

*Running Head:* CLASSROOM BLOGGING

Classroom Blogging in the Service of Student-Centered Learning: A Comparative Case  
Study of Two High School Teachers' Use of Blogs

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**Abstract**

This case-study of two classroom blogs (chronologically-organized series of web-based entries focused on classroom learning) illuminates the ways in which blogs can be used to strengthen and transform classroom learning. By using blogging as both an extension and enrichment to classroom practices, student learning in these classes was more individualized, relationships between students and significant others (including teachers) were nurtured, and students were given new ways to interact with the concepts and their community that are uncommon in many classrooms. Consideration across the two cases illuminated specific structures of classroom blogging use that can lead to more engaged and in-depth student participation.

## Introduction

Though calls for reform emphasize the importance of student-centered learning that engages the individual student in constructing her own understanding through active participation in a learning community (e.g. National Research Council, 1996), implementing these recommendations is very challenging for even classroom teachers committed to this pedagogical approach. The increased burdens of standards-based accountability initiatives such as those resulting from the “No Child Left Behind” legislation have further exacerbated these challenges (Settlage and Meadows, 2002). Reform-minded teachers committed to student-centered learning need support in accomplishing their pedagogical goals. New media literacies and tools such as blogging may offer classroom teachers this type of support.

New forms of media literacies have been argued to have unique affordances as they are the result of a dramatic shift in the way our culture works and thinks and what we are coming to value (Lankshear & Knobel, 2006). Specifically this new shift in thinking emphasizes tools for mediating and relating as opposed to tools for producing; focuses on collective intelligence as opposed to individual intelligence; and realizes and values expertise and authority that are distributed as opposed to expertise that is “located” in the individual (Lankshear & Knobel, 2006). Blogging as a form of participation and as a tool with unique affordances are outcomes of this new mindset.

A blog is a frequently-updated personal online space (a type of web page) where an author publishes a series of posts, engages others in discussion about her posts, and collects and shares resources. These posts are searchable by categories and archived sometimes over a long period of time usually in reverse chronological order thus presenting the most recent work first (Nardi, Schiano, & Gumbrecht, 2004). Specifically, in this paper, we define “classroom blogs” as blogs that are managed by a teacher for her/his students to post their work, ideas and questions and allow, even welcome, peers, parents, experts and others outside the classroom walls to engage with their work.

The activity of blogging, due to its context and features, has been argued to offer bloggers (the owners/writers of the blogs) access to a number of potentially valuable learning resources (e.g. Luehmann, under review). A number of authors who have

written about the educational value of blogging described the following affordances of blogging:

- The long-term and ongoing access of blog posts makes materials available for subsequent reflection and analysis, allowing for students to revise their work, thus enriching the learning experience (Downes, 2004; Ferdig & Trammell, 2004)
- The structure of blogging encourages and enables the integration of other resources (often web-based) which complexifies, in potentially valuable ways, the task of reflection. Hyperlinks stretch outward into the web and bring news stories, comments, pictures and other content to a student's own composition (Ferdig & Trammell, 2004). In this way, students are involved in reading, critiquing, comparing and contrasting and thus situating their own work within a larger discussion (Downes, 2004).
- Blogs offer a venue (activity and availability) to extend classroom discussions outside the classroom which has led to increased interaction between students (Weiler, 2003). One teacher blogger argues that his students' understanding of the material and "their personal relationship with it occurred outside of the classroom in the Web log," (Richardson, 2003b, p.40).
- Classroom blogs which encourage (perhaps require) students to read and critique each other's posts have been argued to lead to "deeper and more meaningful interaction than previously afforded during individual journaling," (Poling, 2005, p.14).
- Classroom blogs are often public, thus making student work available for comment and critique by a much broader audience than the teacher. Awareness of an audience larger than the teacher can lead to increased student motivation to produce quality work with respect to content, clarity, and editorial components of their compositions (Carlson, 2003; Downes, 2004; Martindale & Wiley, 2004). The public nature of the blog also allows students to target and craft their writing for different audiences (Carlson, 2003). One teacher writes that interactions with "outside voices" that shared in class discussions led to a more in-depth understanding of the content.

Though these arguments are persuasive in articulating the potential of classroom blogs to support student-centered learning, empirical evidence is needed to explore specific cases of K-12 teachers using this tool and the corresponding benefits and limitations realized by these classes. This study contributes to the existing literature by offering an in-depth, empirical consideration of the use and value of two classroom blogs – one managed by a veteran math teacher and another by a first-year biology teacher - through a case study approach. As such, this study will also show that the affordances offered by classroom blogs will depend significantly on how teachers structure the use of their blog.

### **Methods**

The two blogs examined in this study were chosen as a result of an extensive search for classroom blogs, using five popular search engines, which resulted in the identification of 17 blogs. Of these 17 classroom blogs, four met the pre-defined selection criteria: 1) managed by a high school teacher; 2) posted to frequently (at least three times a week); 3) represented a dominant student presence (more posts authored by students than the teacher), and 4) publicly available. Two of the four teachers who managed these blogs were available to be interviewed, and thus, these two blogs became the focus of this case study. The first blog is a Biology blog managed by a first-year classroom teacher (Ms. T) who used classroom blogs with each of her four different mixed ability Living Environment classes. The second blog is a pre-Calculus blog, managed by a veteran teacher (Mr. K.). Mr. K used this blog with his eleventh grade Pre-Calculus class, but he also has separate blogs for his two other classes, Pre-Calculus (10<sup>th</sup> grade) and AP Calculus as well as one he uses to reflect more generally on his math teaching.

#### *Data Collection and Analysis.*

The teacher bloggers were interviewed with respect to the specific ways they used their blogs to support classroom learning and their rationale for selecting these uses. The interview with Mr. K was conducted on the computer through a program called Skype ([www.skype.com](http://www.skype.com)) on January 12<sup>th</sup>, 2006. Skype allows one to make free long-distance calls though a cable modem. The type of interview was beneficial because Mr. K could direct the interviewer to specific pages on his classroom blog or personal blog to further

his points on certain topics. This allowed him to give specific concrete example to back up his thoughts and ideas. The interview with Ms. T was conducted in person on January 17<sup>th</sup>, 2006. Meeting in person allowed for a more free flowing conversation due to both the interviewer's ability to read her body language and hand gestures; because Ms. T. was a friend of the interviewer, she was very open and honest about her feelings about blogging. Both interviews were transcribed and analyzed.

Following the interviews, blog posts (main posts and corresponding comments) for one curricular unit for each teacher, publicly available through the published blog in Fall 2005, were qualitatively analyzed for uses and pedagogical benefits. The blogs were printed out for the given time period to ensure that the data would not change during the time of analysis. In addition, during the interview Mr. K referenced one additional post he wrote January 24, 2006 titled "What if your blog was gone?" and the resulting student comments (18 comments, 324 lines) that were included in this analysis.

For these particular units on each teacher's blog, following the basic tenets of grounded theory (Strauss & Corbin, 1998), codes related to *use* (teachers' decisions regarding structured ways to integrate the use of this tool) and *rationale* (teachers' reasons for these instructional decisions) were identified and used to identify patterns within and across data sources. Informed by the literature yet also emergent from the data, codes included uses of blogs (e.g. engage in metacognition, provide resources, give assignment, and offer student encouragement); perceived value (teacher's perspective and students' perspectives); and learning affordances (e.g. nurturing community, supporting identity development, and making thinking visible). Atlas TI, a qualitative software program was used to support coding and managing qualitative data. In addition, descriptive statistics were generated with respect to patterns of use.

### **Findings**

This section is organized into two primary sections, one for each teacher, beginning with the first-year teacher, Ms. T. In each of the two cases, data will be shared with respect to (1) the structures designed by teachers to integrate the blog into the unit's instruction and (2) perspectives of the teacher with respect to this implementation. In addition, because Mr. K. had collected his students' perspectives of blogging and made

them available to us during the interview, a third section will be presented for this case regarding students' perceived value of classroom blogging.

### **Ms. T's Classroom Blog**

#### *Classroom Blog Structure and Content*

The unit analyzed for this study was a segment of Ms. T's first semester integrating the use of blogs, the unit topic was Reproduction and lasted 37 days (December 11, 2005 – January 16, 2006). In this unit (and throughout the year), Ms. T used the blog to “extend and enrich” classroom conversations outside the four walls and 50-minute period of class meetings in two ways: 1) to post teacher-question prompts that students were expected to respond to using the comments feature, and 2) to collect and disseminate resources such as vocabulary and review sheets. For this unit alone, there were 1,594 lines of text written on the blog; four posts by Ms. T and no posts by students; 171 comments from the students and no comments from Ms. T. A typical post was 4-5 lines, and a typical comment from a student was 2-3 lines.

*Student response to teacher-posted questions.*, Ms. T. posted three key questions for student response during this unit:

- 1) Why should we continue to do research on cloning when so many people are against the idea? (December 11, 2005);
- 2) What is the importance / significance of sexual reproduction? & How is meiosis different from mitosis? (December 14, 2005); and
- 3) Should we harvest stem cells for research on diseases or organ transplants? (January 5, 2006).

The first two questions were required work for students titled “Reproduction Unit Assignment 1” and “Reproduction Unit Assignment 2” respectively. Students were not required to respond to the final “stem cell” question, which was titled “Stem Cell Issues,” and was added in response to an opportunity the teacher recognized and decided to act on: “The stem cell thing, we were talking about it in class one day, and my students started firing back and forth to each other and I said, ‘Great, let’s make this a debate on the blog.’ So that was really them, and they got to choose that topic. It was totally student-driven” (Ms. T, interview). Table 1 provides some quantitative measures of student responses to these questions.

Table 1. Summary of student contributions to teacher-blogged questions.

	Number of student responses	Number of on-task responses	Range of lines for student responses	Average number of lines per student response
Question 1: Cloning	67	63	1-7	2.95
Question 2: Sexual reproduction	71	70	2-6	3.28
Question 3: Stem cells	11	11	1-6	2.64
Total	149	144	1-6	average: 2.96

These questions, especially the first and third, elicited a range of student opinions phrased in a variety of ways. First, with respect to content, a consideration of student responses to the first question about cloning illuminates the range of issues students were considering and weighing. Examples of these issues included the importance of maintaining individual choice, the value of scientific exploration, the need to ensure ongoing variation in species development, the potential for “good” such as cure for diseases, what humans’ relationship should be with the rest of nature, the reliability of scientific methods, and the lack of certainty with respect to outcomes of scientific explorations. Some students presented a case in favor of cloning ( $n = 36$ ), some against it ( $n = 13$ ), and some articulated support for both sides of the argument ( $n = 10$ ). Student responses to this question ranged from 1-7 lines long (average 2.95 lines); not surprisingly, some student responses were more nuanced than others. Coded as “simple,” 15 student responses included only an opinion (e.g. “I think we should still clone but only clone animals to prevent world hunger.”). Coded as “nuanced,” 48 student responses included an argument and reason for a given position. For example, beyond a statement of opinion, this student included three different aspects of the ethical debate about cloning (scientific discovery, “power” from knowledge, and species variation:

i dont think that we should do clonning, because our scientist will probly discover a way to corectly clone humans and mamals, meaning make them have the same of a chance to surive as their "parent". And if we had the power to clone the "perfect" human o mamal or plant or anything.. then they will over power the rest of the world. And clonning gets ride of the variation within a species.

With respect to format, student responses varied in a number of important ways: a) students differed with respect to owning their comments by including identifying information such as a name; b) they expressed themselves in a variety of ways; and c) the length of their posts varied.

First, the blog was set up to allow students to respond through the comments feature without logging in with a pre-determined personalized account; thus their comments were posted to the class blog as “anonymous.” Ms. T. described this feature in the post of the first assignment, with a follow up request: “So please type in your first name and last initial to receive total credit for the assignment.” If students chose not to (or forgot to) follow this direction, Ms. T. (or any other reader) had no way of knowing who the author of a given comment was. Looking only at the first assignment which received the largest number of student responses and was closest in time to Ms. T’s reminder for students to identify themselves, 49 of the 67 included their names, 2 included no name, and 16 signed a silly name such as “Sir Paco McTaco,” “Big Head,” “pack man” or “t.” Though few off-task comments were published ( $n = 4$ ), this anonymity decreased student accountability and correspondingly, recognition, for their work.

Second, Ms. T explained that her intention with for the students to use these blogging assignments as opportunities to express themselves in a variety of ways:

So they are not constricted to what is appropriate to the classroom and they can really speak their mind. I like classroom activities the same as any other classroom teacher, but I know that sometimes they feel they are limited in their speech and this is a much more open forum for them (interview, January 23, 2006).

Students indeed capitalized on this opportunity. For example, the first student post was published in the student’s native language, Spanish. Translated, her response to the cloning question was the following:

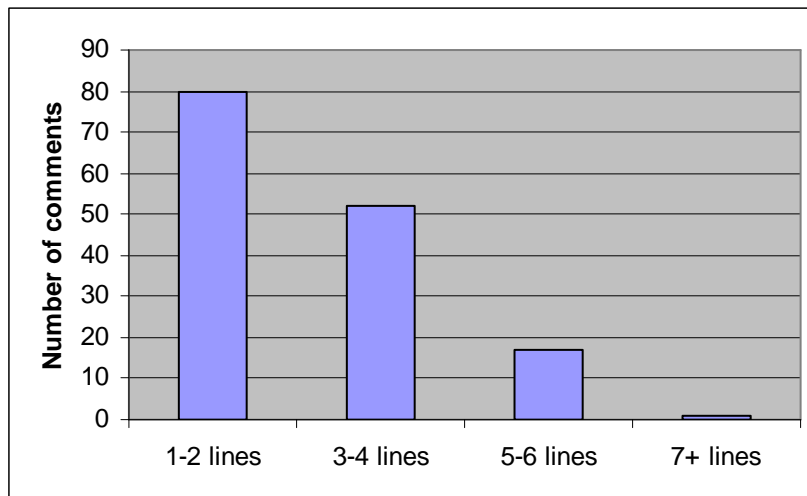
I think it's a great scientific discovery but that many people are forgetting the meaning of being human beings. We are destroying feelings, ethics, morals. I don't think the idea of cloning a person who has died much less one who is alive is fair/correct/just ("justo").

Clearly, this student response represents a nuanced consideration of the issue of cloning. Blogging allowed her to express herself through her native tongue, an opportunity not likely available within the constraints of traditional classroom exchange. As blogging

occurs in written form, students responded using typed language. Student sometimes inserted less formal “student-expressions” such as IM (instant messaging) acronyms (e.g. IDC for “I don’t care.”), familiar to and therefore comfortable for many teens; language that is also not traditionally considered an accepted form of expression in traditional classroom exchanges (such as submitted written homework). Finally, one student added this tagline to his comment about cloning, “Today’s Words of Wisdom: Marriages don’t break up on account of infidelity. It’s just a symptom that something else is wrong,” (Joshua M, December 14, 2005). He clearly had things on his mind other than the Biology assignment, and the blog commenting assignment gave him a voice for his thinking.

Third, regarding format of the student responses, student responses varied in length. Figure 1 shows that most of the posts were short (1-2 lines). Given the more narrowed focus of the task (to answer a given question or two), it is not surprising that the length of these student posts is relatively short.

Figure 1. Number of published student comments of varying lengths



Though these responses differed in many ways, they were similar in general structure: students primarily directed their answers to their teacher. For example, in the responses to the first assignment, eight students began their response with a salutation that included the teacher’s name (e.g. “Hey Miss T”). Two student responses included other comments directed to the teacher. One small “conversation” appeared in response

to the first question in which two students teased each other about their responses. In addition, in a couple instances, the language of one comment mirrored that of the preceding published comment indicating that this student considered another student response. Though there is some evidence that students were reading each other's posts, the general format appeared to be a personal position statement in responses to the teacher's original question.

*Resource Repository.* Ms. T. used her blog as a consistent place students could gain access to vocabulary lists and review sheets for each unit in the course. In Ms. T's own language, she used her blog as a "way to remind them of things." At the end of this unit, For example, Ms. T. posted a blog entry to help students prepare for their midterm exam that listed the "Key ideas you should know well!" For this unit, she listed asexual versus sexual reproduction, types of asexual reproduction, mitosis versus meiosis, sex organs, the path of sperm and eggs, embryonic development, fetal development, prenatal testing, and cancer. "Make sure you cover all of this when you study!" Ms. T developed these routines (posting reviews, vocabularies and reminders each unit) to offer students predictable ways to access these different aides when she was not available at the time they may need it most.

In addition to unit specific resources, like most blogs, Ms. T's blog contained a collection of links to more general science education resources such as "Giant Microbes" (stuffed animals that look like tiny microbes), "How stuff works" (website targeted to young people that tells how a wide range of 'stuff works'), and "I was wondering" (web resource for middle schoolers highlight contemporary women scientists). These links gave students access to other venues to explore as an extension to their science learning.

Thus, Ms. T's blog provided students opportunities to express opinions and perspectives that are in traditional classrooms. As students were not given authority to publish initial posts, the most visible "voice" on the classroom blog was the teacher's despite the fact that more lines of texts were contributed by the students (n = 1549 of the 1594 total lines were written by students).

*Teacher's Perceptions*

Ms. T. was pleased with the amount of student participation on the blog during this unit. In her interview, she described two primary ways the classroom blog met or exceeded her expectations: 1) development of community among students, including the “quieter” ones; and 2) students’ articulation of their ideas through participation in science in ways that are less traditional and more flexible. Though she considered this experience a successful start, Ms. T. also described aspects of classroom blogging she hoped to modify in the future. Each of these will be discussed.

*Developing Classroom Community.* Ms. T. described an increase in student interaction both in-class and online due to students’ interactions on the blog. She described what she saw as a significant benefit of classroom blogging:

I see students talking outside of class that may not normally talk outside of class with each other so they broaden their social horizons a bit. I see students who do not normally talk together in class conversing a little bit more together.  
(interview, January 17, 2006).

When asked if she noticed any difference in the participation of the “quieter” students, her response was, “much, much more.” Ms. T. credits the classroom blog for “breaking the ice” and thus freeing these students from their fear of “speaking up” in class. She identified two groups of students who especially benefited in this way: students who recently transferred into her school and class and students whose primary language was not English. For example, as described previously, one Spanish-speaking student participated on the blog in her native tongue. Because the communication was digital, Ms. T. was able to copy and paste her writing into a translation software program and continue the discussion with her. Ms. T. described another student (Korean) who was studying English concurrently with Biology; this student felt more comfortable participating online than other forms of academic dialogue, and thus turned down offers for help from her ESL (English as a Second Language) teacher who supported her in translating other forms of discourse. As Ms. T recognized these students’ competence with the thinking involved in her class, she also noticed the lack of success they were experiencing because of the language barrier. She clearly valued the options the digital forum gave these students which resulted in them being able to have their thoughtful work recognized: “Again, she can speak to me and that’s the way she wants it and that’s

great...I am really glad that she does what she does, and because it is electronic, it is really easy to do that”

*Encouraging Student Voice.* Ms. T. described classroom blogging as successfully supporting students’ self-expression: “It is a good place for them to articulate what they think.” One of Ms. T’s primary motivations for using a classroom blog was to offer an extension to classroom discussions that allowed students to participate in ways that were more natural to them – in language that was “freer” and through a medium (technology) that was more familiar. Regarding classroom blogging and this issue of students being able to articulate their thoughts, Ms. T stated, “I think this [classroom blogging] helps. I don’t think it is the be all and end all, but it helps.”

Mixed in with developed ideas about why cloning should or should not be pursued as a field of scientific study, two students teased one another about their posts using nicknames. As Ms. T reflected on this student exchange, though she was clear that there are limits to what is appropriate online participation that she has explicitly discussed with her students, she felt this less formal interaction was acceptable. She described her students as “really getting into it [blogging] and having fun with it” which she described as a “good way to draw them into other areas of science and other issues in contemporary science.”

*Room for Improvement.* Though she felt her classroom blogging was successful in meeting her original objectives, Ms. T’s also identified ways she hoped her classroom blogging practice would evolve in the future: she would like to (1) maximize the potential of the Internet to reach a wider audience; (2) encourage more frequent participation; and (3) encourage participation by all students. Ms. T. initially made the decision not to check the checkbox that allowed her classroom blog to appear when the Internet is searched for it; she explained this decision was based on her evaluation of what the classroom blog could offer an outside readership:

I don’t really have any outsider comments, so right now it is between me and the students and between the students themselves... I wanted to wait until there is more substance to it than what I had first originally had. However, she explained in her interview that she is ready to go public, and now she needs to learn what technical moves are required to make that happen.

Regarding student participation, Ms. T. is considering alternative ways to increase participation, both with respect to who is participating as well as how often. She described the challenges she faced to meet these objectives as designing blogging activities that are motivating: "... I still think that I am having trouble motivating students; not all of my students go and I am having trouble motivating them to want to go." As a new science teacher as well as new teacher blogger, these challenges seem large:

... I am trying to get more regular usage but because I am still struggling with the newness of everything and the newness of the blog site I still have not worked out that part yet. I try to keep it [blogging expectation] on a regular basis, at least once a week.

#### *Concluding Comments.*

Ms. T's introduction to blogging through teacher prompts and resource-sharing allowed her to begin to see the value such an Internet-based resource could offer her classroom science teaching. She used it to respond to student interests, offered students consistent access to resource to assist them in studying, and extend classroom discussions around issues she felt would both anchor and enhance classroom learning.

The case that follows, that of Mr. K's use of classroom blogging for an analytic geometry unit, demonstrates how a veteran teacher and more experienced blogger was able to further capitalize on the transformative power of classroom blogging.

### **Mr. K's Classroom Blog**

#### *Classroom Blog Structure and Content*

Teaching an eleventh grade pre-calculus class in the fall 2005 for the 13<sup>th</sup> year, Mr. K. introduced his students to classroom blogging as a way to support their mathematical learning. Though blogging was new to his students, Mr. K. had been blogging with different groups of students for just over a year. The tagline on this blog reads, "An interactive log for students and parents in my Pre-Cal 30S class. This ongoing dialogue is as rich as YOU make it. Visit often and post your comments freely." Mr. K used this blog to support his students' classroom learning in four primary ways: (1) scribe for the day, (2) post before a test, (3) Sunday night puzzle day, and (4) (less structured

and formalized) sharing of resources – as described in more detail below. The unit we analyzed on the blog focused on Analytical Geometry; it lasted 27 days (October 25, 2005-November 20, 2005). In this time period there were 1,292 lines of text written on the blog; 30 posts by students; 11 posts by Mr. K; 26 comments from students; and 3 comments from Mr. K.

*Scribe for the Day.* Mr. K required one student a day to document the events of class on the class blog. The student in charge was given complete freedom as to how to design this post and what to include; with the exception of one day in which the class took a quiz, all other student posts included equations and graphs to illustrate the lesson of the day and all posts included “student-language” like the language “jennie” used to begin: “SORRY PEEPS =)... better late that never hehe..”. See Appendix A for a typical example of a scribe post; this post is 33 lines long, contains 4 embedded images, and 2 corresponding peer comments each with an embedded image. Student scribe posts for the Analytic Geometry unit range in length from 14 to 138, with an average of 47.23 lines. The average number of embedded images per post is 3.46, and the average number of student comments per post is 0.85. The number of embedded links in each post is 0.15.

Though no specific requirements for these posts were made, Mr. K. introduced his students to some formatting tools that might make constructing and embedding equations and graphs easier. When asked about the reasons and sources for the diverse forms of embedded images that different students used, Mr. K.’s email response offered insight into the ownership given to and assumed by his students and their collective treatment of technology as a relatively invisible tool used in service of accomplishing their primary tasks of constructing scribe posts for their class:

Most of them used Paint. In the pic you attached [as an example], that particular student used the TI Graphlink software (available free from TI), imported it into Paint and added their own annotations. They are becoming more sophisticated now. At my suggestion, they search the Mathematics Archives for freeware and shareware graphing software and use that (I'm not sure what specific software each student uses. You could always leave them a comment on their blog and ask.)...The latest innovation is to use this website to create the graph, save as pdf, convert to jpg and upload directly to blogger: <http://fooplot.com/>. (email, February 25, 2007).

Students used different colored font or capital letters to highlight phrases such as mathematical terms (e.g. “distance formula” or “negative integers”) as well as certain numbers in equations. These student-constructed daily summaries included student-interpretations and commentaries interspersed among the math; an example of the incorporation of students’ own voices can be found in Rose’s sample post represented in Appendix A: “Remember, fractions are our friends,” and “Good luck on your test tomorrow.” An example from another student post (note the student’s use of capital letters for emphasis):

Well we WERE supposed to solve these equations, but got distracted from the PILES of tests, pre tests and quizzes that Mr. K seemed to have forgotten to return to us, but it is all good at least we all know where we stand for first term =D. Also Mr. K gave us a lecture on how NEXT TUESDAY IS THE LAST DAY TO MAKE UP MISSED WORK, WEDNESDAY IS TOO LATE!! OH and also you have to give him a day advance so he could make up the test or what you have missed. This lecture led into what Mr. K believed what the marks on our tests and stuff reflect, but now what we have learned but how we apply ourselves, so like Mr. K said if you are doing bad like REALLY bad in class I think you should start applying yourself more. Anyway back to the real reason for this scribe... NOTE:  
\* If you do this instead of squaring everything, this will make Mr. K glow like the sun =D. Ok exaggerated but he will be really, REALLY happy if you do.

Though Mr. K. is acknowledged in this message, it is clear that the student is directing her comments to her peers. This sense of the class as audience was standard for student posts.

At the end of each scribe post, the student identified a classmate to be the scribe for the next day; thus reading the blog daily became a habit of students, at least in part to find out who was in charge of this classroom responsibility the following day. As could be seen in the example in Appendix A, students sometimes chose to leave comments appraising their classmate’s work, usually in the form of praise and gratitude. Specifically, of the 15 comments posted, 11 (73%) included some form of praise or encouragement for their peers, and 5 (33%) of these public encouragement comments included the student scribe’s name.

Student scribe posts evidenced a sense of communal responsibility and accountability both for quality and timeliness for these posts. Indirect evidence of this sense of accountability can be seen in the consistent high quality of the work (length of posts, thoroughness of descriptions, sophistication of embedded images such as equations

and graphs). In addition to this compelling evidence are the direct comments students made to one another about their work or lack thereof. Pamela's scribe post, for example, included three different comments that demonstrated her awareness of her classmate's dependence on her scribing work:

- “wow sorry im posting this up so late and no i didn't forget i was the scribe as you can see i'm on here right now haha but anyways we started class off today with Mr. K talking about pie day and...
- “I'll try explaing or showing the problem that we did in class again hope it helps some of you guys out, but as i said earlier didnt' really do that great with these problems so just bare with me...
- “...and that's how we ended the class and im so sorry if this doesn't help anybody but crossing my fingers and hope it does though” (Pamela, October 27, 2005).

As another example of students' sense of accountability, Jonathon writes the following at the end of his scribe post: “And for the more compicated stuff I haven't quite got yet so I'm not even going to try and put that in my blog cause who ever reads it will just get confused. so I'm done scribing...” (November 2, 2005). Another student reflected on the process this way, “When I make a scribe post I take my time so that it doesn't only benefit me but it benefits others as well so they have a better grasp on what we are learning,” (January 24, 2006).

In another case, “posted by Robert” appears at what appears to be the end of a post, however there is no text preceding this sign-off. An anonymous peer comments (apparently sarcastically), “Great Scribe Robert!!! Very informative, and how did you get that clear text?” Then “Richard” writes an additional comment documenting his conversation with “Robert,” the scribe for the day. He starts his posted comment with the following setup: “Convo with them HOMIES. So... To make a long story short... Where's the scribe Robert?” Richard then includes this quote from Robert that he seems to have had with Robert offline for the class to read: “I did it. Then Blogger told me to sign in again and it was gone. And I'm not doing it again.” Richard finishes his comment with the following admonishment and question: “Oh I see. You should of made a backup copy on the comp... BTW... Who's the Scribe?”

Finally, this example of a student Jennie's concluding remarks to her scribe post (35 lines including three-dimensional graphics) provides both evidence of Jennie's perceived sense of accountability and her peer's and teacher's reactions expressed through attached comments:

well fellow classmates im not even sure if i explained it that well but i tried my best sorry guys about being so late my computer is so strange.  
 posted by jennie\_s @ [11/07/2005 04:28:00 PM](#)

[Richard C. <http://www.blogger.com/profile/12873851>](#) said...  
 Hahahahahaha \*laughs at the pie joke. Great work two. Excellent concept of the THIRD DIMENSION!!!! Hahahaha  
 11/07/2005 8:15 PM

[Mr. Kuropatwa <http://www.blogger.com/profile/6306028>](#) said...  
 Wow! Awesome scribe! The 3D pictures and graphs explained it way better than I did in class!  
 The annotated solution to the system of three equation in three unknowns is excellent.  
 Way to go!

Comments such as that of her peer and her teacher demonstrated an interested readership and an involved community of learners.

*Post before the Test.* Another formal blogging requirement involved every student posting a reflective look back over a particular unit before the day of the unit test. Mr. K. gave students a list of six issues as suggested topics for writing this post. Students were allowed to address any or all of these six: a reflection on a particular class, a reflection on progress in the course, a comment on something the student learned that she thought was "cool," a comment about something the student found difficult, a description of a connection to real life, and/or responses to a specific prompt posted by Mr. K.. In these posts, students typically listed topics of the unit they felt they had a strong command of, topics they continued to wrestle with, advice and reminders for their peers about solving certain types of problems, and "Good Luck" wishes to everyone to do well on the test (See Figure 2 for an example). More specifically, of the 11 student "before-the-unit-test" blog posts, each of them contained at least one metacognitive statement describing the types of mathematical thinking that were perceived to be either difficult or easy for the student writer. About half of these comments included detailed descriptions of the thinking a student found to be either easy or hard. Another common element in these

posts was the expression of feelings such as likes, dislikes or confidence. Most feeling comments pertained to general topics (“I hate circle and distance problems.”) or the unit as a whole (“I like this unit because...”) All but two of the posts included *both* a statement of struggle (e.g. difficulty in understanding or failing a quiz) and a statement of accomplishment (e.g. mastery or confidence).

Figure 2. An example of a student pre-unit test post.

### **Posting Up (On time this Time)**

Well, As this unit comes to a close and the test comes closer, everyone rushes to their computers to post before the test, so I'm taking my turn and doing it know.

Well this unit has been interesting. The hardest part has probably been the time wasted drawing the outlines for the system solving. haha just kidding Mr. K. I understand that it's very important to do this. As well, we have to describe each step of the process. It's annoying but as the problems get harder the more clear it is that we have to do it. This way the teacher can follow your work easier and know what method your using, but more importantly if you make a mistake,you can go back and see where you messed up. The linear equations and circle problems were very easy.

I also wanted to remind everyone to **SET UP THE OUTLINE, DESCRIBE EACH STEP, and WRITE A SENTENCE** for each problem involving systems otherwise Mr. K. won't mark it. So if you forget, the conclusion that Mr. K. can come to is that you didn't read this post.

Well, good luck to all.

Hope my reminders helped!

posted by Craig K @ [11/13/2005 09:49:00 PM](#)

Another core aspect of these posts was the social nature. Each and every post included either reminders or encouragement for the class or both. Most of these comments were general in nature (such as “Study for the test everyone, blog, and I hope you all do well,” written by Aichelle on November 13), but some (n=4) were specific to certain math concepts or skills. Five students also made additional social connections through comments such as “...when he mentioned ordered triples I couldn't help but laugh... remember Liz, Criag? LOL.” All of these student posts were directed to their peer learning community.

In summary, these posts included aspects of metacognition and self reflection, recognition of personal accomplishments, failures, and understandings, and awareness of and encouragement for a known audience (namely, their classmates and teacher). Mr. K. reported that there was a participation rate of near 100% each unit.

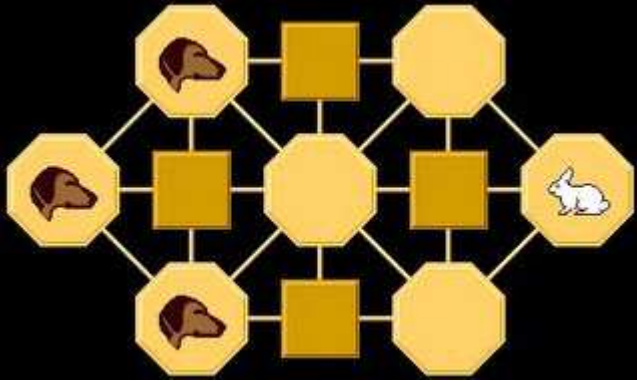
*Sunday Game Post.* Each Sunday night, Mr. K. posted a new problem solving game for students to try (See Figure 3 for an example). Though not a requirement of the class, students could give the online game a try and some would leave a comment about their impressions and success with the experience. Mr. K. described this use of the blog as a subversive way to encourage students' development of thinking skills:

That's me being subtle, or may be not. I try to post games that are problem solving, that make the kids think, that are challenging. Kids are having fun, they're solving problems, and they're learning to think and that's what it's all about. But they think its just a game.

During this month-long unit, Mr. K. faithfully posted a different game each of the four weeks. Three of the four games included an introduction written by Mr. K. along with some emotion (expressed as ;-)) or encouragement to "Have fun!"; these three also received either one or two student comments. The fourth consisted of just the game, and no comments were posted by students. It's interesting to note that though a student named "Graeme" does not post a scribe post this unit, he posts a comment to two of the four games. These posts invite an additional form of participation in high school math class.

Figure 3. Sunday Night Game Post – posted each Sunday night by Mr. K.

**Hare and Hounds**



In [this game](http://www.mazeworks.com/hounds/index.htm) <<http://www.mazeworks.com/hounds/index.htm>> you have to "run for it!" You can be the Hare or the Hounds. The hare has to escape; the hounds are trying to corner him.

The real question is: Are you an expert Hare or expert Hounds? ;-)

Have Fun!  
 posted by Mr. Kuropatwa @ [10/30/2005 12:15:00 PM](#)

*Sharing of Resources.* Within this month-long unit, Mr. K authored 13 different posts (eleven primary posts and 2 comments to student posts). It is interesting to note that of these 11 primary posts, only three of them, interspersed throughout the unit (October 28, 31 and November 14), consisted of collections of math-specific resources such as reviews or tutorials. For example, after embedding a link to a homework assignment, Mr. K. wrote the phrase, “If you need a little help...” followed by three links to different online tutorials and quizzes. In a post published one week before the unit test, Mr. K. posted another collection of 14 web links to various Internet-based resources such as quizzes and tutorials with short one-sentence, narrative descriptions of what the resource offers. The remaining posts consisted of the four weekly games described above, a “food for thought” post titled “What Mathematicians Think” in which Mr. K. encouraged students to take risks, a congratulatory post titled “You made an impact!” in which Mr. K. describes a paper written about their class blog, and two posts that shared and invited participation with a new technological resource.

Students also published resources that they found to be helpful. As described above, students used the blog to post documentations of class events, explanations and interpretations of core concepts and skills (including graphs and solutions to sample problems), and reminders for their peers. Though not directly observable on the class blog<sup>2</sup>, Mr. K. reported extensive student sharing of online resources which resulted in Mr. K’s introducing his class to “social book marking”- a tool and practice in which people (in this case, members of the class) can share personal collections of favorite websites by using a common keyword called a “tag” to search; in this case the tag was the name of their course – prec (for pre-calculus) . Mr. K made a permanent link on their class blog to the results of this social bookmarking in which the last 10 sites identified by someone in the class would be made available.

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<sup>2</sup> It is important to note that students also communicated with each other and the teacher through a chat box (synchronous online communication), social bookmarking using a program called Del.icio.us, and email. Though these data sources were not available for analysis, evidence of bi-directional resource-sharing (from teacher to students, and from students to each other as well as the teacher) through these other media surfaced in the data sources used for this study.

*Less Formal Uses*

*Comments Feature – Named or Not.* Though not included as one of the four core uses of the blog in Mr. K.'s class, the technical settings chosen by Mr. K. in setting up his class blog allowed for two different forms of student participation worth noting. Mr. K. set up his class blog in such a way that students could log in and participate in a way that identifies them (and their participation) by name (first name and last initial) *or* students could choose to log in and comment anonymously. See Figure 4 as an example of the latter.

Figure 4. Conversation that occurred in the comments section of a post published by Mr. K. titled, "Analytic Geometry Assignment."

[Anonymous said...](#)  
 Alright I'm stuck on the first one  
 10/31/2005 9:45 PM

[Mr. Kuropatwa <http://www.blogger.com/profile/6306028>](http://www.blogger.com/profile/6306028) said...  
 Solve the equation of the line for y like this:  
 $y = -2x + 5$   
 Then replace the "y" in the equation of the circle with  $-2x + 5$ ; like this:  
 $(x-2)^2 + (-2x + 5 + 1)^2 = 25$   
 Then solve for x. You'll get two answers. Use the equation of the line ( $y = -2x + 5$ ) to find the corresponding y-coordinate for each x-coordinate.  
 10/31/2005 10:45 PM

[Anonymous said...](#)  
 ok then, that method tells me the answer but it does not tell me why that is the answer. Why would you put the y to the equation of the line.  
 11/01/2005 10:28 PM

[Anonymous said...](#)  
 nevermind.... I got it as soon as i published that...  
 11/01/2005 10:29 PM

[Anonymous said...](#)  
 Wow! The first question I didn't get (but now I see how to get it), but the rest i got. Good assignment Mr. K. it really got me thinking!  
 11/01/2005 10:41 PM

One of the initial reasons Mr. K. began blogging with his students was to give the "quieter" students a voice through a different form of participation. He explained, "But on the blog there is a little room there for them to be anonymous and they can ask their question when no one else is looking. Even though it's not really different, it feels a little different, they're a little more comfortable with it." (Mr. K, Interview). In summary, assuming the comments posted as "anonymous" were written by a student (which seems

likely from the content), 10 of the 16 comments written by a student were anonymous. Five of these ten anonymous comments were directed toward other students (two offered praise, one was teasing in nature, and two asked for clarification) and the other five were directed to the teacher (such as in Figure 4).

*Publicly Accessible.* In addition, posting the blog online in a way that is accessible to everyone on the Internet without a password allowed participation and recognition from readers outside of the 11<sup>th</sup> grade pre-calculus class. For example, someone who identifies herself as “mrs. silva” wrote the following comment in reaction to a student scribe post, “Wow Rosel! That was incredible. I am sure that will help a lot of students all over the world. Congratulations for sharing your knowledge for math!”

*Student Engagement Resulting in New Forms of Participation.* In a number of occasions student use of the blog resulted in a structured change in available ways to participate in class math learning. For example, Mr. K described a situation this past semester when he was receiving 60 or more emails a night in the form of blog comments that needed to be moderated – many of which were short and conversational in nature such as “LOL” (laugh out loud). Mr. K explained that students were using the blog like a chat room, so he researched and installed a Chat Box that allowed synchronous communication on the class blog. Students used this space to help each other with nightly homework.

...its (the variety of ways the blog is used has) really exploded now and its exploded now mostly because the kids push me... (interview, January 12, 2007).

Mr. K. published the chart in Table 2 on his personal teacher blog to compare the evolution of use between his first and second semesters using the classroom blog. Though all of the features described in the column “Fall 2005” were not used in the unit considered in this study, it is interesting to see the drastic increase and modification in its use. Mr. K. described the motivation of this increase to be his students and their needs:

Now this wasn't all part of the plan back in September; the students pushed me and I added the functionality of chatboxes...The students have really picked up on the pull vrs. push idea of learning (science teaching blog, January 4, 2006, retrieved March 7, 2007).

Table 2. Mr.K.'s comparative list of use between his first and second semesters using a classroom blog ([http://adifference.blogspot.com/2006\\_01\\_01\\_archive.html](http://adifference.blogspot.com/2006_01_01_archive.html), retrieved and reformatted according to researcher-defined categories of use, March 7, 2007).

Category of Use	First Semester Blog Integration	Second Semester Blog Integration
Core assigned student practices	Students post reflections on their learning.	Students post reflections on their learning; students have the option of writing <a href="#">an acrostic</a> or <a href="#">editing the textbook</a> instead of writing a reflective post.
		Students write a <a href="#">scribe post</a> for each class every day — this has morphed into them essentially writing the textbook for the class in their own words.
Access to additional resources	I post links to reviews, instructive animations and quizzes.	I post links to reviews, instructive animations and quizzes.
		Students post links to reviews and other learning resources in the <a href="#">del.icio.us</a> boxes.
		Students (and occasionally me) interact in the <a href="#">chatboxes</a> . They often help each other out with homework.
		I've got them learning problem solving by <a href="#">playing games</a> I post to the blog each Sunday.
Additional assigned work	I post blogging prompts often using images from <a href="#">flickr</a> .	I occasionally post blogging prompts. Not using images from <a href="#">flickr</a> often enough.
	I had students do a Muddiest Point exercise on the blog once.	We've done a few Muddiest Point exercises.
		My <a href="#">AP Calculus</a> class is using blogs to write their own <a href="#">digital story</a> .
Teacher practices		I've been <a href="#">more explicit</a> about ethical blogging and internet use.
		Just before the holiday break I added a <a href="#">Visitor Map</a> to each blog.
		I've used the blog to have the students <a href="#">communicate</a> with a substitute teacher before a class I was away from.
		I've also used the blog to give an <a href="#">online class</a> when I was away.

As another example of a student “push,” Figure 5 captures a blog post in which Mr. K. first introduced his students to “social bookmarking.” Note the motivation of this change was the ownership and productivity of the students.

Figure 5. Blog post written by Mr. K. introducing a new course tool that capitalizes on student input.

**A del.icio.us Idea**

I recently received this email from a student in another class:

Hey Mr. K.  
This is one of the websites I was looking at that had simplifying radicals..  
<http://regentsprep.org/Regents/math/radicals/pracRad.htm>  
I found a few that I thought were good just by typing "radicals" in google, they really helped me out.  
See you Monday,  
\*\*\*\*\*

Students often find more, and better, sites than I do. You're better webservers than I am. ;-) That got me thinking .....

I spend a lot of time looking for good websites that help us learn in this class. But what if we all spent a little time doing that? What if there was an easy way for us to both save our bookmarks (without cluttering up our favourites list) and share them with the whole class with the click of a single button? And what if we could access those bookmarks not just from home, but from any computer in the world? Hmmm .....

...

He offered this resource to students and then offered the following commitment, "I'll go one better than that. If you all jump in on this idea, I'll write a post on our blog (with a permanent link in the sidebar) that will load the 10 most recently saved links automatically as you find them. I'll also include a link to the archive that you can browse at your leisure" (February 7, 2005).

*Teachable Moments.* Mr. K engaged his students in a public conversation that was accessible to the world via the Internet. He was not only aware of this public presence, but he emphasized the existence of this global participation with his students in a number of ways. First, Mr. K. described the assignment of daily scribing as a way to co-construct a pre-calculus textbook in student language, that will benefit more than their own class: as a student described it, "[our] hard work [four months of blogging] helped a lot of people across the world as well as ourselves," (student, January 24, 2006). Second, Mr. K. asked students to respond to his questions about their perceived value of blogging posted to his professional blog to benefit other teachers who are reading the posts and considering the classroom use of blogs for their courses. Third, Mr. K. added a "visitor's map" to his blog which visually pin points origins of the last 20 people who have looked at their blog; at the time, this map showed evidence of visitors from different places in

Scotland, United States and Canada (see Figure 6). Finally, Mr. K. publicly recognizes the impact of students' collective blogging work by sharing news of others using their blog (See Figure 7, "You made an impact.").

Figure 6. Visitor's Map for Pre-Calculus Classroom Blog (retrieved from <http://www.gvisit.com/map.php?sid=f4885e077d9e782b3637072aac5cb536> on March 6, 2007).



Figure 7. "You Made an Impact" post by teacher.

***Tuesday, November 01, 2005***

**You Made An Impact.**

About a month ago I was contacted by Meg Gwaltney who works for [Stein Communications](http://www.steincommunications.com/) <<http://www.steincommunications.com/>>, an education marketing firm in the US. She had stumbled across our blog and was impressed with our work. So impressed she wrote an article about us that is distributed across the United States. You can read it [here](http://www.steincommunications.com/thescoop/?p=4) <<http://www.steincommunications.com/thescoop/?p=4>>.

You've made an impact. Congratulations! Keep up the good work!

posted by Mr. Kuropatwa @ [11/01/2005 02:24:00 PM](#)

[Anonymous said...](#)

wow! that's pretty crazy.

11/01/2005 6:52 PM

Mr. K. felt and communicated a sense of responsibility with respect to this broader external audience. This public presence brought about opportunities (and the necessity) for Mr. K to address issues of responsibility and safety in an Internet-based public forum. For example, one student published something derogatory about the teacher. When Mr. K saw it, he first changed the status of the post to “draft” instead of “published.” Then he had a one-on-one discussion with the student about how many visitors likely saw the post (70). When the student argued that the visitors were his classmates and therefore knew he was joking, Mr. K. took a class poll and found out only 3 of his students had seen the post; therefore 67 outsiders still saw the negative post. The student wrote the teacher an apology. Though Mr. K. didn’t publish it, he wished he had so that more students would have access to the lesson learned. “So, he learned a lesson and I have never had a problem since. And the kids have really kept the feeling that the internet is a very safe place if you use it responsibly. And it’s an incredibly unsafe place if you use it irresponsibly.”

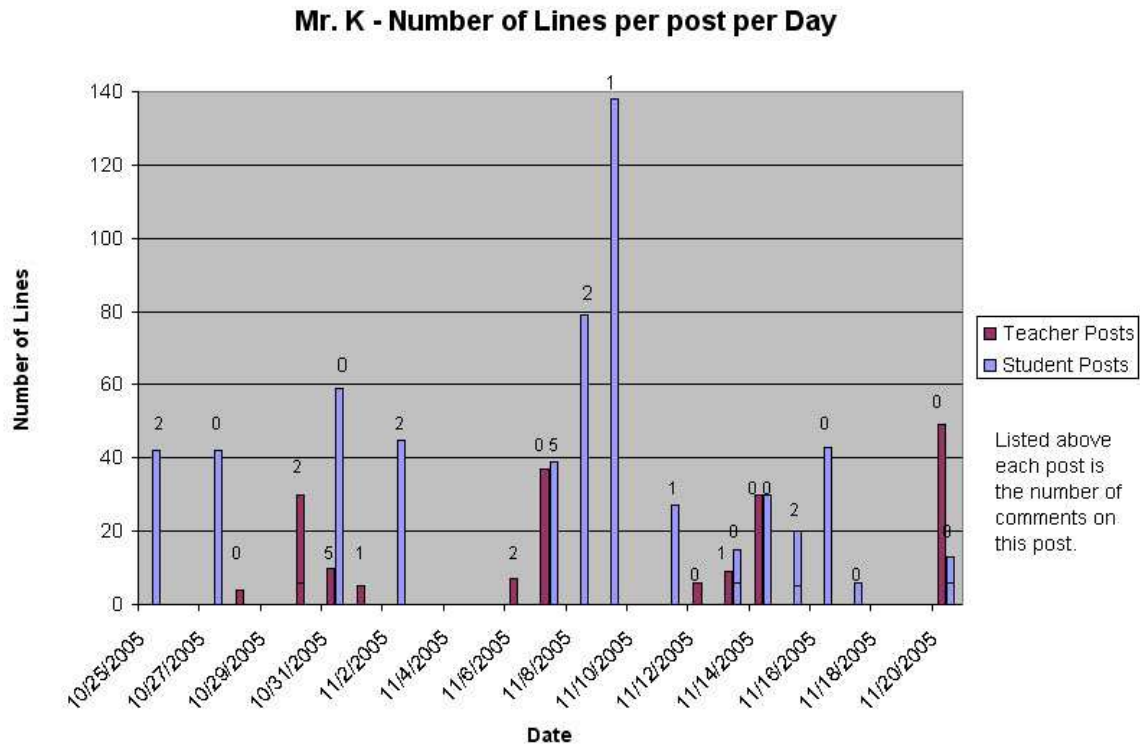
When Mr. K. began blogging, he had very explicit conversations with his students, both online and offline (in class) about appropriate participation on the Internet. He posted the following warning to the class blog including four guidelines and links to others that other teachers have posted for their student bloggers:

Blogging is a **very public** activity. Anything that gets posted on the internet stays there. Forever. Deleting a post simply removes it from the blog it was posted to. Copies of the post may exist scattered all over the internet. I have come across posts from my students on blogs as far away as Sweden! That is why we are being so careful to respect your privacy and using first names only. We do not use pictures of ourselves. If you really want a graphic image associated with your posting use an avatar -- a picture of something that represents you but IS NOT of you (teacher post, September 12, 2005, emphasis his).

A student published this response to the preceding post: “wow, thats scary... now i will think twice when somewhere on the internet asks where i live or what my phone number is. *very very* good advice!” As Mr. K. said in his interview, “This is a grade 10 student. She’s already been online, been in the chat rooms and maybe she already has a blog, I don’t know. But she’s never thought about this.” These lessons-in-the-midst-of-lessons are clearly important, valuable and needed, especially for this generation of students who being referred to as Generation M, 8-18 year olds who are spending an increasing amount of time using “new media” like Internet (Rideout, Roberts & Foehr, 2005).

*Summary of Mr. K.'s use.* Though the description thus far clearly evidences a strong student presence on this classroom blog, the graph in Figure 8 further quantifies this involvement. Students and teacher shared ownership of the primary posts published in this space. Student writing (measured in the number of lines published) far exceeded that of the teacher's. This shared participation was consistent across the duration of the unit. Comments were not many in number and they were short in length (average length 2.96 lines). They were primarily social in nature, offering encouragement, praise, or teasing with a few asking for clarification or help<sup>3</sup>.

Figure 8. Summary of blog use by Mr. K's pre-calculus class for one unit of academic study.



<sup>3</sup> Mr. K. commented that students primarily and regularly used the Chat Box (online synchronous communication channel) available through the blog to solicit and offer each other individualized help. He said that he would sometimes offer assistance through this medium, but the majority of the time, students helped their peers.

*Students' Perceptions*

Students' published responses to the teacher-posed questions, "Is our classroom blog valuable to you? If yes, how so?" and "How would you feel if our blog suddenly went offline and couldn't be recovered?" revealed a thoughtful consideration of both the benefits of blogging and the reasons their classroom blogging led these benefits (specific tools and affordances) (January 24, 2006, See Tables 3 and 4 for quantitative summaries of their responses). Mr. K., in his interview, articulated perceptions to those of his students as well as offering additional teacher-related insights, as reported in the section following this one. Though the blog was not intuitively valuable to all students from the onset (seven of the 18 students who commented on the value of the blog explained that the tool and the process were initially difficult for or unappealing to them), they overwhelmingly developed an appreciation for its existence. In a student's own words, "At first, the blog was really confusing for me, because I had never learned like that before. It took some getting used to, but I am glad I stuck with it, because now, I can't live without it" (student, January 24, 2006).

*Performance and Understanding.* All but one student described how participation in classroom blogging supported their performance in math class (12 students), their learning and understanding of math concepts (13 students), or both (9 students). First, aspects of student work coded as "performance" included things such as staying up-to-date with class work and homework, effectively studying for and performing on tests, and earning high marks. Student comments identified the following uses of the blog to be most effective in helping them succeed: a) the scribe posts which students perceived to be a "virtual textbook" written in their own language to be used as a reference tool (Example 1), b) the chatbox for individualized, always accessible homework help (Example 2), and c) hyperlinked resources posted by the teacher and peers which offer additional resources and sample assessments on specific topics(Example 3).

Example 1. Another thing too, as Mr. K said, our blog has become our "textbook", and we could find the previous posts really helpful for reviewing for exams and test.

Example 2. And it also helps when doing homework too. You could post up the question that you need help with in the chatbox and people in the class will help you and also Mr. K himself.

Example 3. The thing that I find most useful is the links to the resources, the quizzes, the step-by-step instructions and so on and so forth. There is no way my mark would be as good as it is without the blog.

Students felt strongly that the classroom blog was vital to their success in their math class. One student went so far to say he would drop the class if the blog went offline:

I know I would be probably be failing math right now without the blog. Then I'd probably would be in utter shock and just drop the course thinking that there is no way I can do this without the blog. To be honest I have become totally dependent on the blog as a resource on mathematics. It will just make me lose all hope on passing this course in the first place... Well what I am trying to say is that the blog disappeared then I wouldn't take PreCal anymore.

Beyond performance, many student comments focused more explicitly on how the blog has contributed to their learning or understanding of mathematics concepts. As illuminated in the following quotes, students most often connected support for their understanding with increased access to resources (examples one and two) and access to students' perspectives and support (examples three and four).

Example 1. It is valuable to me because each time I read a scribe post I feel more confident in myself when I do my homework because sometimes Mr. K. goes a little too fast and I can keep on reading a certain scribe post until I understand what I have read.

Example 2. a good reference tool now that we have the delicious thing (social bookmarking) we can now look at other web sites that can help us to understand more deeply some topics

Example 3. Having the blog, it helps a 'quiet' person voice out their opinion on particular topics. Now instead of having to learn from same students who likes to voice out their opinion in class all the time, the blog links everyone together. From there, we students all learn from each other. It's like a teacher's dream come true, having ALL their students participate in their class, whether online or in class itself. =D

Example 4. It has helped me with the "learning curve" greatly. If I'm having trouble with anything I just logon and flip to the scribe post. This is also another great attribute. It is the class lesson from the viewpoint of a person that has the same viewpoint as me. That clears up a lot of concepts because it is explained in another manner.

Beyond referring to the blog in general as supportive to student learning (7 comments) specific uses of the classroom blog that students identified as explicitly supporting their learning and understanding were the scribe posts written by their peers on particular topics (5 comments), access the class's list of hyperlinked resources such as animations and quizzes (2 comments), and the chat box in which students answered other students'

questions, often pertaining to certain homework problems (2 comments). Clearly, classroom blogging was perceived by students to be integral to their success as students.

*Shared Ownership, Impact, and Recognition.* Half of the student respondents (9 students) described this published classroom blog as a product of their entire class's effort and energy. Consistently using language such as "we" and "our" to describe both the investment (example one) and the ownership of this ever-evolving "final product," students emphasized its value and potential value for its own core class members (example two) as well as a more global community (example three).

Example 1. ...our site has the opinions and thoughts of what every person in our class has to say and anyone could use what we have to say about the work and put it to use for themselves. We're writing a textbook as Mr.K has said and it could be a bestseller someday who knows.

Example 2. If our blog went offline, to me it would feel like having our very own textbooks get burned. The only difference is the blog was our own written work. Work that is written in our very own student language, one that we could understand more at ease than what a textbook would say.

Example 3. ...not only did I put a lot of effort into my posts but so did my other fellow classmates; we've all worked so hard on making our posts. The time and effort that was put into it is quite amazing because not only did it help our class out, but it also helped many other people who've seen our posts around the world. In addition, three students commented on the opportunity the blog offers to demonstrate and be recognized for their understanding. As an example, one student wrote, "being the scribe is a big opportunity to me to show how i understand the lesson for that day."

It is clear from these comments of ownership, impact and recognition that students' participation in the construction and ongoing development of the classroom blog affected students' identities as participants in a mathematics discourse.

*Reasons Blogging Works.* From the students' perspectives, access to resources (24 comments by 13 students) and participation in a community of learners (16 comments by 12 students) were the most commonly cited reasons for the realized benefits of classroom blogging. Scribe posts, which gave students lead roles and voices, was most commonly cited as a specific blogging use that was valuable to these students (12 students). Students appeared to use the blog in individualized ways that capitalized on peer participation.

Table 3. Summary of codes used to categorize student-described affordances and outcomes of classroom blogging (including the number of student comments that identified a particular aspect out of the 87 comments made about this aspect, and the number of students out of 18 respondents that identified this aspect).

<b>Blog Use</b>	<b>Affordances</b>	<b>Outcomes</b>
<ul style="list-style-type: none"> <li>▪ Blogs (no one specific aspect) (53, 18))</li> <li>▪ Scribe posts (16, 12))</li> <li>▪ Hyperlinks to online resources (including social bookmarking) (9, 9)</li> <li>▪ Chat box (5, 5)</li> <li>▪ Editing process<sup>4</sup> (1, 1)</li> <li>▪ Reflective posts (1, 1)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Access (range of resources, constantly available) (24, 13)</li> <li>▪ Community of learners (value of student perspectives, students helping other students) (16, 12)</li> <li>▪ Student voice (Students' perspectives, student language) (2, 2)</li> <li>▪ Accountability (knowing others were reading and relying on what a student published) (1, 1)</li> <li>▪ Individualized help (1, 1)</li> <li>▪ Performance ("catch up" when class missed; study; and performance on test) (1,1)</li> <li>▪ Understanding (specific concepts, self-diagnosis) (1, 1)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Performance (22, 12)</li> <li>▪ Understanding (17, 13)</li> <li>▪ Shared ownership (co-construction of a valued and valuable learning tool) (9, 9)</li> <li>▪ Access (8, 5)</li> <li>▪ Individualized help (8, 8)</li> <li>▪ Community of learners (interaction with peers; co-construction of quality work) (8, 6)</li> <li>▪ Impact (members of the class, "people across the world") (7,5)</li> <li>▪ Recognition (3, 3)</li> <li>▪ Unique participation (2 2)</li> <li>▪ Student voice (2, 2)</li> <li>▪ Responsive teaching (1, 1)</li> </ul>

<sup>4</sup> Students were given the option to edit a previously published scribe post instead of the end-of-the unit reflection post. As this data (which posts were edited and how) were not available, this use was not included in this analysis.

Table 4. Students' perceptions of the connection between blog uses and outcomes (Numbers represent the number of student comments (total = 87) that addressed a given blog use or outcome).

	<b>OUTCOME</b>	Performance (22)	Understanding (17)	Shared Ownership (9)	Individualized Help (8)	Access (8)	Community of Learners (11)	Impact (7)	Recognition (3)	Unique Participation (2)	Responsive teaching (1)
<b>BLOG USE</b>											
Blogs in general (53)		9	7	9	4	4	10	6	2	1	1
Scribe posts (16)		7	5			2		1	1		
Hyperlinked resources (11)		6	2			2				1	
Chat box (5)			2		3						
Editing process (1)			1		1						
Reflection posts (1)							1				

### *Teacher's Perceptions*

Though Mr. K. initially deferred to the comments of the students for an explanation of the benefits he and his classes have experienced through classroom blogging, his perspective as the teacher clarified and extended their explanations and offered a new and valuable lens for considering the importance of integrating tools like the blog into high school learning. Four categories summarized the different aspects of classroom blogging Mr. K. identified as valuable: 1) support for student understanding; 2) nurturing of a classroom community; 3) use of technology-based tools and practices for students of a digital age; and 4) uncommon supports for teachers' work. Underlying all four of these is a unique lens to teaching: the need to give students preparation for and participation in a different form of literacy.

*Understanding.* Concerned about the fast pace of the course structure, Mr. K. hoped the blog would give students additional opportunities (more time and a variety of structures) to engage with the course concepts: "I also wanted to encourage students to

think about what they are learning. I teach in the semestered system and it goes by really fast and we cover much ground in such a short period of time.” He described the value of the links to the web-based animations he provided through the blog as ways to provide demonstrations not available in the classroom. He also pointed out that “Kids are reflecting about their work.” Though not the primary focus of many of his comments during the interview (perhaps because students’ comments addressed them), learning and understanding were clearly important outcomes for Mr. K.

*Classroom Community.* Mr. K. described one of the core ways blogging contributed positively to his teaching was through this tool’s affordances to support interaction and community-building among class members. First, Mr. K. believed that participation on the class blog led to a quicker bond among students and between students and him in class:

I’ve got much more class participation. Kids buy into the class and I’m able to build a rapport and create a group from a bunch of individuals much more quickly than ever in the past. My first blog, the Pre-Cal 40S blog, by day three the kids were interacting with me and asking me questions and really, really engaging me because of a post that I had written on the blog about asking questions, that that’s what I would really like them to do. Typically that can take weeks before kids reach that comfort level but the kids respond instantaneously to the stuff I post on the blog.

Developing a classroom learning environment of trust and interest is a difficult charge; Mr. K. perceived the blog to have had a significant impact in his work to nurture a positive and supportive class culture.

One of Mr. K’s articulated goals for his class was to help students see and use each other as learning resources. First, he perceived this to have happened during this unit through the blog in a number of ways: through the chat box when students helped one another on scribe posts: “I think this was a success for the kids when on a Saturday night, kids are talking in the chat box and they’re talking about math.” In another example, a student who understood the programming language of the blogging tool realized his peers were struggling with it. He voluntarily constructed and published a tutorial for her classmates to help them: “He did not do this for marks, he saw that there was a need in the community and he responded to it.” Students in other classes and grades heard about this resource and began to use it: “So the kids are teaching the kids unseen.” Finally, and perhaps most importantly, the scribe posts which contain the largest

amount of concept-specific documentation and explanation are written by students for students. The power, as both the students and Mr. K. describe it, is in the students' interpretations of the meanings and skills of these complex mathematical concepts. In addition, it gives students an opportunity to publicly support, encourage and praise each other for their development as math learners. Mr. K described student blogging this way: "They love it! This is their grammar, this is how they talk to each other and this is how they relate to each other. This is how they build their communities."

The blog gave increased, uncommon and personalized access between students (and between students and teacher) in ways that the constraints of traditional science classrooms could not allow (e.g. freedom to think before "talking;" opportunity to participate anonymously; open opportunities for students to praise and encourage one another; and being recognized for one's understanding, flow of information and understanding in many directions, not limited to from teacher to student).

*Online Participation.* As previously stated, high school students are being called Generation M, the group of young people between 8 and 18 who are deeply steeped in a technology media-rich world. Mr. K. hoped to capitalize on these interests and literacies to support their math learning; however, through this work, he identified a problem that is of serious concern, his students' uninformed (and therefore dangerous) out-of-school participation in online practices such as blogs and instant messaging:

So the kids are doing this and they're doing it anyways. They're doing it out of school and unsupervised, they're doing some really stupid things because no one is giving them an example or a model. Like when you write sometime on the internet, that goes out there forever. If you put your name on it and ten years down the road you get Googled as an employer is looking you up as a perspective employee and they see sometime stupid you have written, they may ignore the date. Kids don't think about stuff like that and they need to be told about that.

In response, Mr. K. has used classroom blogging as an opportunity to embrace these "teachable moments." Through many online as well as in-class conversations, Mr. K explicitly addressed issues of responsibility, appropriateness, potential impact, and safety with respect to online participation. Some of these conversations addressed participating through blog in general, and some were more directly connected to a particular student's decision (such as one student's choice to post her phone number in the chat box to get a friend to call her for homework help, and another students' published satirical but

disrespectful description of his teacher), In addition, through the blog (e.g. the visitor's map which shows origins of the most recent visits worldwide) as well as in-class, Mr. K. emphasized the "authentic" and "global audience" their classroom blog enjoys which should inspire students' thoughtful consideration of published posts. As Mr. K. stated, "Because when they write everyone listens."

Mr. K. felt that these conversations and opportunities have indeed opened students' eyes to important issues related to participating in an online, public forum such as the blog. Each of the many stories Mr. K. shared about their explicit consideration of these issues led to increased student awareness: "And the kids have really kept the feeling that the internet is a very safe place if you use it responsibly. And it's an incredibly unsafe place if you use it irresponsibly." Though not specific to math class, Mr. K.'s class offered students and teacher an authentic and personally-relevant context to address issues argued by many as paramount to students' ultimate success and safety in our global community connected by the Internet.

*Benefits for the teacher.* Finally, Mr. K. argued that the blog helped him in his professional work: "It certainly has improved my teaching." Besides allowing him a venue to make a wide variety of activities, resources, and thus ways of participating available to his students, he most valued the insight he gained through reading his students' math writing:

Having the scribe post has allowed me really deep insight into one kids head every day. Usually when you have a struggling student, you ask them if they understand what is going on and their first response is no I don't understand anything. But when the kids have to scribe what happened in class today, they're forced to wrestle with the material and try to present the best they can what they do understand.

In one particular example, Mr. K. could work with a frustrated and disengaged student to both encourage and conceptually support her:

There are only these one or two things that you didn't understand and almost like a surgeon I can say this is what you didn't get and here's how to fix it. I'm not usually privy to that level of detail as to where the student is at. But because they have to write it, I'm getting that insight.

Classroom blogging, in this case, gave individual students the opportunity to make their thinking visible through asynchronous, less constrained ways; which, in turn gave the

teacher uncommon opportunities to diagnose and offer individualized encouragement and support.

*Room to grow:* Though Mr. K. clearly perceived his classroom blogging to be successful in many ways, it is interesting to note what aspects he hoped to address as he looked to the future. First, he described a desire to engage additional people such as graduates of his classes or college students as online mentors for his students. In addition, though parents have been supportive and he has some evidence that parents and students have worked together on the Sunday night games, he would like to use the blog to offer parents information they would value about their child's math learning. Figuring out the specifics of what that looks like and how to best accomplish it is on his list of future work. Finally, he expressed a desire to help his students increase their ownership regarding the quality of their posts:

If anything now, I want them to take better care about what they write and watch that spelling and grammar. I want them to take better care about their work and I want students to go back and edit their own work.

Classroom blogging has become an integral, central and core aspect of Mr. K's pre-calculus class. Capitalizing on the unique affordances this internet-based medium allows appears to be long-term (lifelong?) challenge.

*New School-based Literacy.* More than a new tool to teach math, Mr. K. argued for and demonstrated accomplishments toward a new conceptualization of school-based learning. Though many have argued that school should be student-centered, few have identified concrete practices that effectively give students ownership over their own learning, offer students consistent access to a wide range of authentic resources in a "just-in-time," individualized way, help students in developing networks of support for rigorous conceptual understanding that include other students as well as adults in a true community of learners, and provide opportunities for participation that privilege the student voice. The constraints of traditional school-based instruction, both self-imposed by way of adopting and enforcing certain practices (e.g. students work alone to "prove" their understanding) as well as seemingly embedded in the structure of school (limited resources such as class time, access to teacher support, access to outside resources) make this vision of education seem almost impossible. Mr. K. argued that schools could

benefit greatly from being open to the media opportunities that technology in general, and the Internet more specifically, afford:

These kids are born into a world that has never seen a record, they can't ever remember music being written on anything except a CD, the internet has been in their lives since the day they were born, they can't remember a time without the internet. They live in a totally connected world, media rich, media intense world and then they go into a classroom which is really based on a model from the industrial revolution. They sit in rows and columns and everyone does the same thing at the same time, usually, and their supposed to absorb this knowledge. They're not allowed to have the cell phones on, their Instant Messenger, they're not allowed to have access to all of this external media, they're supposed to use pencil and paper, industrial revolution technology, and just focus on the one way direction from teacher to student.

Consistent with Mr. K's use of the classroom blog, Mr. K's epistemology focused on the student's need to construct understanding and use this understanding in individual ways using personalized support systems.

Learning is really in the network of connections that you have. Each person has to build a personal, private knowledge network and they makes connections and links to various knowns on the network where information is stored so that they can retrieve it and use it as needed. What's important for students to learn is not to record the facts, what's important for students to learn is to learn how to manipulate the information, how to verify the accuracy of the information, and use the information that they're exposed to. They also have to know how to access it when they need it. But it should be stored somewhere on their personal learning network.

Students need support in building these networks in addition to learning how to use them. In order for this to occur, teachers need to be willing to relinquish their position in center stage. Not implying a less-involved role for the teacher, Mr. K. argued that the blog allowed him to be more engaged and involved in individual student's learning than was possible in class. Mr. K. made a concerted effort to empower students and give their voices lead roles in their learning and that of their peers:

As a matter of fact, you will see that the student's voices predominate. That perspective is the one that is most important to me. It's more about the students and even in the comments, most of the comments are written to students by students.

*One final note.* It is interesting to note that Mr. K's first iteration of classroom blogging was very similar to Ms. T's – focused on teacher prompts and resource sharing with students' voices hidden under that of the teacher's:

if you look at Pre-Cal 40S, my first blog, you will see that the dominant voice is mine and most of the posts are written by me. While students do participate, its mostly in the comments. They do write their pre-test reflective post but they don't really totally buy into it. If you read any of my current blogs, you will see that the students have really taken ownership of the space. If you start reading through the posts there you will not see my voice as the dominant voice. As a matter of fact, you will see that the student's voices predominate.

### Conclusions

These examples show how classroom blogs can be set up and used to effectively support student-centered learning, even by first year teachers (and bloggers). Yet the two blogs featured in this study differed considerably in terms of the extent of students' participation and "transformative nature" of classroom interactions, as a result of different structures and choices by each teacher in terms of how the blogs was set-up, used, and made available to students.

*Connections to the Literature.* These two cases offer empirical support for documented strengths of classroom blogging in the following ways:

- *Long-term and ongoing access of blog posts makes materials available for subsequent reflection and analysis.* It is clear that Mr. K's students revisited the material on the blog to complete homework and prepare for tests, while we have no evidence of this practice by Ms. T's students. This difference has much to do with the content of the blogs - as the "scribe posts" and additional posts by Mr. K. were written for the purpose of helping students understand and review course material, the opinion posts written by Ms. T's students were primarily intended to give students the opportunity to explore their own personal ideas about a given topic.
- *The structure of blogging (including hyperlinks) encourages and enables the integration of other resources.* These two cases differed in their connection to and integration of additional web-based materials: Ms. T. limited her use of hyperlinks to a few non-topic-specific science resources listed on the front page of the blog, though she identified the use of topic-specific hyperlinks as a goal for future iterations of her classroom blog. Mr. T. instead constructed posts consisting of collections of web resources (e.g. online quizzes, animations and reviews) related to specific topics. Additional web-based resources were shared by Mr. K's students and Mr. K through

social bookmarking. Mr. K's students also extensively used embedded images in the way of equations and graphs to construct their reflections. These varied resources were valued by students as additional authoritative resources on a given topic; however, in contrast to the benefits proposed by the literature, evidence did not exist that students critically compared or situated their understandings with respect to the perspectives from these outside sources.

- *Asynchronicity and accessibility of blogs can extend classroom discussions outside the classroom.* Both cases support the claim that blogs can extend discussions beyond the classroom and lead to increased interaction both within class and on the blog. Ms. T. specifically used this venue to extend the discussion to ethical issues that are not included in the state standards but she believed to be motivational for students. Mr. K's introduction of three uses of the blog offered additional, valued ways for students to interact and support one another outside of class meetings: up-to-date, daily documentations of class events through scribe posts (asynchronous), collections of hyperlinked resources class members found to be value made available through social bookmarking (asynchronous), and individualized support offered just-in-time through the Chat Box (synchronous). Students emphasized the value of this 24-hour access to help them catch up on any given night as well as to look back over time to review specific concepts.
- *Students are able to access peer's reflections and interpretations.* Evidence existed that students read peer's posts in Ms. T's classroom blog; however it is not possible to determine the extent of this interaction. Mr. K's students valued the opportunity to read summaries and interpretations of math concepts framed in student-language (scribe posts), crediting these online summaries for contributing significantly to their understanding and performance. In addition, Mr. K.'s students articulated and demonstrated a strong sense of accountability to their peers with respect to the composition of scribe posts which resulted in the construction of thorough and thoughtful reflections, interpretations, advice and encouragement.
- *Classroom blogs are often public, thus making student work available for comment and critique by a much broader audience than the teacher.* Evidence was not found that students were targeting outside audiences in their writing: Ms. T's students

focused on writing for the teacher while Mr. K's students focused on writing for their classmates. This focus was not surprising for Ms. T's class, as she had not made her blog publicly searchable so it was unlikely that she would have outside readers. Mr. K. monitored and emphasized the importance of the "authentic" and "global" audience that his classroom blog experienced, encouraging students to respond to this readership by being thoughtful, responsible and safe in their publishing. Student comments provided evidence that students were aware of and motivated by this audience. Voices from outsiders through links to the blog or published comments were not a significant presence in these classroom blogs; though nurturing this potential was identified by Mr. K. as a future goal.

These two cases contribute three additional insights into the value of using classroom blogs to support student learning:

- *Student writing for blogs offered teachers a diagnostic tool to assess more nuanced aspects of student understanding and thus respond with more individualized encouragement and support.* The blog posts written by students gave both teachers additional insight into their students' thinking: Ms. T. valued the blog posts as uncommon ways to access students' expressions of their unique voices (such as the student who wrote in Spanish or the students who used less formal language). Mr. K. expressed enthusiastic appreciation for the insight the scribe posts offered him into the details of an individual student's thinking. Describing benefits for both the student-writer as well as for himself as teacher, he explained that students' written explanations and interpretations of a specific math topic gave him the insight he needed to offer more detailed encouragement and feedback. One of his students also identified this feature of the blog to lead to more responsive teaching by Mr. K.
- *Participation in an online environment provided much needed opportunities to teach process skills regarding participating in an online environment.* In addition to academic learning, classroom blogging opened the door for both teachers to capitalize on "teachable moments" regarding concepts and skills of Internet participation. Both teachers articulated the importance of these skills and understandings for this generation of teens being referred to as Generation M, teens who are more immersed and dependent on internet-based participation than any of their predecessors. These

lessons included potential impact of publishing, responsibility when writing for a global audience, and safety in these open and public interactions.

- *Blogging assignments gave all students (including and especially “quiet” students) uncommon opportunities to participate and contribute to the learning community.* Students and teachers alike commented on the value of the blog medium to lead to increased diversity of participation with respect to members of their classroom community. Ms. T. credited the asynchronous and digital aspects of blogs posts for increased student participation, giving less confident students more comfortable and familiar ways to participate. Mr. K’s homework structure in which each and every student composed and published a scribe post, by name, mandated participation by all. Students explicitly valued hearing and learning from all students – not just the students are vocal in class. In addition, the option to participate through comments “anonymously” offered an additional way for students to participate, one which was utilized by students when asking for clarification or to socially engage with peers (offering compliments or gentle ribbing).

It is important to note that both teachers did not realize the same benefits, and neither teacher realized all of the benefits of classroom blogging identified in the literature. Not surprisingly, the specific affordances of the particular tool were connected directly to ways in which it was used. These case studies offer us insight into valuable classroom structures to maximize the transformative power of blogs to nurture student-centered learning.

*Extension, Enrichment and Transformation.* Mr. K and Ms. T used blogs to engage their students in ways that extended typical classroom forms of participation as well as ways that enriched and transformed some of these practices. As an extension of typical classroom practices, teachers used blogging in the following ways:

- Student reflection (e.g. “Post a summary of the main ideas of this unit.”);
- Day-to-day student assignments (e.g. “What is the difference between mitosis and meiosis?” and
- As a repository for classroom resources (e.g. The blogs housed a historical record of class events and discussions through the posts as well as resources such as handouts, deadlines, and assignment details.).

As enrichment to classroom practice, the blogs were used in the following ways:

- To broaden the learning community for the students (including peers from other class periods and the public);
- To increase the types of tools available (e.g. Students in Mr. K's room used a synchronous chat box associated with his blog to connect and discuss math concepts and challenges at unpredictable times); and
- To allow for different forms of communication than typically available in classrooms (e.g. anonymous and asynchronous posts and comments, student-initiated discussions and debates, and peer encouragement and critique of written work).

These varied, student-centered ways classroom blogs were used allowed students to engage in, participate in, and take ownership of their learning in different ways, which, in turn, resulted in altered in- and out-of-classroom learning.

In addition, both students and teacher in Mr. K.'s class described positive transformations of classroom culture as a result of the ways they used their blog:

- Students voices (including *all* voices) constituted a dominant presence on the blog – students assumed ownership in a true community of learners through the many different aspects of classroom blogging, in the main posts, comments, chat box and social bookmarking,
- Student learning and performance in math class became dependent on this outside interaction and resource. Many student statements about perceived value of the classroom blog were phrased using extreme language (e.g. inability to be successful without it).
- Online interaction changed the in-class dynamics between students as well as between students and teacher. Relationships within this community were both created and nurtured through interactions on the classroom blog. It was common for both students and teachers to author reminders, compliments and words of encouragement.

*Evolutionary Process.* A look at these two curricular units highlights that the use of blogs to support student-centered learning, like the integration of any learning tool with this purpose in mind, is an emerging and evolutionary process. Ms. T.'s case

offered insight into what could be considered a “starting point.” Similar to Mr. K.’s first use, the teacher-initiated questions and collection of curricular resources served Ms. T’s initial goals of giving students additional opportunities to engage in science, access to a more open and flexible medium that allows students to use less “academic” and more varied voices, and a forum for addressing student-generated, often politically-charged issues related to core classroom concepts. Though successful in meeting these goals, Ms. T. described a desire to structure blog use to entice more extensive student online participation and engagement. In addition, she planned to alter the settings to allow for participation (reading and commenting) from those outside the participating class.

Mr. K.’s use demonstrated what is possible in future iterations of classroom blogging use. The structure of the assigned student scribe posts essentially handed the ownership of this learning space over to the students. Allowing for anonymous participation (through comments) while requiring significant named-participation (through scribe posts) gave students different opportunities to participate in and be recognized for their mathematics understanding. Introducing the chat box and stepping back to allow students to support other students gave them additional opportunities to individualize and own their learning.

Truly student-centered pedagogy requires an informed and open-minded, nuanced approach to teaching that is both sensitive to student needs and group dynamics as well as insightful about how to meet these needs. In both cases of classroom blogging, new ideas for use came from students as well as teachers. The evolution of blog use in Mr. K.’s classroom was a direct result of a number of attributes: 1) his ability to “see” and “hear” student needs; 2) his technological knowledge of diverse tools that could support the class in meeting each other’s needs; and 3) an open-mindedness and courage that allowed change. In addition, capitalizing on the unique affordances (and learning potential) of blogs requires an ability to nurture and develop community (e.g. create situations of positive interdependence between the students including a careful consideration of accountability).

Though in part, these cases foreground differences in the teachers and their pedagogical decision-making with respect to classroom blogging, they also serve to highlight the flexibility of the tool. These extremely different uses of blogging by the

two teachers demonstrated how the classroom blog can be adapted to the desired objectives and level of confidence of an individual teacher – while still provide a valuable addition to classroom teaching.

Teachers committed to a student-centered pedagogical philosophy need supports that can enable new forms of student participation which lead to individualized student engagement within supportive learning communities. This case study of two classroom blogs illuminated the ways in which blogs can be used to strengthen and transform classroom learning. The unique affordances of this new literacy were capitalized on by these two teachers to the benefit of their students' learning and engagement.

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## Appendix A. Sample student scribe post and responding student comments.

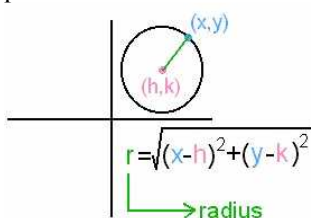
**Tuesday, October 25, 2005**

### Scribing for Circles

Hi guys! Today we started a new unit on equations of circles. The first thing we did was talk about the **distance formula**. You might remember this from last year. This equation is used to find the distance from one point to another.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

The next thing we did was use this piece of information to find the radius of a circle. If the coordinates  $(h,k)$  is the center point of the circle and  $(x,y)$  is one of the endpoints then the distance from both points is the radius.



To get rid of the square root sign you have to square both sides. You'll end up with an equation like this. This is the **equation of a circle**.

$$\text{EQUATION OF A CIRCLE}$$

$$r^2 = (x-h)^2 + (y-k)^2$$

Two things you need to know about a circle is its radius and its center point. From this equation, you can retrieve  $(h,k)$ . Remember that the actual coordinates of  $(h,k)$  is the negative inverse or opposite from  $h$  and  $k$  in the equation. For the radius, remember to square root it for your answer because in the equation, it's  $r^2$  not  $r$ .

ex.1:  $(x-3)^2 + (y+2)^2 = 64$

center =  $(3,-2)$  (negative inverses of  $h$  and  $k$ )

radius =  $8$  (square root of  $64$ )

ex.2:  $x^2 + (y+5)^2 = 20$

center =  $(0,-5)$  (opposite of  $h$  and  $k$ )

radius =  $2\sqrt{5}$  (square root  $20$  then simplify)

The next thing we learned was how to write an equation if we were given the information.

ex. center =  $(-2,8)$

radius =  $3\frac{1}{2}$

$(x+2)^2 + (y-8)^2 = 49/4$

## Appendix A Continued.

To retrieve this answer the first thing you do is find the opposites of (-2,8) which is 2 and -8 then plug that in to the equation. To get the radius, change  $3\frac{1}{2}$  to an improper fraction,  $7/2$ . The next step is to square it and you'll get an answer of  $49/4$ . Leave it as a fraction. Remember, fractions are our friends.

If you are given 2 endpoints and are asked to write an equation, the first thing you do is find the midpoint (h,k) is the opposite of the midpoint. The next step is to find the radius by using the distance formula. Do not simplify  $\sqrt{104}$  because it is easier to find  $r^2$  in the equation. Once you have done this, plug the numbers in the equation.

$$1. \text{ midpoint} = \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}$$

$$\text{midpoint} = \frac{4+(-16)}{2}, \frac{-1+(-5)}{2}$$

$$\text{midpoint} = \frac{-12}{2}, \frac{-6}{2}$$

$$\text{midpoint} = (-6, -3)$$

$$2. d = \sqrt{(-6-4)^2 + (-3+1)^2}$$

$$d = \sqrt{(-10)^2 + (-2)^2}$$

$$d = \sqrt{100+4}$$

$$r = d = \sqrt{104}$$

$$3. (x+6)^2 + (y+3)^2 = 104$$

When you have an equation like  $x^2+4x+y^2-2y=4$ , in order to find the center and radius, you must complete the square.

$$\text{ex. } x^2+4x+y^2-2y=4$$

$$(x^2+4x+4)+(y^2-2y+1)=4+4-1$$

$$(x+2)^2+(y-1)^2=9$$

$$\text{center}=(2,-1)$$

$$\text{radius}=3$$

After, we were given plenty of time to do exercise 21.

Well, that's all that happened today. Good luck on your test tomorrow. The next scribe is Pamela. posted by RoselS @ [10/25/2005 07:36:00 PM <http://pc30s.blogspot.com/2005/10/scribing-for-circles.html>](http://pc30s.blogspot.com/2005/10/scribing-for-circles.html) [2 comments](#)  
<http://www.blogger.com/comment.g?blogID=14084555&postID=113028738480867864> links to this post  
<http://pc30s.blogspot.com/2005/10/scribing-for-circles.html>  
<http://www.blogger.com/email-post.g?blogID=14084555&postID=113028738480867864>  
<http://www.blogger.com/post-edit.g?blogID=14084555&postID=113028738480867864&quickEdit=true>

[Richard C. <http://www.blogger.com/profile/12873851>](http://www.blogger.com/profile/12873851) said...

Hahaha. Diagrams in 3D. Hahaha. Crrrazy!!! Excellent Work.



10/25/2005 8:54 PM

[AichelleS. <http://www.blogger.com/profile/12875351>](http://www.blogger.com/profile/12875351) said...

three words...A-MAZ-ING hahaha I love the colours and graphics

