra, so the activities and general conceptual approach fits well. What I'll do more of, as a result of this course, is work with the OTHER teachers in the building on how to do this stuff, since now I'm clearer that this isn't just some kooky idea that I happen to like, but one that is proven successful nationwide.
- Definitely the concept of stressing the underlying linear function and with that, using multiple representations to solve word problems. This is one area that students have the most difficulty with and one in which I feel that I can extend the knowledge gained here with linear equations/functions to other forms such as exponential and quadratic.
  Using the interactive tools such as the function analyzer will help students to see the connection between the function, the related equation, and its evaluation.
- I will use the multiple representations of a linear function more often than I have in the past and as I plan my lessons, I will incorporate the interactive graphers when I can as well as more manipulatives and group work. I also was made more aware of the confusion in vocabulary terms and will try to clarify student's thinking based on that.
- At this time I am unsure, with so much going on, it is hard to re-adjust the plan
- The activities and interactives tools. I plan to schedule more time in the computer lab so my students can learn how and learn from using the interactives. I feel it will help them to understand the linear concepts better.
- All of the above...I will use the cell phone plan, the starburst activity, and other people's problems in my class. I would love to use all the interactives if I can get my district to allow it. The concepts of variable, constant, and unknown are definitely a big topic to use as well as the difference between equation and function. Finally, I think I have been renewed in my thinking that less is more and not to worry about not having enough time...do the big projects!
- I plan on implementing most of this course--from the beginning squirrel activities to the cell phone lesson and interactives. I see how important the underlying idea of rate of change is to planning lessons, discussions, and activities. I don't want to focus on the "geometric shortcut" of rise over run; I want my students to graph and symbolize real world events based on true understanding of that rate of change (function).
- I plan on using the interactives, the online handouts to copy(already put some to use), and the Plans shared by the other teachers
- All the interactives, the "For your student" activities, and the math concepts.
- Starburst activity
- Using the technology on a data projector
- The interactive graphing tools. I love the concepts of these tools and I really plan on using them in class during lecture time and maybe have them do some work on the computer with them. I will use some of the student activities that you have in order to facilitate this in class.
- Lots of themes and activities.
- Interactive tools, definitely. i encourage students who have access to internet home to take some time on interactive tools. i use the projector to graph equations and functions with interactive tools in class.
- I plan to use the student activities of cell phones and the interactive tools in my classroom. In addition I hope to enable my students to distinguish between an equation and a function using what I learned in this class.
- I have already used some of the activities and the q-grapher and Linear Transformer. I used them to differentiate equations and functions, why we solve equations in a particular order, and translating lines.

Q32. Elements of RTT Course You'll Take Back To Class

- Many of the activities as well as the curriculum problems we made up in the discussions, I would also like to use the interactives but I do not have access to a lab so that will be a challenge.
- Just about every activity we did during the course along with the interactives
- I have already used all of the activities except the elevator problem and the cell phone problem. I plan to use those later in the year. I am especially interested in using the elevator problem to see how they react to the types of possible responses. I have not used piecewise functions in algebra I as it is not a part of the Texas curriculum, but I think that the students can further develop understanding of functions through the piecewise graphs. I did the squirrel problem when introducing functions, and the starburst problem later when we were studying the influence of changes in slope and y-intercepts. The students really liked using that interactive.
- I plan to use as many of the activities in my class as seem appropriate to the class that I am teaching.
- Almost all. I love the interactives and have already used many of the projects and concepts in my classroom this year. Next year I plan on starting my teaching with a new perspective about functions that I didn't do this year.
- I am using the interactives, to help in the study of functions.
- I liked the collaborative activities the students did in the videos. I plan to use mor collaborative type work in my classes.
- I really hope to be able to use the interactives. I think they will help students' understanding of math concepts, especially graphing concepts. I want to use better methods for questioning and guiding students through problem-solving activities - the videos helped me see better ways to do that. I also have only spent a day or two on slope with my 7th graders, and this year I will feel better prepared to teach that and so spend more time with it.
- I plan to take back the cell phone problem back to try with my students. I plan on using it as a problem of the week in which the students will evaluate the problem, EXPLAIN their thinking, and evaluate what they learned from doing it.
- Most of the activities I will take back to the classroom and use to enhance the learning.
- Piece-wise linear functions and its applications
- The starburst and diamond problems when doing transformations, the interactives such as the q-grapher and the others, and many of the problems submitted by the participants will be used either in my class or in projects. I will also investigate using the 'object' perspective.
- I will use some of the interactives such as the piecewise grapher. I also plan to draw more connections between functions and linear graphing in my teaching and discussions.
- I plan to use some of the interactives, many of the problems (both from the course content and from fellow teachers), and I have some new ideas concerning my approach to teaching as well.
- I liked the activities and the emphasis on vocabulary.
- I plan to focus more on writing, solving, graphing, and analyzing linear functions, not just linear equations. I would like to introduce students to available technology, including graphing calculators and the interactives that we used in this class, especially the Linear Transformer.
  I will use the cell phone problem and/or my adapted internet service provider problem as a context for students to analyze various linear functions. I will also focus on slope as a rate of change â€“ not just rise over run. Finally, I will continue to use the Starburst problem to highlight the importance of point-slope form, as well as a family of functions.
- the interactives, suggestions from discussion, and some of the lessons. I will use them when I hit that topic in our semester.
- All aspects of the program I intend to incorporate into my teaching. I am currently rewriting my curriculum to allow for a more functions approach and a more problem solving approach. Incorporating the interactives will be the most difficult for me, but I believe they would help my students in ways, which I cannot measure at this time. I will take a more hands off approach and allow my students to teach themselves and each other.
- I have already used the starburst and squirrel problems in my class and I plan to use the elevator problem later this year. I will be taking my students into the computer lab at the end of this month and show them the graphing programs so they can use them on their algebra class when working at home.

Q32. Elements of RTT Course You'll Take Back To Class
• One thing I know I use already is that slope is a rate of change. I might use some of the questions from the cell phone problem to add to a similar problem I already do with my students.
• All the different examples that we examined will be introduced to my students (some have been introduced already). I will use these as a review for certain concepts and a way to motivate them to think about something beyond what they already know.
• Some of the material regarding language and terminology is something that I am using right now. The interactives that we used were good, but I need to find the time and space to be able to use them in my curriculum.
• We are re-writing curriculum this semester and I plan to suggest we incorporate the sequence presented here - functions before equations.
• I think that the approaches to teaching were the most useful for me. I plan to take extra care with my questioning techniques and also with the use of mathematical vocabulary in the classroom. I would like to use the interactives but think that I may have problems accessing them. I will try however.

33a - Would you recommend the Ready to Teach Algebra: Linear Family course to a colleague?

Choice	Count	Percentage
Yes	40	98%
No	1	2%

33b - Why or why not ?

Q33b. Recommend RTT Algebra: Why or Why Not?
• I have talked about this course to my fellow math teachers. They have seen my excitement in learning about functions and I am sure they will want to take the course next fall.
• Many of the math teachers in my building are purely directed at the procedures and algorithms of mathematical processes. The content, and the emphasis on teacher discussions would really help to get them thinking about WHY they do what they do, and what other approaches might also be worth trying. The non-confrontational non-judgmental aspect of the discussion boards make it "safe" to explore new ways of thinking, or to show our weaknesses and ask for help.
• I felt that this experience opened my eyes to alternatives I had not explored previously and helped me to see beyond the textbook. I have seen how using concrete representations can help students develop understanding of mathematically concepts in my other classes but wasn't sure how to incorporate these strategies into my algebra class. This course has helped me to see ways in which I can accomplish this without losing time on "fun" activities that don't necessarily improve understanding.
• It is a good way to take a class when you are working full time, instead of having to drive to a facility. It uses novel interactives and other ideas that I have not seen in other courses.
• It opens eyes and helps to start a different way of thinking and teaching
• It was informative, but I needed more time on some of the concepts to complete the assignments.
• I learned a lot, but not enough to be able to teach them completely. However, I wouldn't recommend it to just anybody...I am one of the most saavy tech-people in my building and I cried for the first 2 weeks. I wanted to quit and I think it takes a certain kind of person to take an online course. I missed not being with people...I am definitely a people person.
• This course demonstrates why it is so important to listen to students to understand what they are thinking to guide them to conceptual understanding and application of math ideas. It is not helpful to simply memorize algorithms and answer multiple textbook problems, even if accurate. What do they mean? How will they be used in real life? It shows why our state standards demand thoughtful instruction and learning.
• Because of the immediate feedback, the challenging activities and the help from other peers
• Great alignment with NCTM standards. Great professional development opportunity and lots of

Q33b. Recommend RTT Algebra: Why or Why Not?

tools and activities to take away.

- It was really beneficial and was a breath of fresh air to my current curriculum
- It was a lot of bang for my buck and a lot of bang for my time. It got me thinking in was I needed to be a good teacher.
- I thought about things in this class that I never thought about before. It is always good really do some thinking every now and then. If a teacher can get just one thing out of a course, it is well worth it. And I was able to get much more than just one idea from this course.
- So many great ideas.
- I would definitely recommend RTT to those who want enhance their teaching skills. it improves the way you see algebra. it is a nice experience and is worth it.
- I think it was a good learning experience. I would make sure that they knew the time requirements as stated were pretty accurate as far as my experience was concerned.
- The course exposed me to other thinking, challenged me as to why I work the way I do, and realized some shortcomings that need addressing.
- Every teacher should have the opportunity to share their knowledge and gain from others. This course will help me become a better teacher and they all deserve the same opportunity.
- Because the topics were truly unique and beneficial to me as an algebra teacher
- It helped me see some new ways to improve my teaching.
- I think it has been a very enlightening experience
- Absolutely. I believe there are many math teachers out there that could strongly benefit from this course.
- It has enabled me to take a good hard look at what I do in class and why, and given me the "tools" to make needed adjustments.
- I think it my be a good eye opener, especially if the teacher is one who has been teaching for a long time and may not be quite up to date with current teaching methods.
- I feel I learned a lot about instructional strategies and also algebra concepts. I also think that the 4 credit hours is fair for the amount of work I did.
- I got many new approaches to teaching math. This course also made me do a lot of self-reflection.
- It is good to experience on line class taking and it was fun.
- Enriching knowledge and great perspectives
- Yes, especially if it is a beginning or alternatively certified teacher, who has not been using our materials. I think the course emphasizes the goals and uses the strategies that we use in our math department and pushes the use of student used technology. Also, I think it is very helpful to be in contact with teachers from other schools, even from other states.
- It is great to hear and share so many great math ideas with colleagues I otherwise would not have met.
- I felt that it was very beneficial to me. Although it required more of a time commitment than I originally realized, I was very pleased with the overall course and what I've gained from it. I would consider doing it again.
- Great way to collaborate with other teachers
- I learned a lot from this course, and I believe it has helped me become a better teacher of algebra. I thoroughly enjoyed conversing with, sharing with and learning from other teachers around the country. This course took a lot of time and hard work, but it was time well spent. (And the money and graduate credits don't hurt, either!)
- I think it is a great course to get new ideas.
- I am an experienced teacher. I have attended workshops and seminars on teaching algebra. This experience as opened my eyes in new ways. It is an experience old and new teachers should have.
- I learned a lot. I have a new view of teaching algebra using the function concept rather than just teaching them the procedures to come up with the right answer. As I am incorporating this in my class I am finding that many of the students are really not getting the concept, but at least they are being exposed to it. I would let my colleague know that it takes quite a bit of time, but is worth it.

Q33b. Recommend RTT Algebra: Why or Why Not?
• The Algebra teachers at our school have a great curriculum. The Ready to Teach Algebra course focuses using and adapting real world situations, which is what our curriculum does. It is more work than you initially think it will be.
• As you are doing this course, it is an excellent reflection tool for your teaching skills and application.
• There are always lots of opportunities to learn new things and I think that as a teacher that one should explore as many possibilities as one can.
• I thought it was well worth the time and effort.
• It gives valuable teaching techniques and uses approaches that I had not thought of.

34 - What other comments and suggestions do you have for the developers of the Ready to Teach Algebra: Linear Family course?

Q34. Comments and Suggestions
• Sometimes week 2 of linear Transformations and week 2 of Linear equations was overwhelming work wise. More time might be given for longer assignment. Maybe give 2 weeks instead of 1. it was great to have more time over Christmas to do the work.
• I'm pretty suggested out.
• I would love to see a quadratic version/extension of this course.
• I think the "control teachers" who are getting paid half of what the teachers who went through the course are getting a lot of money. But we did get the knowledge also.
• Guide the discussions to help reach the objectives of the lesson
• I would not have the students post their pictures, I was not comfortable posting during discussions because I knew others could place a picture with my name, I held back on sharing some of my comments. Also, I knew the rule was that people could not give put downs, but I just felt a little discomfort in my responses. Since this course was offered to all teachers that taught algebra, I as a middle school teacher felt a little inadequate in some of the discussion forms. For me, a 6-8 week course on ready to teach algebra, then the linear relationships would have given me a better foundation.
• I think Thursday to Wednesday would be a better schedule. Often I wouldn't have the chance to look at the next weeks work until Thursday or Friday...then you actually have to do something before you can post so I wouldn't end up posting until Saturday or Sunday. Then you have to respond to other people's posts and so it was a crunch to get it all done by Tuesday. I know Sandra felt overwhelmed that so much activity happened on Sunday, Monday, and Tuesday.
• Thanks, I now understand functions and graphing (y-intercept and point-slope) and can guide students to the same understanding.
• This has been fun!!
• Great job. Thanks for the interactives!
• None
• Two post deadlines.
• I think all of this is great. I really appreciate your group doing this class.
• Try to not have the course end during the holiday season.
• i can't think of anything else.
• Again, I would pay the stipend in a more incremental nature than was done with this course. If the bulk of the money were paid out in 2-3 installments during the actual course work, students would probably stay with the program longer and stay on schedule longer. I hope I don't sound like a "money-grubbing overpaid teacher" but in all honesty I would not have taken the course if the stipend were not offered. I am very busy and spent many hours on Saturday and Sunday doing work for this course. It made for an even busier semester than usual.
• I think you all have done a wonderful job. The mix of educators and professionals allowed diverse, deep, and insightful discourse. Kudos to you.

Q34. Comments and Suggestions
• Get a spell check for the postings!! hahaha
• It would be nice to make if each of the graphers could work for any slope and any range and domain
• I enjoyed the course and my students and I will all profit from my participation. Thank you.
• I think you have done a great job.
• Email major changes and announcements. I was always checking my email, but not always getting on the site everyday.
• This was a really great course. I learned a lot that I will use in my classroom. It was great to see that other people struggle with some of the same things I do. I was also pleased to see that our curriculum really fit well with this program.
• It was a great opportunity, thank you.
• I appreciate that you were up-front about the amount of time necessary on a weekly basis to complete this course. It ended up being a good chunk of my time, but because you "warned" me, I was prepared for it! I also like the discussion board format - even though it is not as good as being in a room with others sharing thoughts, it is the next best thing. When i was stuck on a problem, I could go in and see what other teachers were doing to solve the problems, or at least I could see that others were struggling also. I like that the student worksheets were provided for learning to use the interactives and for the cell phone problem (and other problems). All in all, it was a good course.
• None.
• None
• Involve more teachers
• Great job. Enjoyed the course. (However, I would tone down the 3rd elevator problem. It was really a head buster.) THANKS !
• None that I can think of.
• The only problem for me was making time every week for the course with an already busy schedule. I made time, but it was difficult, at times. I would suggest (if it's not already being done) doing some courses similar to this in the summer time when teachers have more free time. I realize that would pose a problem with the pre-test/post-test aspect, but as far as content of the online course, I could still benefit from this type of class in the summer when I'm preparing for the following school year.
• There should be more activities to use in the classroom
• Complete the course before the holidays in December. It was difficult to work on this course during the holidays and to come back to it in January. It would have been nice to finish up before winter break. This is an effective and enlightening course, especially for my first on-line experience! Thank you for your time and efforts!
• None
• I believe the structure for the course allows for the participants to engage with one another in such a way as to make the learning and sharing experience as good as possible. The environment that is created is beneficial for all participants, experienced and new. I have no suggestions on changing or improving the course. <i>"If it aint broke, don't fit it."</I>
• It would be nice if people starting out in the course had some idea of the benefit of sticking with it. As you know many of the people in this course dropped out. Perhaps having previous student's comments available before taking the course would prepare the new students for the work expected and also that the work is worth it.
• The interactives were great!
• I just would like concrete answers to the examples somewhere in the course so I can check to see if I am doing things correctly. Just relying on my colleagues is not enough for me.
• Nothing.
• None

Q34. Comments and Suggestions
• I gained a lot from this course and found it very valuable.

(7) End of Course Teacher Review

SeeingMath by The Concord Consortium Secondary

Bringing Mathematical Thinking Into Focus

1. End of Course Teacher Review

2. Online Survey Results

edcentric

21 responses - received between: 5/24/2105 and 6/6/2005

Which Seeing Math course have you just completed?

Course	Count	Percentage of Total Sample
Proportional Reasoning	5	24%
Quadratic Functions	16	76%

Note:

The table above shows the two courses that were reviewed during the April – June 2005 Seeing Math Secondary pilot test. All survey questions are grouped and presented separately for each of the two Seeing Math Secondary courses, in the following order:

1. Proportional Reasoning (n = 5)
2. Quadratic Functions (n = 16)

Proportional Reasoning Questions 1 to 28 (n=5)

1 - Please provide your opinion about each of the following statements.
For 'Proportional Reasoning' (n=5)

(n=5)	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Students learn mathematics best in classes with students of similar abilities.	0	2	1	2	0
The testing program in my state/district dictates what mathematics content I teach.	0	2	0	2	1
I enjoy teaching mathematics.	0	0	0	2	3
I consider myself a "master" mathematics teacher.	0	1	1	3	0
I have time during the regular school week to work with my colleagues on mathematics curriculum and teaching.	1	1	1	0	2
Mathematics teachers in this school regularly observe each other teaching classes as part of sharing and improving instructional strategies.	3	1	0	1	0
Most mathematics teachers in this school contribute actively to making decisions about the mathematics curriculum.	2	2	0	0	1

2 – How difficult/easy was it for you to navigate around the course?
For 'Proportional Reasoning' (n=5)

Very difficult			Very easy
0	1	3	2

3 – How valuable was the week one 'orientation' in helping you understand the structure of the topics in the overall *Seeing Math Secondary* course?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable
0	1	3	1

4 – Were the goals and objectives clear to you?
For 'Proportional Reasoning' (n=5)

Not at all clear			Very clear
0	2	1	2

5 – What suggestions do you have for improving the course structure? Please be as specific as possible and provide examples when you can.
For 'Proportional Reasoning' (n=5)

Q5. – Suggestions for improving course structure
• I think the course was too advanced to be used in lower level classes.
• The reason I enjoy taking classes is because of the stimulation of thought that occurs. Most of the time, I become more interested in the tangents that have been generated. I would have found a recommended reading list for further exploration useful. I probably could just ask for one as well.
• None come to mind.
• I enjoyed the course as it was structured.
• The private feedback area took me a couple of weeks to find the personal emails. A way to make this more obvious would be good.

6 – What, in your opinion, were the main content emphases of the course?
For 'Proportional Reasoning' (n=5)

Q6. – Main content emphases of the course
• Understanding students' approaches to proportional reasoning
• The main content emphases were proportional reasoning within the contexts of mathematical thinking, learning and teaching.
• Ensuring that each participant had a clear understanding of the course in order to create a lesson that will allow student input into a course with realia permeating its entire core and more.
• Student Thinking.
• Exploring ways that are the most effective in teaching/learning proportional reasoning

7 – Please list two aspects of these themes that are new to you.
For 'Proportional Reasoning' (n=5)

Q7. – Two aspects of themes that were new to you
• Landscape of learning Random Operation - Using operations until one produces a result
• Mathematical learning is hidden pictures. The broad connections that proportional reasoning has.
• Expanding the lesson beyond the idea of a word problem into a project unmathematized problems
• Proportions and Graphing Contrasting Strategies
• 1. Private feedback area ~ which, once I found, I truly enjoyed. 2. Videos of students in

Q7. – Two aspects of themes that were new to you
groups.

8 – List two ideas about teaching that you found useful.
For 'Proportional Reasoning' (n=5)

Q8. – Two ideas about teaching that you found useful
• The way a teacher questions students to get them to thinking. Connections between proportional relationships and graphing. • Connecting the concept of ratios to graphs. Creating unmathematized problems and requiring reflection in context • Connecting Personal Experiences and Research to Teaching Contrasting Strategies • 1. group work 2. rubric comments by George ~ I would have appreciated more.

9 – What areas do you feel need further clarification?
For 'Proportional Reasoning' (n=5)

Q9. – Areas that need clarification
• I would have liked to see how the teacher approached the problems given. • What types of building blocks do algebra students generally have in place from which further development of proportional reasoning can be built upon? Or, what are the major arithmetic ideas that can be built upon to develop algebraic proportional reasoning? • Links to algebra, further information is needed because I know there must be more than what we've learned. • Techniques for Teaching Proportional Reasoning • I did not understand the "Post 3" until the very end. I thought it was three posts in a week not three days of posting.

10 – Were you able to complete the course within the suggested timeframe of four to six hours per week? If not, what assignment(s) took longer than expected?
For 'Proportional Reasoning' (n=5)

Q10. – Were you able to complete assignments in 4 – 6 hours a week?
• Somewhat. I had difficulty with my password on several days one week. And could not access the site for one whole week. • Yes. • Yes, except for the last week's activity. • Yes • Yes, the course was provided at a good pace.

11 – How valuable were the video clips in helping you clarify your understanding of student thinking around the algebra content?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable

Not at all valuable			Very valuable
0	0	2	3

12 – How valuable were the video clips in demonstrating new instructional strategies for teaching algebra?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable
0	2	1	2

13 – What changes would you make to the video clips? What would you keep the same?
For 'Proportional Reasoning' (n=5)

Q13. – What changes would you make to the video clips?

- Nothing
- I would have liked to increase the video to full screen size. Also, it would be interesting to hear the classroom teacher reflect upon his/her students and their learning. This would give each clip a better context in which to consider it.
- I would suggest changing the amount of teachers in the videos, more teachers gives a more in depth understanding I would keep the teacher vs. specialist format the same, great idea to have an on-hand expert.
- I would like to have seen how the teacher introduced the activity as well as the wrap up.
- More videos of developing student groups that bring them to the point shown in the course.

14 – How valuable were the initial discussion questions presented in the online discussion for generating discussion?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable
0	0	4	1

15 – How valuable were the online discussions in helping you with instructional strategies for teaching algebra?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable
0	1	2	2

16 – How valuable were the online discussions in helping you clarify your understanding of the course content?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable
0	2	2	1

17 – How valuable was the feedback provided by your facilitator on your progress in the course?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable
0	0	2	3

18 – How valuable were your facilitator's efforts to guide the online discussions?
For 'Proportional Reasoning' (n=5)

Not at all valuable			Very valuable
0	1	1	3

19 – What changes would you make to the online discussions? What would you keep the same?
For 'Proportional Reasoning' (n=5)

Q19. – What changes would you make to the online discussions?

- I felt a lot of time intimidated. I felt that most of the teachers were more advanced than me. I felt reluctant to answer the questions
- I don't have suggestions in regards to how to improve online discussions. I think that people, in general, need to learn how to communicate effectively within this medium.
- I consider the discussion to be perfect as is.
- I would like to see more depth in the discussions.
- Be clearer on what is expected in them, examples may be good to provide.

20 – Did you have any technical problems accessing this *Seeing Math Secondary* course?
For 'Proportional Reasoning' (n=5)

	Count	Percent
Yes	1	20%
No	4	80%

21 – Did you have any technical problems running the interactive programs?
For 'Proportional Reasoning' (n=5)

	Count	Percent
Yes	1	20%
No	4	80%

22 – Did you have any technical problems viewing the video clips?
For 'Proportional Reasoning' (n=5)

	Count	Percent
Yes	1	20%
No	4	80%

23 – Did you have any technical problems taking part in the online discussions?
For 'Proportional Reasoning' (n=5)

	Count	Percent
Yes	1	20%
No	4	80%

24 – Please describe any specific technical problems you had while taking this course.
For 'Proportional Reasoning' (n=5)

Q24. – Describe any specific technical problems
• Several times I couldn't get into the discussion area. Other times I could but when I clicked on a student's name it would take 30 minutes or more to load. One week I called tech support on several days because it would not take my password. My password was changed four times in one week. • • • No major problems, I had difficulty logging on a few times, but I chalk that up to Internet traffic, not anything significant. • I had a difficult time attaching my plan to be viewed. The formatting was not good. • The only problems I had were in seeing the videos but they were temporary.

25 – What elements of this *Seeing Math Secondary* course took the most time? (i.e., learning the technology, time spent doing the activities, time in online discussions, etc) In your opinion, was the time well spent in terms of what you learned?
For 'Proportional Reasoning' (n=5)

Q25. – What elements of course took most time?
• Time spent doing the activities. Yes and no. • The most time was spent on the final lesson plan. I think the time was well spent. I wish I had been encouraged to think about my lesson plan prior to the week in which I needed to

Q25. – What elements of course took most time?
work on it. • The lesson plan in week 5 • Doing the activities took the most time. I think the time was well spent. • I liked the time for thinking of what and how I teach.

26 – What elements of the course (i.e., an activity, interactive math concept, approach to teaching) do you plan to take back to your classroom and try out with your students? Please describe what you plan to use, and how.

For 'Proportional Reasoning' (n=5)

Q26. – What elements of course will you try out with your students?
• Several things. I will use some of the lesson plans other teachers shared. I plan videotaping my students and letting the students observe other classes' thinking process. To help the students see and think mathematically in a context and not just a computational sense. • I am thinking through a systems shift in regard to how day-to-day interactions shape what happens the next day. I am also trying to break off my pacing schedule to follow students thinking and learning more and my plan less. • I loved the activity creation, and the ability to unmathematize any problem and allow students to connect to a problem. • The math concept of connecting proportional reasoning to graphing and the student activity. • To my classroom I shall take ideas and approaches to teaching.

27a – Would you recommend this course to a colleague?

For 'Proportional Reasoning' (n=5)

	Count	Percent
Yes	5	100%
No	0	

27b – Why or why not?

For 'Proportional Reasoning' (n=5)

Q27. – Why or why not?
• There was some valuable information. It also helped me to look at the way I approach my teaching. • The facilitators give excellent feedback and as stimulating questions. • Because it caused me to think outside the box and all from the comfort of my own home. I think it's a great idea to consider professional development but many times the time crunch doesn't allow for very many opportunities. • I believe that it will improve my planning and selection of activities. • If someone desires time to contemplate thinking about how the to teach proportional reasoning.

28 – What other comments and suggestions do you have for the developers of the *Seeing Math Secondary* program?

For 'Proportional Reasoning' (n=5)

Q28. – Comments and suggestions for developers of SMS
• Maybe dividing it up into different levels. • • Continue to expand the themes that can assist teachers in understanding the methods of student learning. • I enjoyed the course, particularly the connection of each week's activities to the prior week. I would like to see more discussion from the instructor. • I enjoyed the facilitator's personal comments; this is the most benefit from this course.

Quadratic Functions Questions 1 to 28 (n=16)

1 - Please provide your opinion about each of the following statements.
For 'Quadratic Functions' (n=16)

(n=16)	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Students learn mathematics best in classes with students of similar abilities.	0	8	1	6	1
The testing program in my state/district dictates what mathematics content I teach.	0	2	1	9	4
I enjoy teaching mathematics.	0	0	0	1	15
I consider myself a "master" mathematics teacher.	0	3	2	7	4
I have time during the regular school week to work with my colleagues on mathematics curriculum and teaching.	0	4	2	7	3
Mathematics teachers in this school regularly observe each other teaching classes as part of sharing and improving instructional strategies.	7	5	3	1	0
Most mathematics teachers in this school contribute actively to making decisions about the mathematics curriculum.	0	3	4	9	0

2 – How difficult/easy was it for you to navigate around the course?
For 'Quadratic Functions' (n=16)

Very difficult			Very easy
0	1	6	9

3 – How valuable was the week one 'orientation' in helping you understand the structure of the topics in the overall *Seeing Math Secondary* course?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable
0	3	7	6

4 – Were the goals and objectives clear to you?
For 'Quadratic Functions' (n=16)

Not at all clear			Very clear
0	2	5	9

5 – What suggestions do you have for improving the course structure? Please be as specific as possible and provide examples when you can.
For 'Quadratic Functions' (n=16)

Q5. – Suggestions for improving course structure
• None • In the private feedback area there is a group discussion board title- I think that was misleading-other than that I think everything was set up nicely and very clear. We had a hard time getting onto the quadratic transformer and into the reg. discussion board 2-3 different times but that may have been because of heavy usage. • Every thing worked out great. I really liked the way the class was set up. It was too bad that I was unable from two different computers to access the Quadratic transformer. I would have liked to see what it offered. • Make students aware of the final week project ahead of time. • Give more feedback about grades. • Make the objectives of the discussion group clearer and easier to navigate. Not being able to "Add a new thread" made if VERY difficult to figure out if the subject was changing or it someone was merely replying to a message. • None • I really enjoyed taking this online class, as it was my first experience at doing so. I loved the introduction and going right into the toothpick problem. What that did, was show us how many different ways students arrive at the same solution. One could look at sequences, or one can look at colored toothpicks, and the colored toothpicks solution can be arrived at several different ways. Diversity in the number of solutions was the key, and the point was established very nicely. Some people really struggled with the three different forms of the quadratic function, and seemed unwilling, at first, to using the Quadratic Transformer. Once people explored its abilities, everyone fell in love with its capabilities. Some people pulled out math books and algebraically attempted to find the vertex form and root form of the quadratic function, not knowing it could have easily been derived by the push of a button with the Transformer. Maybe, this should be hinted at before some of the class members become frustrated. Many of these same people were, at first, resistant to using new technology (the Transformer). Everything fell into place very nicely, however, as I'm very confident that 99% of the students enrolled were thrilled at the content, and what they walked away knowing. I have taught for 30 years, and enjoyed the class immensely, and even recommended it to my department head, who has a PHD in mathematics. I know she would enjoy the experience. • You may want to have the 'add a thread' feature, when responding to the discussions. • The course structure was fine; I have no suggestions for improvement. • When reading replies to posts, it was almost always confusing trying to figure out which post someone was responding to. It would be a huge improvement to redesign the process so every reply automatically included a reference to both the topic and the writer of the post being replied to. • I just feel that offering at a different time of year, which I am certain will happen, would be

Q5. – Suggestions for improving course structure
valuable. Also, posting what was necessary to complete before the week would be nice, that way those of us short on time could work ahead when we had time, and then the three postings a week would not be so hard. I would suggest that three separate days may not be necessary, so many of us can commit to a block of time each week.
• None
• Not sure if this is the right place for these comments, but... The orientation materials mentioned several key concepts. Two that I thought were correctly emphasized were: 1) functions as objects rather than processes (or maybe, in addition to processes) and 2) algebra as a mathematical model for physical reality. Yet I thought both of those principles were more-or-less abandoned for the remainder of the course. The one exception was the "mapping back" of solutions to the toothpick problem onto the physical model. But, for example, the match quadratic graphs activity, well...I didn't see the connection to anything that had been discussed in the class. I still don't see the point. And the "adapt a problem" activity didn't result in too many answers that tried to match a mathematical model to a physical situation, and not too many that explicitly addressed the noun vs. verb interpretation. It's been a while since I did the exercise, so maybe we just weren't following instructions...but it seemed the opportunity was there to continue the themes in the introduction, but wasn't really taken advantage of.
• Since this was my first time taking a Seeing Math Secondary course, I noticed it was more clearly laid out than the other courses that I have taken.
• Need to have different levels to accommodate different levels of students.

6 – What, in your opinion, were the main content emphases of the course?
For 'Quadratic Functions' (n=16)

Q6. – Main content emphases of the course
• Student Thinking Multiple Approaches to problem solving - Deeper understanding of quadratic functions
• Viewing quadratic functions in many ways and letting your students learn through discovery.
• •Questioning techniques for quadratic equations. Also Methods of exploration of quadratic equations
• Multiple representations
• Working in groups, different representations of functions, getting feedback by watching and listening to students
• Using models, tables, diagrams and graphs to represent quadratic functions; using small groups of students to effectively solve problems together
• Looking at Quadratic Functions in various forms (graphs, tables, equations) and making connections between them
• Emphasizing that different students might have different perceptions of the same problem, and both perceptions might be different than mine. Making me aware, as a teacher that there are many methods to solving a problem, and each method is accompanied by a different perception. The course also emphasized teaching quadratic equations from the function aspect, rather than the equation aspect. The course emphasized the difference between looking at a function as a "verb" or a "noun" (a process or an object). That led to many interesting discussions among class members. In fact, all of the discussions were excellent. Another major point of emphasis was proper questioning techniques, and although I have heard of this, I never realized how important it was in developing problem solving skills in young people. I really need to work on this to improve my communication skills with my

Q6. – Main content emphases of the course
students. The content of this course pointed out that the teacher is more of a facilitator who, through proper questioning techniques, leads students to "discover" for themselves. This is where real learning takes place, and problem-solving skills are developed. Group work that emphasized students interacting and exchanging ideas, and arriving at solutions independent of the teacher telling them the answer. Additionally, student presentations are important, in that students must know the material and understand the thought process in order to make an informed presentation. Additionally, they must rely on each other, have dialogue, and evaluate each other's thinking in order to "discover" the solution. All of this is excellent, and was most a very big part of the class, as it was presented to us.
• The relationship between the graphs, tables and equations. How to use technology, such as the quadratic transformer. Breaking up the class into groups so that they may be able to discover the solution together, using good questioning techniques.
• Multiple representations of quadratic functions.
• The algebra content was "quadratics," but that was just the medium to explore the importance of listening to your students and seeing things (problem solving) from their point of view.
• Quadratic Functions, and the many ways to represent them. Including graphical, analytical, and algebraic.
• Various ways to "see" the quadratic equation
• Multiple solution methods. Group problem solving (although that may have been more in the discussion than in the curriculum).
• The main content was about quadratic functions.
• To help teachers enable students to learn to explore quadratic functions as a general relationship between variables

7 – Please list two aspects of these themes that are new to you.
For 'Quadratic Functions' (n=16)

Q7. – Two aspects of themes that were new to you
• Using the quadratic transformer to relate graphs to the three forms of quadratic functions, Using color coding to help analyze visual problems
• None- I have a Harvard Calculus reform background so I'm well trained in asking students to see relationships as tables, graphs, or equations.
• The Questioning techniques were somewhat new to me. I have used groups to discover things just not quadratic equations before.
• Group work
• None
• 1. Emphasizing alternative "views" or ways of looking at the problem to find the pattern. 2. Using colored drawings to illustrate aspects of the pattern
• I really liked the Quadratic Transformer to show how various forms of the equation relate to each other.
• I never realized that my students might be looking at a function totally different than I do. I might be referring to it in the context of an object, while they perceive it as a process of solving and finding a solution. And during my explanation, I might switch back and forth between the process and object, without realizing it. How confusing this must be for my students. The toothpick problem emphasized finding different solutions, as something we should emphasize to our students. I have never really done that, as sometimes it is very time consuming. I need to restructure my questioning techniques, and lead students to discover for themselves, rather than give them the answer, and take all of the potential for growth and discovery away from them. I need to have more confidence in my students and be more of a facilitator, than "one who knows all". I must learn proper questioning techniques in order to

Q7. – Two aspects of themes that were new to you
be a good facilitator. • The technology portion, quadratic transformer, and the process and object perspectives. • Using multiple representations of quadratics to promote better student understanding, and using the quadratic transformer. • Listening to my students so I could better understand how they were approaching problem solving. The importance of exploring multiple solutions to a problem. • I just never was able to connect them all as clearly as I feel this course has allowed me to do. I also never realized the potential for technology in this topic. • 1. That it is important to use various approaches to teaching the quadratic -- i.e. graphing, tables. 2. That I am not very far behind other teachers in my ability to teach this subject. (I thought I was totally inept in this area.) • I actually do appreciate the "pattern matching" approach a little more than I did prior to the class. Pattern matching in terms of identifying the numerical sequence of a set of numbers has always seemed to me an academic exercise--interesting and challenging, but not too practical. But mapping the pattern back into physical reality fills the vacuum. Perhaps because of my prejudice against pure pattern matching, a tabular approach to problem solving has not been my favorite. It still isn't, but I now have more appreciation for the value of the table as a problem-solving tool, rather than simply an intermediate step towards a graphical solution. • ...toothpick activity and writing an equation for it ...matching equations to graphs. • Nouns, Verbs, and mathematics concept - The concept of object and process.

8 – List two ideas about teaching that you found useful.
For 'Quadratic Functions' (n=16)

Q8. – Two ideas about teaching that you found useful
• Questioning techniques -- facilitating through questioning Encouraging dialogue between and among students • Students verbalizing and writing their mathematical ideas. Software (the quad transformer) that allows students to see the visual relationship without using a calculator. • I found the methods of group participation to be very helpful. • Group work and writing in class • Listening to students, use of quad transformer • 1. Using effective teacher questioning to help students work productively in their small groups 2. Having teachers share their solutions and "final projects" • Having my students do writing about their math and having students see that there are a lot of ways to solve a problem as in the toothpick problem • There are many, but the idea of being a better facilitator was extremely informative and should improve the problem solving skills of my students. How am I going to improve my abilities as a facilitator? By learning how to "lead" students to "discover" the answer through improving my questioning techniques, when they become lost, confused, or frustrated with the problem solving process. That way, I am not giving them the answer, and they are growing. Introducing more group work into my daily curriculum activities will also be quite useful. I need to develop a good rubric for evaluating group work, and another for evaluating group presentations, and I should be off and running. It is very exciting, but I have more confidence in allowing my students to do these activities than ever before. • The process and object perspectives, and the group activities using good questioning techniques. • Modeling real world events or patterns, and using cooperative learning groups. • Using the quadratic transformer. Using physical models (toothpicks) to better understand

Q8. – Two ideas about teaching that you found useful
quadratic equations. • The connection among the types of ways to display a quadratic, and the dialogue with fellow classmates (those not in my school) • 1. Using the web to generate new ideas. 2. Adopting problems from the textbook to meet the learning styles of all. • I liked the group guidance approach modeled in the video. I tend to be so worried about not giving the answer away that I don't provide enough guidance. I'm correcting that tendency. Also helpful (as a result of this course, but perhaps not directly) is the idea that the solution to the problem might not be the appropriate endpoint. Perhaps the true goal should be communicating the solution to other students. Then clarity of thought and communication become part of the problem itself, rather than an add-on. • ...I now use Learning Reflections with my students, they have a difficult time trying to express themselves using math terms ...I am now able to use applications with quadratic functions • Graphic Transformer Discussion Board

9 – What areas do you feel need further clarification?
For 'Quadratic Functions' (n=16)

Q9. – Areas that need clarification
• I would like to have seen more videos on student thinking. I would like to go deeper into forms of functions and graphs. • None • The due dates. And maybe well I guess it is because I don't pay close attention, but the number of posts required for each topic. • In depth feedback on lessons • ? • 1. How to help students progress from recognizing the pattern (even from the recursive pattern) to being able to write the symbolic equation. Or as the students on the video said, "Write it in algebra." 2. In most math textbooks, the sections on quadratics have "application" problems that give the students the equation to used. How can we use models and word forms of patterns to help students "understand" where these equations came from or how they were developed? • The last assignment on week 4 was really hard for me in that I wasn't sure what I was supposed to do, I needed to wait till someone else posted to get an idea of what we were being asked to do. • We were shown the importance of good questioning techniques and the value of group work, but we should have been lead to discovering "what questions to ask" when students become lost or frustrated with an assignment. Additionally, finding a good rubric for evaluating group work and another for evaluating class presentations should appear somewhere in the curriculum, even if they are simply given to us as an example of what to model. The discussion boards were full of discussions about good questioning techniques, and where to find examples. • More directions on how to use the quadratic transformer. • Teaching students to graph quadratics without technology; is it beneficial or not? • I think the questions regarding the relationships between the different symbolic representations of the quadratic equation were a little vague. • Just the timing exactly. There were times, when it was still Wednesday in Arizona, but not where the course was being conducted and as a result the three postings each week did not count.

Q9. – Areas that need clarification
• 1. How to use the tools -- especially the quadratic transformer. • What should be different about our teaching at the end of this class? It seems that many of what I am identifying as changes came about indirectly, as a result of the group discussion. For example, some teachers adding more emphasis on written journals; others adding more opportunity for group work, etc. • I took algebra a while back, so basic review is helpful. When taking algebra, the reasons were not given for why we were doing the different equations. Application did not seem to be a priority. Now, that I teach these same concepts to young students, I need to be able to connect real life with math concepts. • None

10 – Were you able to complete the course within the suggested timeframe of four to six hours per week? If not, what assignment(s) took longer than expected?
For 'Quadratic Functions' (n=16)

Q10. – Were you able to complete assignments in 4 – 6 hours a week?
• Usually. Weeks 4 and 6 took longer. • Yes • The lesson plan was longer than the time frame. However it was doable. • Yes • Yes, I got pushed toward the end because of exams and end of year stuff at my school...if it had been another time of year no problem • No, the discussions took longer than they should have for the value derived (at least for me) due to very slow loading time and difficulty following unlabelled threads. Also, I had A LOT of difficulty getting the videos to run! • For the most part yes, the last assignment in week 4 took a long time and so did the action item in week 5 • I probably did several hours more than was required, but the time frame was pretty accurate. Some people took longer, I'm sure, but some really struggled with understanding the math concepts, and like I mentioned before, the Quadratic Transformer did all of the work for us, but some did not use it until they had become somewhat frustrated. No one should have to look in a math book for a formula, as this course was structured excellently. Again, the value of the Transformer should be emphasized more, as it jumps back and forth between the root form and vertex form with the push of a button. No work of the algebraic nature is required of the students, and some did not realize that. The emphasis of the class was on improving the ability to work with our students, not to learn any math, and that is how it should be. • Yes. • Usually, but the last week's assignment (Lesson Plan or Action Plan) took longer than 6 hours for me. • The assignments for Week 5 took much longer. The individual assignment(s) was not particularly time-consuming, but reading, considering and responding to so many other posts and plans took long periods of time. • I feel that having been able to previously look at content rather than having to wait for that week to come, would have been useful • The final assignment has taken me about 12 hours to complete. It would make more sense to spread it out over the last two weeks. • Usually not, although this was probably mostly due to my desire to read every post. My own work was usually within the 4-6, except for the final project. • Yes • Yes

11 – How valuable were the video clips in helping you clarify your understanding of student thinking around the algebra content?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable
0	2	9	5

12 – How valuable were the video clips in demonstrating new instructional strategies for teaching algebra?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable
0	4	9	3

13 – What changes would you make to the video clips? What would you keep the same?
For 'Quadratic Functions' (n=16)

Q13. – What changes would you make to the video clips?

- I would like to see more of the same nature.
- If possible -streaming that allows a larger screen without so much distortion.
- It might have been helpful if they showed two different groups of students thinking through the same problem. And their interactions
- The video clips were too small. I liked seeing good questioning in progress.
- Show clip of whether the students actually solved problem or not!
- They were interesting and beneficial once I could get them to run. One I spent hours on, never did get to work, and had to depend on the transcript only.
- I liked having the transcripts because that was something I could follow along with and keep notes on regarding the clips.
- None, they were very good. The outstanding feature of the video clips was the demonstration of the teacher being a good facilitator, rephrasing student questions to her, and directing them back to students. This all came out in the video, and was excellent.
- The time for each clip could be extended.
- Possibly viewing more groups of students.
- I did not recognize in the student clips significant student learning and understanding. I think the student videos would have presented a stronger message if all the students shown were clearly understanding what they were doing and learning from their group activities.
- I would incorporate more.
- Make them easier to access. Some students had difficulty.
- Hmm...Presuming I can remember enough details from three or four weeks ago... We never got to see the kids reach a solution! Did they? How much guidance did they need? How was it delivered? When the project was done, did the kids have to explain their approach to other groups? How well did they do that? The teacher comments were good, but there were too many comments from the educational specialist, that didn't seem entirely helpful.
- The video clips were helpful in the ability to observe students working on math concepts, and

Q13. – What changes would you make to the video clips?

how the teacher interacted with the students. Watching someone talking did not seem to be very helpful.

- Nothing. More of the videos. I learn better when observing. I would like to have seen the actual assignment on video.

14 – How valuable were the initial discussion questions presented in the online discussion for generating discussion?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable
0	1	7	8

15 – How valuable were the online discussions in helping you with instructional strategies for teaching algebra?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable
0	1	7	8

16 – How valuable were the online discussions in helping you clarify your understanding of the course content?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable
1	1	6	8

17 – How valuable was the feedback provided by your facilitator on your progress in the course?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable
0	0	10	6

18 – How valuable were your facilitator's efforts to guide the online discussions?
For 'Quadratic Functions' (n=16)

Not at all valuable			Very valuable

Not at all valuable			Very valuable
0	3	7	6

19 – What changes would you make to the online discussions? What would you keep the same?
For 'Quadratic Functions' (n=16)

Q19. – What changes would you make to the online discussions?

- I would put a limit on the number of responses. I tried to get through all the messages instead of contemplating deeply on a lesser number.
- We had a great group with lots of discussion and feedback. I would not make any changes.
- I would make it a point to have every one change the subject line. It was hard to follow which response went with what original statement or question.
- Enjoyed being able to go back to them at any time
- They were ok...
- Have some quality control on the "replies". In many instances, it seemed that replies were made just to meet the requirement rather than because there was something valuable to say. Skip the "replies" to "getting to know you" and have the postings be more concerned with current (and former) teaching situations, since experience with teaching algebra had an effect on the viewpoints taken to working the problems.
- Request that people put a name on responses to know who people were responding to as well as possibly copying the quote that was being responded to on the reply.
- What can I say? The online discussions are the outstanding part of the course. I learned more through interacting with teachers in our online discussions than I have at any time in my thirty years of classroom teaching. This feature of the course is incredible, and cannot be emphasized enough. Don't change any portion of what now exists. Frances, our facilitator, was excellent too, as she provided great feedback and was a very easy person to work with. Keep her around.
- I would keep the discussions the same, but I would like the 'add a thread' feature put in.
- I found the online discussions to be very valuable. I would not change them.
- A more clear connection between the replies posted to the person and message who made the initial post.
- I would like to see more time to truly communicate, and not just make silly comments about each other's lessons. Sometimes the comments were great, but often they were "that's interesting, or good job." That was not helpful.
- None. It worked much better than any other online class that I have taken
- Again, I'm not sure if this is the proper place for this comment, but... The discussion board software was unduly cumbersome. The entire page needed to be reloaded each time a comment was read, and only one comment in a thread was visible at any one time. The page loading often froze before the end...frustrating to reload, etc. Just a few times the board would show only the comments within a single thread--that's an improvement, but it was very inconsistent. Some discussion board comments seemed not particularly helpful, such as "good job with this problem." On the other hand, I didn't feel comfortable replying to a reply to my posting...if that makes sense. I just didn't want to drag the discussion along with some kind of clarification or minor refutation of someone's comment to something I had said. I'm wondering if a live chat might make the course more truly interactive. Or perhaps one of the projects can be made into a group activity? Then the groups given an opportunity for "live" interaction?
- I would not change anything. I like being able to read my peers' ideas, and how the facilitator

Q19. – What changes would you make to the online discussions?
would make comments and guide us in the right direction. • I would have liked to see more of the teacher's participation.

20 – Did you have any technical problems accessing this *Seeing Math Secondary* course?
For 'Quadratic Functions' (n=16)

	Count	Percent
Yes	8	50%
No	8	50%

21 – Did you have any technical problems running the interactive programs?
For 'Quadratic Functions' (n=16)

	Count	Percent
Yes	9	56%
No	7	44%

22 – Did you have any technical problems viewing the video clips?
For 'Quadratic Functions' (n=16)

	Count	Percent
Yes	8	50%
No	8	50%

23 – Did you have any technical problems taking part in the online discussions?
For 'Quadratic Functions' (n=16)

	Count	Percent
Yes	5	31%
No	11	69%

24 – Please describe any specific technical problems you had while taking this course.
For 'Quadratic Functions' (n=16)

Q24. – Describe any specific technical problems
• I could not view the video clips over Internet Explorer. I had to change to AOL for the videos and use Explorer for the Discussion Board. • Already mentioned previously. Several times the discussion board would not come up or only partially came up. I knew I had posted but it wouldn't show until I backed all the way out 6 times. You might check if this was caused from 75-80 messages on one board at a time.

Q24. – Describe any specific technical problems
• I was unable to access the quadratic transformer. Even after other people were able to go back and use it I was unable. I tried the transformer from two different computers. The only thing I would get was a gray screen. • Slow Internet, freezing while trying to post on discussion board, unable to load correct software to use graphing tool, could only open one video clip per log-on. • Video clips didn't work sometimes, sometimes when moving from one discussion to another, computer would be slow! • 1. Biggest was getting the videos to run. 2. The Quadratic Transformer ought to be easier to find, and to load prior functions. 3. In the discussions, for ease of following various discussions, participants ought to be able to "start a new thread" when doing a posting rather than a reply. In the beginning of the course, it ought to be clearer how to find and send email to the instructor, and to find your "grades." • To view the videos I tried accessing them on several different computers, and then I finally found one I could access it on, but the picture was so small it was hard to see what was going on. • Sometimes, especially with the video clips, I had to attempt to run them several times until they functioned properly, but that was the extent of my difficulties. • I could not get the quadratic transformer to work. My video clips would not come on all the time. • I could not save or print anything from the quadratic transformer. • Connecting to the video server. • I feel that the items need to be easy to access. • Ahhh -- the quadratic generator. And from your questionnaire -- yes should be listed first, not last as above:(• No major problems...although the initial checkouts did not go smoothly, when course time came, just about everything worked. But it did not work efficiently. For example, a small, but annoying, "feature" of the program. I logged on at pbs.org/teacherline, but when I selected the course it would always open a new window, that was always a small, dysfunctional thing that needed to be resized. An annoyance. But no more than an annoyance. I was also a bit annoyed at the discussion board software. Surely you can use something that shows perhaps three or four layers of a thread at once? • I have dial-up so the videos would have to upload periodically. • One week I couldn't access the discussion at all. It would take hours to load. I tried other sites and had no problem. One week it would not recognize my password. Called tech twice. Changed my password four times before it would work.

25 – What elements of this *Seeing Math Secondary* course took the most time? (i.e., learning the technology, time spent doing the activities, time in online discussions, etc) In your opinion, was the time well spent in terms of what you learned?

For 'Quadratic Functions' (n=16)

Q25. – What elements of course took most time?
• Reading all the comments. They were somewhat enlightening, somewhat entertaining, and somewhat useful. They varied by comment. • The online discussions because we had so many postings and you want to read them all. Delays in going from message to message added unnecessary time. • The most time was in online discussion. The time was well spent. However my home computer took along time loading the discussion board, with a DSL connection. And at work the boards were quickly accessed and we have A group server here.

Q25. – What elements of course took most time?
• Time in discussions, yes • Lesson plan at end...yes • Working the problems was valuable and worth the time. Trying to get the videos to run took the most time, but once I did get one to work, the ones of the students working was beneficial. The interview with the teachers were very helpful, but the transcript was more helpful than the video (videos of "talking heads" are not that interesting. The online discussions were somewhat helpful, but "3 replies 3 different days" over-did it. The replies became trite. • The last few activities took me a long time, and I spent a lot of time reading the discussions, however they were great discussions. • The time well spent in terms of what I learned was during the online discussions. The activities took a certain amount of time, especially the final project, but the online discussions provided great feedback for our work that we posted, and the feedback was provided by experts, people who have many years of classroom experience. Again, people who have never spent considerable time in the classroom can have all kinds of opinions about how things should go, but I will continue to value the opinions of people who work with young people in the classroom on a daily basis. See, you are getting expert opinions when your work is evaluated by other teachers in one of these online classes. I will always value the opinion of another teacher over anyone else, because we are both talking from the same reference point. • Learning the technology, but the time was well spent! • Doing the activities took the most time, but I felt that it was time well spent because I learned something from each of the activities. • The most time was spent reading, considering and responding to the posts of my classmates. The time was well spent. • Getting to the technology. • The final project • Activities for "adapt a problem" and the final project took time. The discussion board took the most time. A bit frustrating because about a third of that time was due to the discussion board software. • This course took a lot of time and was not always equally allotted. It was time well spent. • Technology

26 – What elements of the course (i.e., an activity, interactive math concept, approach to teaching) do you plan to take back to your classroom and try out with your students? Please describe what you plan to use, and how.

For 'Quadratic Functions' (n=16)

Q26. – What elements of course will you try out with your students?
• Toothpick, quadratic transformer, my class plan. I want to create a more problems-based environment coupled with student collaboration and dialogue. • I love the toothpick problem. It is such a great starter for so much discussion and a way to validate each person's diversity in seeing a different way to solve this problem. I will use this in every class from Algebra 1 to Calculus as written and with extensions to set the climate for classroom discussions. • •I will use the activity I planed in my lesson plan. I am also planning on using the questioning techniques. • Teaching approaches from discussion - group work on a regular basis, writing in class, presentations

Q26. – What elements of course will you try out with your students?
• Lesson plan (mine and others!), quad trans, • More with "alternative views" of the geometric progressions of the elements of the sequence. • I want to do more group work, use the quadratic transformer, have my student do more writing in class about the math, and try to have them make better connections between all the different ways that we represent quadratics. • My lesson plan that I submitted several days ago, emphasizing group work and group presentations is high on my list. I have never had group presentations in all of my years of teaching, so I would say this course had a huge impact on my thinking about teaching methods. I will improve my questioning techniques, and become more of a facilitator, who leads students to "discover" solutions to problem solving situations, rather than just "showing" them how to do it. And the way I show them to arrive at a solution is mine. They just might have a different method of arriving at a solution that is just as valid as mine. • The quadratic transformer will be used as the technology portion of my lesson. • I would like to teach quadratics using table, graph, and function representations and I will teach that each form of the equation (polynomial, root form, vertex form) gives different information about the graph. I would also like to try using more group work, possibly with modeling activities like the toothpick problem. • I plan to listen to my students and through judicious questioning try to understand the math as they see it through their eyes. • •I could not use Quadratic Transformer for a very long time • Quadratic transformer • Already used the toothpick problem. Already more appreciative of alternate problem-solving methods. Already using a "kinder and gentler" approach to problem-solving guidance. • I plan on taking some of the activities, math concept, and approach to teaching back to my classroom. The activities we completed in the course entailed a discovery approach, which is something that I use in my own classes. • The toothpick puzzle - exactly as used on site. Quadratic Transformer

27a – Would you recommend this course to a colleague?

For 'Quadratic Functions' (n=16)

	Count	Percent
Yes	15	94%
No	1	6%

27b – Why or why not?

For 'Quadratic Functions' (n=16)

Q27. – Why or why not?
• It reminded me of what good teaching looks like. • It was excellent, gave us good ideas into understanding that we need to find out how our students think so that we might better address their educational needs. • It was fun and I could do the work at my own pace • I feel that I gained valuable incite by discussing ideas with teachers nationally • Good course...got some good ideas from other students • Kinks listed above need to be worked out first. • I learned so much stuff that I can use with my student, and the ideas and input that I got from

Q27. – Why or why not?
the discussions was excellent. • As I mentioned before in this evaluation, I recommended this course to my dept. head, and she has a PHD in mathematics. I was so excited about what I was learning in this class that she said she was going to take it too. And she may already be registered. I was the only one in my school to take the class, and now about five others math teachers are planning on enrolling in a PBS class. They are fantastic!! • Very informative and quite interesting. • I would recommend this course to a colleague because I was able to learn more about quadratics and as a result I hope my students will have a better conceptual understanding of quadratics in the future. The activities were valuable, and the discussion was interesting and I found it very helpful to know how and what other teachers were thinking. • This class was a great forum for interacting with interested and interesting professional peers of a very high caliber. • I learned a lot. • Valuable use of my time • Increased appreciation of alternate problem solving methods. • This course was very informative and clued me in to some terminology that I was unfamiliar with along with being able to share ideas. • It was interesting and very helpful to see where I could improve and help my students.

28 – What other comments and suggestions do you have for the developers of the *Seeing Math Secondary* program?

For 'Quadratic Functions' (n=16)

Q28. – Comments and suggestions for developers of SMS
• I appreciate the efficiency, helpfulness, and courtesy of the facilitator. • Keep up the good work- I hope to find and take several more classes in this series. • You might change the details for Algebra 1 classes verses Algebra 2. The quadratic equations are used and investigated at different levels in each class • I would like to see the discussion board load more quickly. Great involvement from facilitator. Thank you. • ? • Have a component on adapting existing materials (e.g. adopted textbooks we have to live with for 7 years before adopting newer ones!) in order to incorporate "visualizing" ideas. • Great class • I already mentioned them several times in the other answer sections. Rubric development for group evaluation and group classroom presentations are essential. I have never evaluated group work or group presentations, but this course has convinced me to include both in my curriculum, so now I must learn how to evaluate such work. (Rubrics are the key) • This was a wonderful class!! • Possibly adding more topics like trigonometry or proportional reasoning. • I think that the major assignment(s) during week 5 should maybe be done over a two-week period instead of one. • None • Make the quadratic transformer easier to access. • I was going to say that the focus on the course goals drifted. But after reviewing the goals I recognize that it was my own problem. The teaching methodology aspects were of great help to me, but the quadratic understanding (in and of itself) I was pretty comfortable with. But I'm the oddball in this class--the engineer and sometime teacher--so my experience is not

Q28. – Comments and suggestions for developers of SMS
necessarily reflective of a problem with the course design. • I really enjoyed this class!!! • None

Appendix B:
Teacher Background Data from the Quantitative Evaluation

(1) Teacher Background Data

Figure 2. Have you taken an online course before?

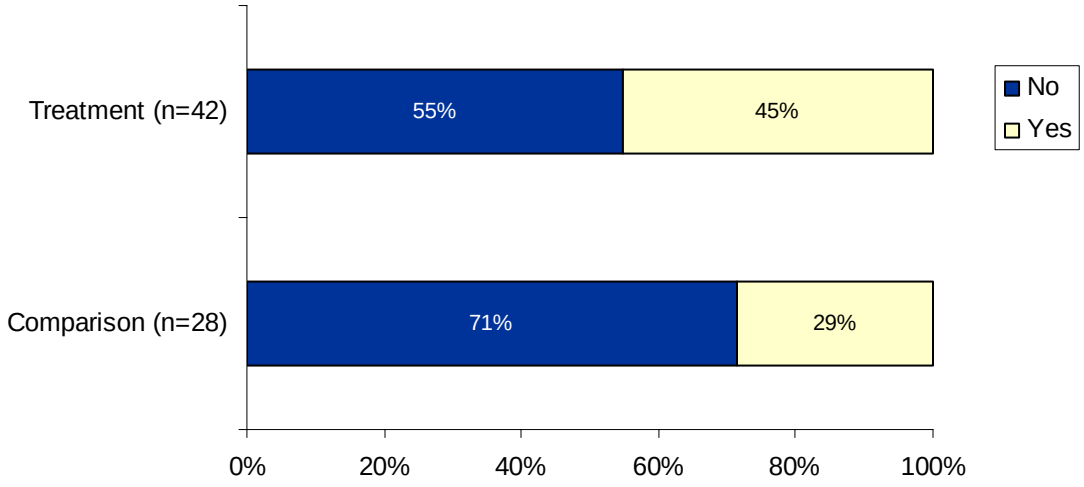


Figure 3. Have you taken an online TeacherLine course before?

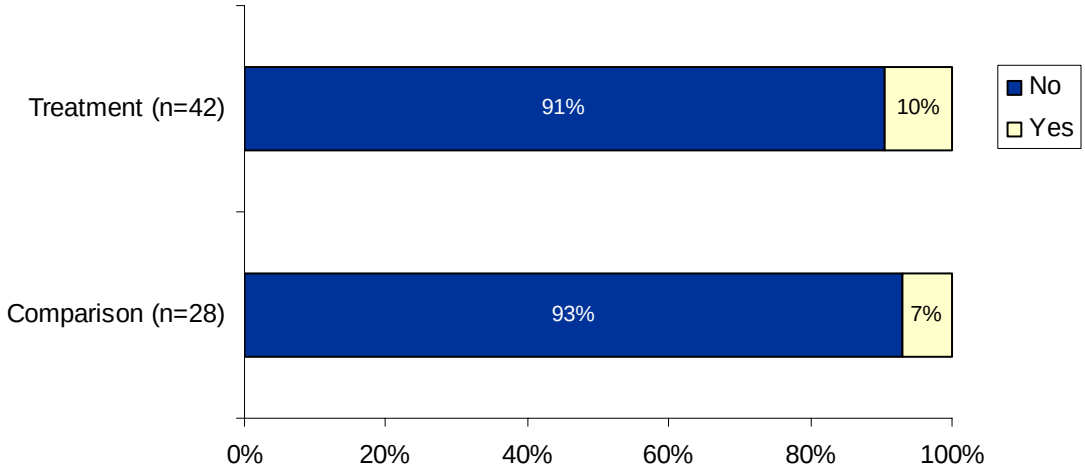


Table 13. Please indicate your race/ethnicity:

Group	n	American Indian/Alaskan	Asian	Black	Hispanic	White
Treatment	42	2.4%	2.4%	7.1%	0.0%	88.1%
Comparison	28	0.0%	10.7%	10.7%	10.7%	67.9%
Total	**70**	**1.4%**	**5.7%**	**8.6%**	**4.3%**	**80.0%**

Figure 4. Please indicate your gender:

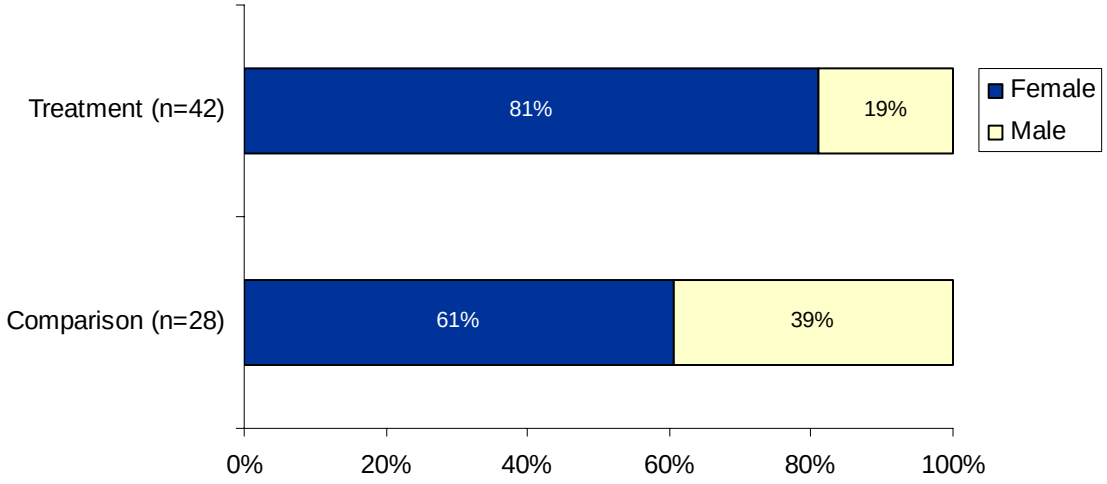


Table 14. What best describes your current position?

Group	n	Middle school math teacher	High school math teacher	Other
Treatment	42	54.8%	45.2%	0.0%
Comparison	28	60.7%	35.7%	3.6%
Total	**70**	**57.1%**	**41.4%**	**1.4%**

Figure 5. Are you currently a certified teacher?

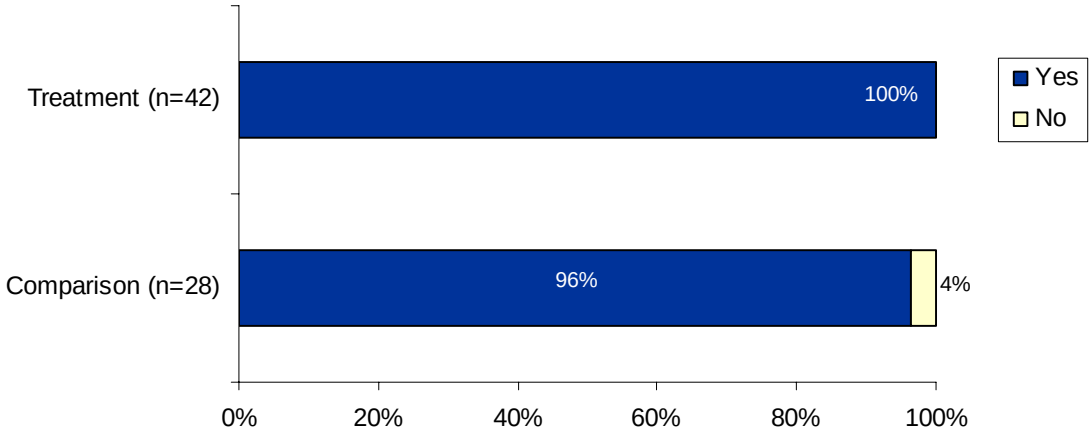


Table 15. How many years have you taught at the K-12 level prior to this school year?

Group	n	Min	Max	Mean	Standard Deviation
Treatment	42	1	34	10.1	8.5
Comparison	28	1	28	11.9	7.5
Total	**70**	**1**	**34**	**10.8**	**8.1**

Table 16. How many years have you taught math prior to this school year?

Group	n	Min	Max	Mean	Standard Deviation
Treatment	42	1	30	9.1	7.5
Comparison	28	1	28	11.3	7.4
Total	**70**	**1**	**30**	**10.0**	**7.5**

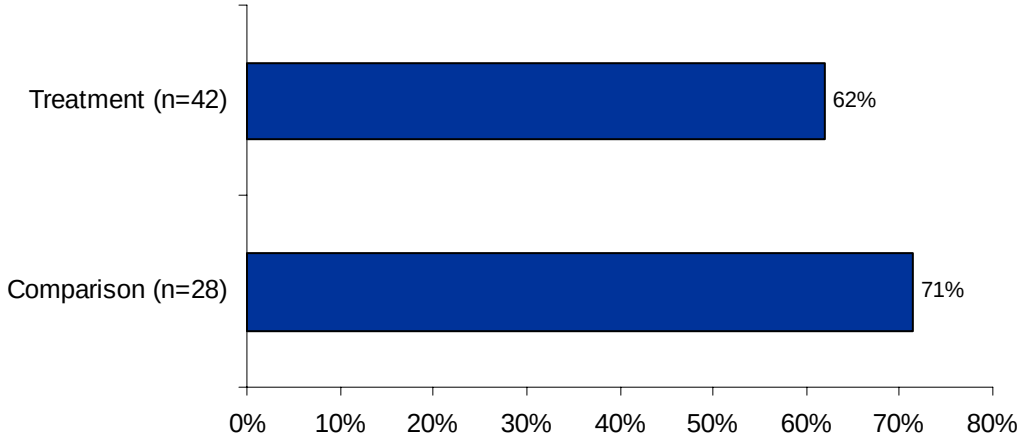
Table 17. How familiar are you with NCTM Standards?

Group	n	Not at all familiar	Somewhat familiar	Fairly familiar	Very familiar
Treatment	42	2.4%	23.8%	54.8%	19.0%
Comparison	28	0.0%	50.0%	28.6%	21.4%
Total	**70**	**1.4%**	**34.3%**	**44.3%**	**20.0%**

Table 18. Please indicate your highest degree from the following list:

Group	n	Bachelor's degree	Bachelors degree + additional courses	Master's degree	Masters degree + additional courses
Treatment	42	7.1%	33.3%	11.9%	47.6%
Comparison	28	10.7%	50.0%	7.1%	32.1%
Total	**70**	**8.6%**	**40.0%**	**10.0%**	**41.4%**

Figure 6. Participants holding degrees (any level) in Mathematics or Mathematics Education



(2) Student Background Data

Figure 7. Student Gender by Group

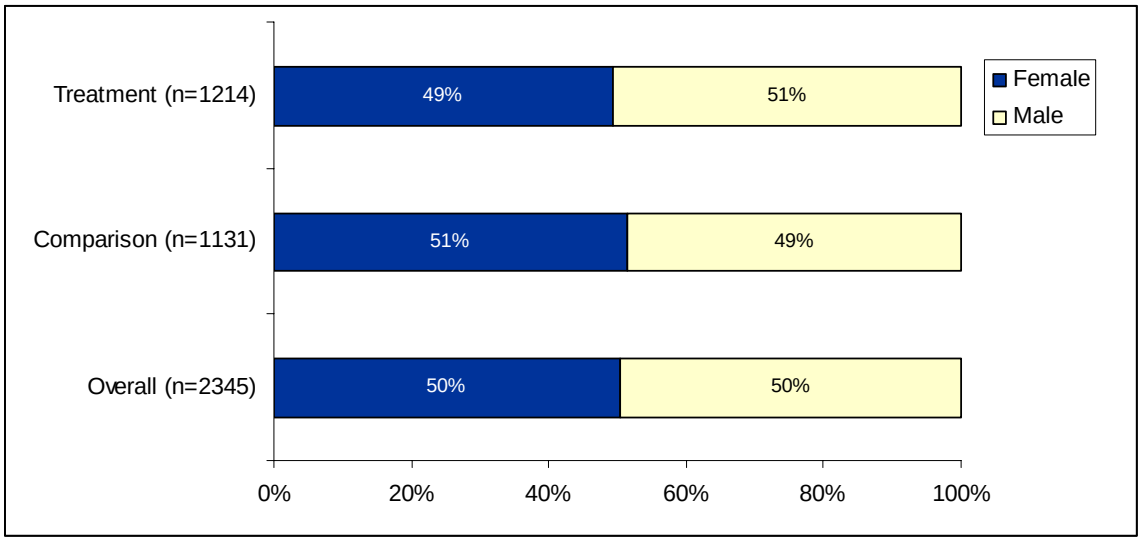


Table 19. Student Ethnicity by Group

Group	n	American Indian	Asian	African American	Hispanic	Caucasian
Treatment	1196	1.8%	4.1%	8.8%	26.9%	58.4%
Comparison	1103	1.4%	3.7%	7.6%	23.5%	63.8%
Overall	**2299**	**1.6%**	**3.9%**	**8.2%**	**25.3%**	**61.0%**

Table 20. Student Grade Level by Group

Group	n	6th Grade	7th Grade	8th Grade	9th Grade	10th Grade	11th Grade	12th Grade
Treatment	1234	0.2%	10.7%	41.8%	40.2%	5.5%	1.1%	0.5%
Comparison	1234	1.8%	10.6%	48.5%	35.2%	2.8%	0.8%	0.2%
Overall	**2468**	**1.0%**	**10.7%**	**45.2%**	**37.7%**	**4.2%**	**0.9%**	**0.4%**

Figure 8. Student Gender by Cohort

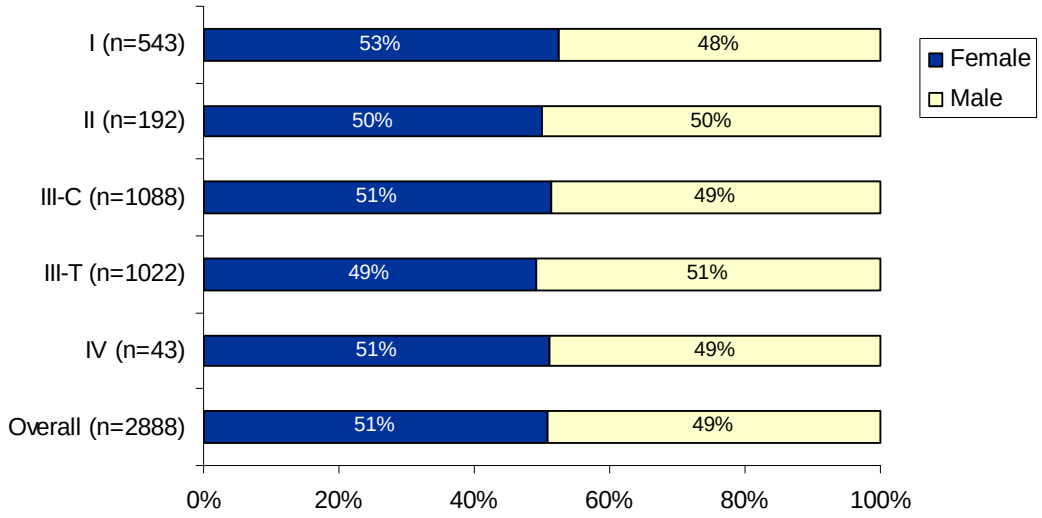


Table 21. Student Ethnicity by Cohort

Cohort	n	American Indian	Asian	African American	Hispanic	Caucasian
I	565	4.2%	1.9%	4.6%	11.0%	78.2%
II	187	1.1%	10.7%	4.3%	25.1%	58.8%
III-C	1064	1.3%	3.8%	7.9%	24.2%	62.8%
III-T	1009	2.0%	2.9%	9.6%	27.3%	58.3%
IV	39	2.6%	2.6%	0.0%	2.6%	92.3%
Overall	**2864**	**2.1%**	**3.5%**	**7.5%**	**22.5%**	**64.4%**

Table 22. Student Grade Level by Cohort

Cohort	n	6th Grade	7th Grade	8th Grade	9th Grade	10th Grade	11th Grade	12th Grade
I	567	0.0%	13.6%	39.3%	44.6%	1.8%	0.5%	0.2%
II	195	0.0%	12.3%	42.6%	34.4%	8.2%	2.6%	0.0%
III-C	1175	1.9%	11.1%	47.7%	35.7%	2.8%	0.7%	0.2%
III-T	1039	0.3%	10.4%	41.7%	41.3%	5.0%	0.8%	0.6%
IV	59	0.0%	0.0%	66.1%	25.4%	3.4%	3.4%	1.7%
Overall	**3035**	**0.8%**	**11.2%**	**44.1%**	**39.0%**	**3.7%**	**0.9%**	**0.3%**

Appendix C:
Pre/Post Test Results

(1) Teacher Survey Results

Table 23. Balanced Assessment Pre-Test Means

Sub-Scale	Group	n	Min	Max	Mean	Standard Dev.
Modeling/ Formulating	Comparison	28	3	18	11.1	3.7
	Treatment	42	1	22	11.6	4.0
	Total	**70**	**1**	**22**	**11.4**	**3.9**
Transformation/ Manipulation	Comparison	28	2	35	23.8	8.0
	Treatment	42	0	36	24.7	7.8
	Total	**70**	**0**	**36**	**24.3**	**7.8**
Inferring/ Drawing Conclusions	Comparison	28	4	33	20.9	7.6
	Treatment	42	2	33	19.2	7.5
	Total	**70**	**2**	**33**	**19.9**	**7.5**
Communicating	Comparison	28	5	44	24.8	9.1
	Treatment	42	2	43	27.0	9.3
	Total	**70**	**2**	**44**	**26.1**	**9.2**
Total (sum of all sub-scales)	Comparison	28	14	119	80.5	24.7
	Treatment	42	5	129	82.5	25.8
	Total	**70**	**5**	**129**	**81.7**	**25.2**

Table 24. Balanced Assessment Post-Test Means

Sub-Scale	Group	n	Min	Max	Mean	Standard Dev.
Modeling/ Formulating	Comparison	28	7	20	12.3	4.1
	Treatment	42	6	20	13.6	3.4
	Total	**70**	**6**	**20**	**13.0**	**3.7**
Transformation/ Manipulation	Comparison	28	7	35	26.4	7.7
	Treatment	42	7	38	27.1	6.4
	Total	**70**	**7**	**38**	**26.8**	**6.9**
Inferring/ Drawing Conclusions	Comparison	28	7	36	22.7	7.3
	Treatment	42	11	38	25.6	6.5
	Total	**70**	**7**	**38**	**24.4**	**6.9**
Communicating	Comparison	28	11	44	25.4	8.0
	Treatment	42	14	38	28.2	6.4
	Total	**70**	**11**	**44**	**27.1**	**7.1**
Total (sum of all sub-scales)	Comparison	28	32	131	86.8	24.7
	Treatment	42	45	125	94.4	19.9
	Total	**70**	**32**	**131**	**91.4**	**22.1**

Table 25. Balanced Assessment Gains (difference between post-test and pre-test)

Sub-Scale	Group	n	Min	Max	Mean	Standard Dev.
Modeling/ Formulating	Comparison	28	-3	6	1.2	2.4
	Treatment	42	-4	9	2.0	3.5
	Total	**70**	**-4**	**9**	**1.6**	**3.1**
Transformation/ Manipulation	Comparison	28	-7	13	2.6	5.2
	Treatment	42	-6	15	2.5	5.4
	Total	**70**	**-7**	**15**	**2.5**	**5.3**
Inferring/ Drawing Conclusions	Comparison	28	-9	12	1.8	6.0
	Treatment	42	-7	24	6.4	6.5
	Total	**70**	**-9**	**24**	**4.5**	**6.7**
Communicating	Comparison	28	-9	14	0.6	5.7
	Treatment	42	-11	24	1.2	7.4
	Total	**70**	**-11**	**24**	**1.0**	**6.8**
Total (sum of all sub-scales)	Comparison	28	-16	36	6.3	14.2
	Treatment	42	-16	71	12.0	18.8
	Total	**70**	**-16**	**71**	**9.7**	**17.2**

Table 26. Standard Grading Pre-Test Means

Sub-Scale	Group	n	Min	Max	Mean	Standard Dev.
Linear Functions	Comparison	28	5	35	24.3	7.0
	Treatment	42	0	38	25.5	7.8
	Total	**70**	**0**	**38**	**25.0**	**7.5**
Transformation of LF	Comparison	28	4	37	24.5	8.2
	Treatment	42	1	40	26.3	9.0
	Total	**70**	**1**	**40**	**25.6**	**8.7**
Linear Equations	Comparison	28	1	20	12.8	5.4
	Treatment	42	0	19	12.1	4.9
	Total	**70**	**0**	**20**	**12.4**	**5.1**
Part C	Comparison	28	0	20	10.6	6.4
	Treatment	42	0	21	9.9	6.2
	Total	**70**	**0**	**21**	**10.2**	**6.3**
Total (sum of all sub-scales)	Comparison	28	10	107	72.1	23.0
	Treatment	42	3	113	73.8	23.8
	Total	**70**	**3**	**113**	**73.1**	**23.3**

Table 27. Standard Grading Post-Test Means

Sub-Scale	Group	n	Min	Max	Mean	Standard Dev.
Linear Functions	Comparison	28	11	37	27.0	7.3
	Treatment	42	12	37	26.5	5.4
	Total	**70**	**11**	**37**	**26.7**	**6.2**
Transformation of LF	Comparison	28	8	37	25.7	8.0
	Treatment	42	13	40	29.3	6.8
	Total	**70**	**8**	**40**	**27.9**	**7.5**
Linear Equations	Comparison	28	3	20	13.9	4.7
	Treatment	42	2	20	13.7	4.3
	Total	**70**	**2**	**20**	**13.8**	**4.4**
Part C	Comparison	28	0	25	11.5	7.1
	Treatment	42	2	26	15.1	6.2
	Total	**70**	**0**	**26**	**13.6**	**6.8**
Total (sum of all sub-scales)	Comparison	28	25	113	78.0	23.4
	Treatment	42	37	114	84.6	18.4
	Total	**70**	**25**	**114**	**82.0**	**20.6**

Table 28. Standard Grading Gains (difference between post-test and pre-test)

Sub-Scale	Group	n	Min	Max	Mean	Standard Dev.
Linear Functions	Comparison	28	-7	12	2.7	5.4
	Treatment	42	-7	26	1.1	7.5
	Total	**70**	**-7**	**26**	**1.7**	**6.8**
Transformation of LF	Comparison	28	-9	9	1.2	4.7
	Treatment	42	-10	17	3.0	5.9
	Total	**70**	**-10**	**17**	**2.3**	**5.5**
Linear Equations	Comparison	28	-10	10	1.1	4.0
	Treatment	42	-5	12	1.6	3.7
	Total	**70**	**-10**	**12**	**1.4**	**3.8**
Part C	Comparison	28	-8	14	0.9	5.1
	Treatment	42	-7	20	5.2	6.3
	Total	**70**	**-8**	**20**	**3.5**	**6.2**
Total (sum of all sub-scales)	Comparison	28	-13	29	5.9	11.8
	Treatment	42	-16	62	10.8	16.8
	Total	**70**	**-16**	**62**	**8.8**	**15.1**

(2) Student Survey Results

Table 29. Student Pre-Test Means by Group

Scale	Group	n	Min	Max	Mean	Standard Dev.
Overall	Comparison	1234	201.0	274.0	242.0	9.6
	Treatment	1234	194.0	279.0	239.4	11.1
	Total	**2468**	**194.0**	**279.0**	**240.7**	**10.4**
Target	Comparison	1234	211.1	284.9	242.7	11.4
	Treatment	1234	211.1	285.1	240.2	12.3
	Total	**2468**	**211.1**	**285.1**	**241.5**	**11.9**
Non-Target	Comparison	1234	212.9	275.9	242.0	10.9
	Treatment	1234	212.9	275.9	239.5	11.4
	Total	**2468**	**212.9**	**275.9**	**240.8**	**11.2**

Table 30. Student Post-Test Means by Group

Scale	Group	n	Min	Max	Mean	Standard Dev.

Overall	Comparison	1234	198.0	283.0	240.8	12.0
	Treatment	1234	187.0	283.0	239.8	12.7
	Total	**2468**	**187.0**	**283.0**	**240.3**	**12.3**
Target	Comparison	1234	207.5	280.4	243.2	12.8
	Treatment	1234	207.5	292.2	242.0	13.6
	Total	**2468**	**207.5**	**292.2**	**242.6**	**13.3**
Non-Target	Comparison	1234	213.6	277.4	238.7	14.2
	Treatment	1234	213.6	277.4	238.2	14.3
	Total	**2468**	**213.6**	**277.4**	**238.4**	**14.3**

Table 31. Student Gains by Group

Scale	Group	n	Min	Max	Mean	Standard Dev.
Overall	Comparison	1234	-44.0	48.0	-1.2	12.2
	Treatment	1234	-65.0	60.0	0.5	13.2
	Total	**2468**	**-65.0**	**60.0**	**-0.4**	**12.7**
Target	Comparison	1234	-48.9	48.7	0.5	13.8
	Treatment	1234	-74.7	65.6	1.8	14.6
	Total	**2468**	**-74.7**	**65.6**	**1.2**	**14.2**
Non-Target	Comparison	1234	-50.1	51.5	-3.3	16.3
	Treatment	1234	-53.9	61.5	-1.3	16.3
	Total	**2468**	**-53.9**	**61.5**	**-2.3**	**16.3**

Table 32. Student Pre-Test Means by Cohort

Scale	Cohort	n	Min	Max	Mean	Standard Dev.
Overall	I	567	209.0	277.0	241.6	9.3
	II	195	194.0	279.0	239.2	12.6
	III-C	1175	201.0	274.0	242.2	9.4
	III-T	1039	194.0	275.0	239.4	10.7
	IV	59	211.0	262.0	238.4	12.2
	Overall	**3035**	**194.0**	**279.0**	**240.9**	**10.2**
Target	I	567	211.1	275.2	242.3	11.0
	II	195	211.1	285.1	240.4	13.1
	III-C	1175	211.1	284.9	242.9	11.4
	III-T	1039	211.1	277.6	240.2	12.2
	IV	59	219.4	267.0	238.4	11.1
	Overall	**3035**	**211.1**	**285.1**	**241.6**	**11.8**
Non-Target	I	567	212.9	275.9	241.3	10.3
	II	195	212.9	275.9	238.9	12.0
	III-C	1175	212.9	275.9	242.1	10.8
	III-T	1039	212.9	275.5	239.6	11.3

	IV	59	216.8	267.4	240.3	13.0
	Overall	**3035**	**212.9**	**275.9**	**240.9**	**11.0**

Table 33. Student Post-Test Means by Cohort

Scale	Cohort	n	Min	Max	Mean	Standard Dev.
Overall	I	567	203.0	283.0	242.1	11.6
	II	195	187.0	283.0	239.9	14.3
	III-C	1175	198.0	283.0	241.0	11.9
	III-T	1039	208.0	283.0	239.8	12.3
	IV	59	211.0	274.0	237.4	13.1
	Overall	**3035**	**187.0**	**283.0**	**240.7**	**12.2**
Target	I	567	207.5	280.4	245.1	12.4
	II	195	207.5	292.2	241.8	15.8
	III-C	1175	207.5	280.4	243.4	12.7
	III-T	1039	207.5	280.4	242.1	13.2
	IV	59	207.5	280.4	239.1	15.1
	Overall	**3035**	**207.5**	**292.2**	**243.1**	**13.1**
Non-Target	I	567	213.6	277.4	239.1	14.2
	II	195	213.6	274.4	238.5	14.8
	III-C	1175	213.6	277.4	238.9	14.2
	III-T	1039	213.6	277.4	238.1	14.3
	IV	59	213.6	264.8	236.3	13.4
	Overall	**3035**	**213.6**	**277.4**	**238.6**	**14.3**

Table 34. Student Gains by Cohort

Scale	Cohort	n	Min	Max	Mean	Standard Dev.
Overall	I	567	-50.0	43.0	0.6	13.6
	II	195	-65.0	60.0	0.7	15.9
	III-C	1175	-44.0	48.0	-1.2	12.2
	III-T	1039	-41.0	41.0	0.4	12.6
	IV	59	-28.0	30.0	-1.0	12.5
	Overall	**3035**	**-65.0**	**60.0**	**-0.2**	**12.9**
Target	I	567	-44.5	47.7	2.8	15.5
	II	195	-74.7	65.6	1.5	17.2
	III-C	1175	-48.9	48.7	0.5	13.8
	III-T	1039	-58.1	57.9	1.9	14.0
	IV	59	-26.7	42.5	0.7	13.8
	Overall	**3035**	**-74.7**	**65.6**	**1.5**	**14.5**
Non-Target	I	567	-52.3	56.7	-2.2	16.7
	II	195	-46.9	61.5	-0.5	17.3
	III-C	1175	-50.1	51.5	-3.2	16.3

	III-T	1039	-53.9	49.9	-1.5	16.1
	IV	59	-46.9	22.3	-4.0	16.2
	Overall	**3035**	**-53.9**	**61.5**	**-2.3**	**16.4**

Appendix D:
Ready to Teach Teacher Post-Test

Ready to Teach

Teacher Post-Test: Linear Package

July 21, 2004

It's summer and you have a test to take! :-)

Enclosed please find the Ready to Teach Post-Test, which covers the content of the Ready to Teach Linear course you completed this spring. Please take the Post-Test at your convenience, during the next few weeks, if possible.

Your test results will be used only for statistical research purposes. All data collected will be stored in a secure location, and kept completely confidential. Your name and identifying information will not be disclosed or referenced in any way.

We expect that this test will take between 1 and 2 hours. Answer the questions in any order you like, and spend no more than 2 hours on this test (don't worry if you don't complete it). You may use scratch paper, graph paper, and a calculator (not a graphing calculator). However, we'd like to discourage you from discussing the test with others, showing anyone the problems afterwards, or using it with your students. Thanks!

Return the test and your answers, including any notes or scratch paper showing your work, in the enclosed envelope. If you have any questions, please feel free to e-mail or call me at the number and address below.

Thank you for your participation in our research. Enjoy the rest of your summer!

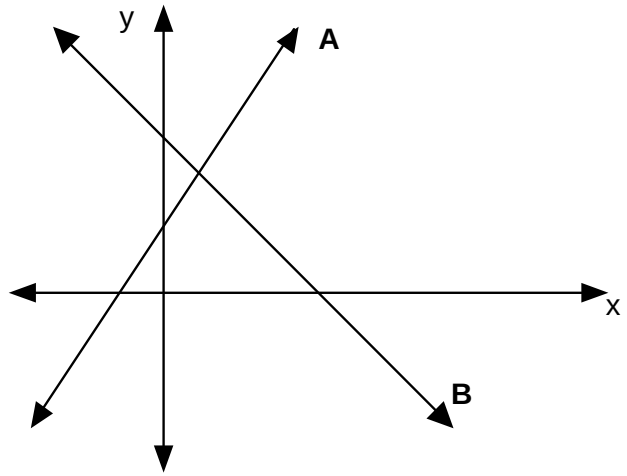
Dr. Shari Metcalf
Research Associate
shari@concord.org
978-371-5854

Name: _____ Date: _____

Linear functions

PART A.

Use the figure below to answer questions 1-6



1. What could an expression *f(x)* be for the function whose graph is A? for the function *g(x)* whose graph is B?

   A.

   B.

Based on the functions you have just defined above, answer the following questions 2-6.

2. What is the slope of function A and why? of function B and why?

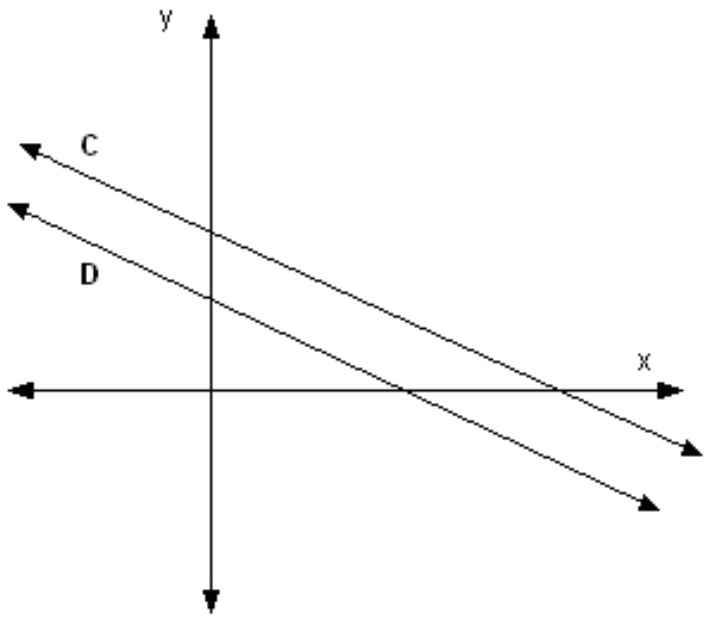
3. What is the *y*-intercept of the graph of function A? of the graph of function B?

4. What is the *x*-intercept of the graph of function A? of the graph of function B?

5. What are the coordinates of the point where functions whose graphs are A and B intersect? Please explain how you initially figured that out.

6. What equation could the above figure represent?

7. Can you write one equation representing lines C and D shown in the following figure? Why or why not?



PART B.

Making choices: Bagels or Donuts? [1]

Your school has offered you an opportunity to run a breakfast concession in the cafeteria. You will be allowed to sell either bagels or donuts, but not both. Your market research indicates that students would buy the same quantity of either product at your planned selling price of 50 cents each. Therefore your choice of which item to sell will depend upon which you can obtain at a lower cost.

Your bagel supplier requires that you make a $200.00 initial payment to cover franchise fees and delivery costs for the rest of the school year. After that, you can buy as many bagels as desired at a cost of 12 cents per bagel. On the other hand, you can purchase donuts with no initial charge, at a cost of 30 cents each for the first 500 donuts, and 20 cents for each additional donut.

1. Write a formula that describes the total cost of buying a given number of bagels.

2. Write a formula that describes the total cost of buying a given number of donuts.

3. Sketch the graphs of these two functions using the same set of axes.

[1] Adapted from Balanced Assessment in Mathematics Project
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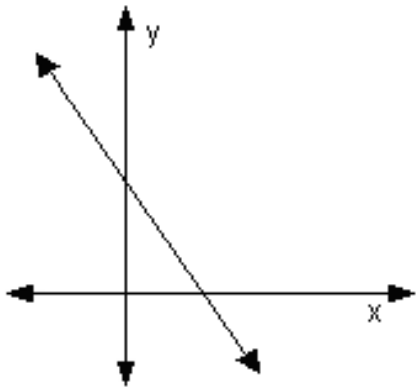
4. From your graphs in question 3, how could you tell at what level of sales a bagel business and a donut business would be equally profitable?
[Do not bother to calculate a numerical solution]

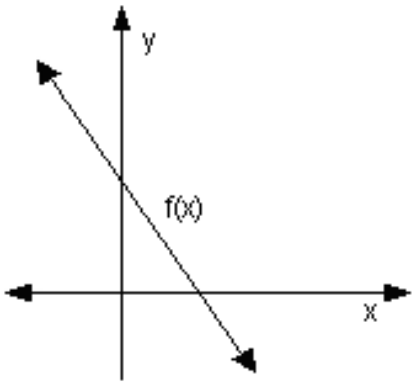
Transformation of Linear Functions

PART A.

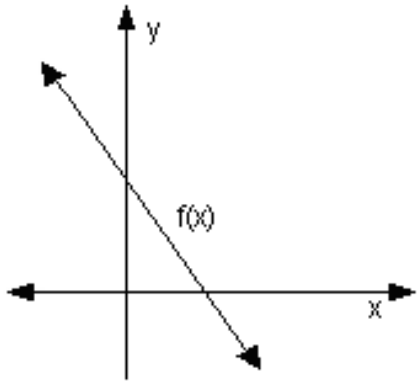
1. The graph of a function *f* where $f(x) = mx + b$ {m ? 0 and b ? 0}, is shown below:



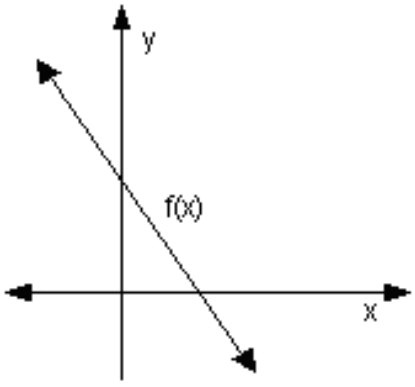
a. Using the same *f* sketch the graph of $f(x)+a$, where a > 0
b. Using the same *f* sketch the graph of $f(x+a)$, where a > 0
c. Using the same *f* sketch the graph of $f(-x)$
d. Using the same *f* sketch the graph of $-f(x)$



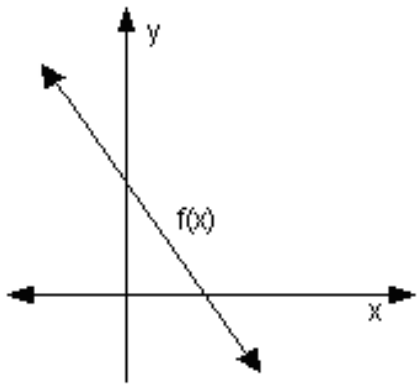
a.



(b)



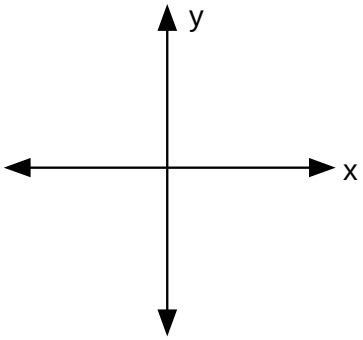
(c)



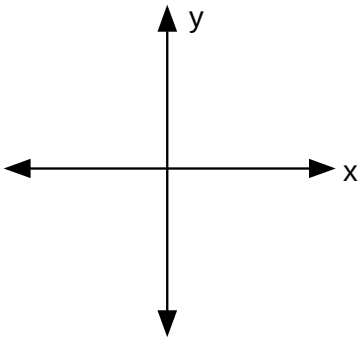
(d)

2.

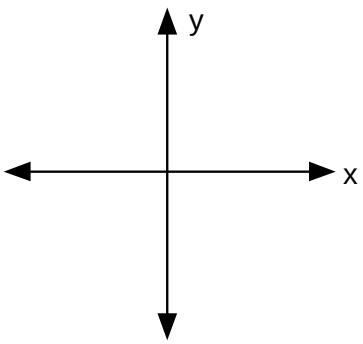
a. Write an expression for a linear function that lies *only* in quadrants I, II, & III.
Sketch the graph of your function.



b. If you were to reflect the function in (a) across the x-axis so that it lies *only* in quadrants II, III, & IV, what would the expression of the new function be?
Sketch the graph of your new function.



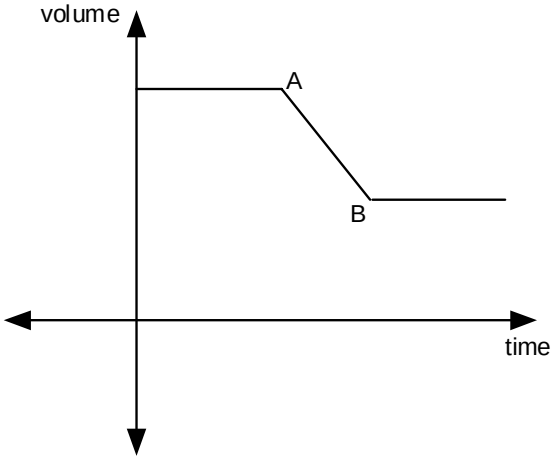
c. Write an expression for a linear function that lies only in quadrants I and III. Sketch the graph of your function.



PART B.

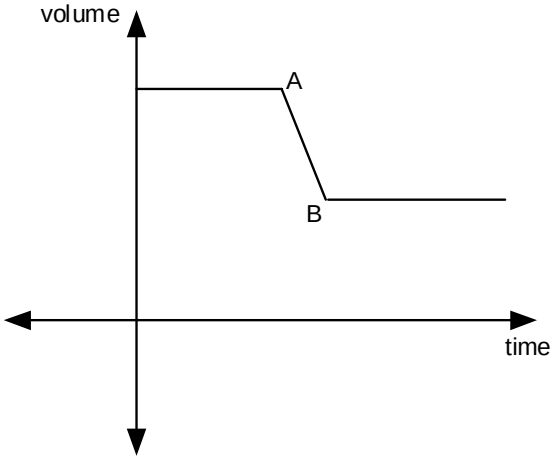
Water tank

A water tank starts to leak. It loses water at a steady rate until a plumber fixes the leak. Here is a graph of the volume of water in the tank as a function of time:

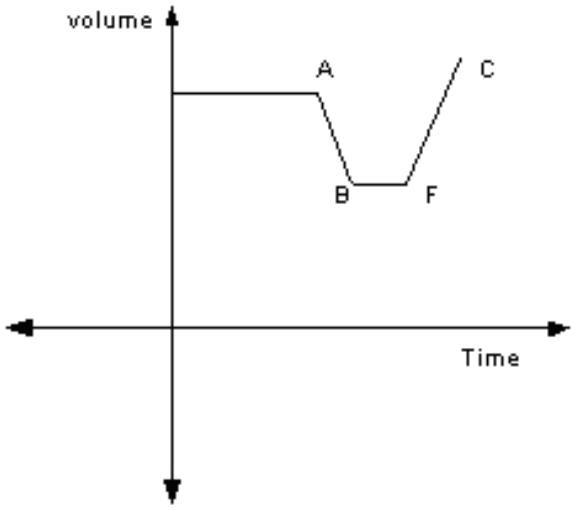


1. Within the water tank context, describe the meanings of the vertical and horizontal coordinates of the points labeled A and B.

2. Suppose the graph of the volume of water in the tank as function of time looked like the graph below. [Assume the vertical and horizontal scales of the graph are the same as in question 1.] Now describe the meanings of the corresponding points A and B in the graph below as compared to points A and B of the above graph.



3. Suppose the graph of the water level in the tank looked like the graph below. What meaning might you give the points A, B, F, and C? What meaning might you give to the segments AB, BF, and FC?



4. Please write a symbolic expression that could correspond to the graph given in question 3.

Linear Equations

PART A.

1. Given the equation $9(x + 1) = 2x + d$,

   a. Find a value for *d* such that 2 is a solution to the resulting equation.

   b. Use the value of d that you found in part (a) above to see graphically if 2 is a solution to the above equation. Treating the left and right-hand expression as linear functions, what do you expect as the coordinates of the intersection point of the two linear functions?

2. Given that you solved the equation in 1 (a) above, please find a value for each of a, b, c and d so that $x = 2$ solves the equation

   $a(x + b) = cx + d$

PART B.

1. Two people, Alex and Ruth, are arguing about what one is permitted to do to both sides of the equation

   $7x + 2 = 3x - 1$

   Alex claims it is legitimate to multiply both sides of the equation by x. Ruth claims it is not. Who do you agree with and why?

2. For given non-zero values for a, b, and d, Lisa tried to solve the equation: $a\,x + 4 = b\,x + d$, and found that the equation has no solution. What values could a, b, and d have for this to be true?

PART C
(Linear Package: Linear Functions, Transformations on Linear Functions, and Linear Equations).

1. Please give examples of two questioning strategies that you might use with your students to reveal their thinking and to help build their understanding of Linear Functions and/or of Linear Equations.

2. How would you distinguish between the use of letters as unknowns versus the use of letters as variables? Please give an example of each.

3. Research-based literature reports how functions may be regarded at times as mathematical objects and other times as processes. Please describe how knowing the difference between using a function as an object and a function as a process may help you as a classroom teacher. Give an example of a task where operating on a function as an object is more beneficial (and perhaps efficient) than operating on the function as a process.

4. By observing students (either in the classroom or through well-designed videos) solve problems related to functions or equations one develops insights into the learning process and eventually tries using this knowledge to support teaching the related topic. Please describe an observation experience, the insights you gained, and what you have done to improve your teaching based on this insight.

5. You may have used computers or calculators to support the development of mathematical concepts related to linear functions, transformations, and related equations. Can you give specific examples as to what concepts you may have learned or may have understood better from using such technology?

6. Some claim that **"we need to teach algebra from a function perspective"**. What does this mean? What is your position regarding this issue? And how did your position evolve? Please elaborate.

a. What does this mean?

b. What is your position regarding this issue?

c. How did your position evolve

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Thank you for your participation in this test.