# The Blogosphere as Representational Space

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**Abstract:** During the semester, the work of the instructor and students can produce a large number of representations that support student work. A significant element of the orchestration for a course is to organize the *representational space* so that it enables efficient and effective learning within and across different activities. In the case study that is presented, the students do their homework in a blogging environment. The data will show that student work in the blogosphere created alternate and progressive representations that persisted throughout the semester and were re-usable for other learning activities. As a representational space, the blogosphere enabled students to share at all phases of learning, while maintaining autonomy and ownership of their own work.

## Introduction

Over the course of the semester, the work of the instructor and students can produce a large representational space in which learning activities can develop. Within any single learning activity, providing both good and alternate representations for the students to work with has significant positive effect on both reasoning and learning. Across learning activities, each new activity depends on the representations created earlier in the semester. The gradual accumulation of representations is a significant element of the effectiveness and efficiency of student learning. Thus an important part of the orchestration for a course is the design of the *representational space* used during the semester.

The representations that students share and create can potentially mediate their collaborations. A significant design goal, thus, is to create a uniform space of representations that enables students to maintain autonomy and ownership of their own work, while supporting collaboration at all stages of student work and reducing the overhead of sharing. This paper explores the utility of student work in a blogging environment as a basis for achieving this aim within learning activities and across stages of learning.

In the case study that is presented, students do their homework throughout the semester in a blogging environment. The first stage of the course was lecture and homework. During the second stage, student work was more oriented towards a team term project, but the students continued to do homework (and also reflection) in the blogosphere. Student work in the blogosphere created representations of the central content of the course that persisted throughout the semester and were re-usable for other learning activities.

As the students did their homework, they could read each other's drafts and were free to re-edit their own posts up until the deadline. For each assignment, the collective work of the class produced a case-base, with each post, and its accrued comments and meta-content, functioning as a case. Later in the semester, because the posts of each student persisted, the students were free to mine the blogosphere content for other learning activities and different stages of learning. The focus of the study is on how well the blogosphere content functioned as a representational space throughout the span of the semester.

There are three parts to the evaluation of the functioning of the blogosphere as representational space. First we look at the students doing homework before the term project was introduced; there were five assignments during that period. The second part of the evaluation examines the reading behavior of students in the blogosphere as they transitioned from attending lecture and doing homework to the term project stage. The third part of the evaluation looks at blogosphere activity after the term project proposal was finished until the end of the semester. Both survey data and a quantitative analysis of the students' reading behavior is presented.

## About the Class

The class is a course on Human Computer Interaction (HCI); there were 48 students in the class, a mix of undergraduate, graduate, and post baccalaureate students. The main goal of the course was for students to learn methods for designing a human computer interaction. Most of the lectures were on methods and techniques. Some lectures included in-class design sessions or design briefs from design projects that were independent of the class. Throughout the semester the students had weekly homework assignments that were done in the blogosphere: the homework assignments counted for 30% of the grade.

The first part of the semester was lecture and homework. The lectures were focused on design methods and techniques for HCI. Towards the middle of the semester the term project was introduced. The focus then shifted from learning and practicing methods to applying them to an ongoing project; during this period the students continued to do weekly assignments in the blogosphere. The term project was to develop a design for a human interaction with technology using the methods and techniques the class had begun learning during the first part of the course. Students worked in teams of 2-4 students. There was a minimum set of methods and

techniques that each term project was required to use.  The term project counted for 40% of each student's grade.

The team term project supported student learning in the ways that are associated with project based learning in general (Krajcik, et al, 2008; Blumenfeld et al 1991).  It connected course material to the everyday experiences of the students, providing motivation and context for learning, while making the HCI design methods more meaningful.  The project enabled the students to develop skill and knowledge in more depth than what they attained from the less contextualized homework assignments. During the project part of the course, much of the in-class time was run like a workshop with the instructor, teaching assistants, and students interacting with one another to work on the team term projects.  The design artifacts that the students were producing made the progress and understanding of each team visible to other students, and thus it was a medium of sharing work, ideas, and giving each other feedback.

The project report, due at the end of the semester, asked each team to provide a narrative of how the students developed their design, emphasizing the selection and organization of methods that were used. Another requirement was to produce numerous design rationales for their final product; these design rationales were the kinds that professionals in the field would use to defend their design decisions.  The design methods, techniques, and rationales were foreshadowed by student work in the blogosphere.

## Student Blogging

In a student blogging community, each student has full control over the content of her blog. The blog is composed of multiple posts written by the blog owner. Blog posts can be lengthy, and they are self-contained. The format of a post or comment is flexible and adaptable to different kinds of contributions (Du & Wagner 2005). Students can browse in the blogosphere at any time, reading and commenting upon the contributions of other students. The overhead of learning to use the technology is low (Glogoff 2005).

At a very basic level, blogging is an activity composed of writing, reading, and commenting. From a more social perspective, the students' activity can be viewed as sharing (e.g., Deng and Yuen, 2011). From a third vantage point, over the course of the semester, the contributions of the students form a 'warehouse' of content that can be "mined" throughout the semester (Williams and Jacobs 2004).

Blogging has a social orientation in that each post initiates communication with other students; it fosters a sense of community and provides a channel for interaction amongst the students (Deng and Yuen 2011). Contributions to the blogosphere simultaneously maintain relevance to the course material while "retaining the self-directed, internal focus of the owner" (Cameron and Anderson 2006; Ellison and Wu 2008; Lara and Lomicka 2008). Prior studies have show that students perceive reading in the blogosphere as improving their understanding of the course concepts (Ellison and Wu 2008), helping them to better organize ideas and consolidate knowledge (Zeng & Harris 2005), and exposing the students to alternate viewpoints (Oravec 2002; Ferdig & Trammel 2004).

The blogging environment used in the class was a complete rebuild and revision of an earlier version of the system that had been used in several classes. Early in the semester, we engaged the students in design sessions for revising the new blogging environment. Periodically updates to the blogging environment were released. After the first few weeks, almost all of the revisions to the design of the technology were completed.

On the front page of the blogosphere, the posts were shown in reverse chronological order, with the most recent posts at the top of the page. Students could also access posts by the tag label associated with each assignment.  Each post included the name of the author and the date of the post, the title of the post, the assignment tag, a count of the number of comments, and a count of the number of "thumbs-up" given to a post by other students.  Clicking on the author's name changed the display to show all the posts from that author. Hovering over the title of a post showed a preview of the post; clicking on the post itself showed the post in its entirety and any comments the post has accrued. A search function allowed the students to find all the posts that contained a search term.

During the semester, the students were responsible for writing 10 posts and 20 comments.  Most of the posts were skill building; a few, later in the semester, were student reflections on term project work. Some assignments were preceded by in-class exercises that gave students face-to-face group time before beginning an assignment. While doing the skill building assignments, the students applied the same methods or techniques to examples of their own choice.  Students were encouraged to post drafts of their work before the deadline, thus the students could collaborate on the homework by reading and commenting on each other's drafts.

After the submission deadline for each assignment, the TA assigned to each student two posts to "officially comment on"; the official comments were due a few days after the post was due.  After both the posts and official comments had been graded, the TA gave "gold stars" to the best posts for a given assignment.  Thus for each blogging assignment, there were several iterations on the content of the blogging assignment: some before (reading the assigned material and listening to a lecture), some during (doing the homework and browsing while doing the homework), and some after (commenting and interpreting feedback).

The first five assignments were concerned with techniques and methods for designing a human computer interaction. The sixth post was draft of the project proposal, written by each student individually. A week before the team proposal was due, each student wrote a draft version of the proposal as a blog post; so a team of three students would have three different draft versions of their project proposal written a week before the proposal was due.  The draft proposal substantially overlapped with post 5 (scenarios, conceptual models, and prototypes) and to a lesser extent post 4 (data gathering plan). From the in-class discussion it was clear the students struggled with the scenario creation part.

After the draft proposal posts, there were four other posts.  Two of these posts were additional skill building activities that were directly related to the requirements of the term project.  The other two posts were "progress reports" written by each student on his/her team term project.

Students were encouraged to read freely throughout the semester in the blogosphere. While working on an assignment, it was perfectly fine for a student to review the posted work of other students. It was also ok for a student to revise her/his post up until the deadline.

## Features of Blogging as a Knowledge Community

For the class, the blogosphere was an open space (Duval 2011) that made it easier for students to collaborate: the students broadcast and shared their work. They had access to the draft versions of each other's post to support their own learning. The students could "work together" even though they worked from different places and/or at different times.

Doing homework in the blogosphere was a loosely coordinated activity: the students connected and shared with one another, producing sharable objects, and common (background) knowledge in a distributed fashion while collaboratively acquiring knowledge and building skills (Alterman and Larusson, 2013).

Each contribution was self-contained. As each post was authored, there was an expectation that the reader should be able to read the post by itself.  Where, for example, an utterance in a chat is designed for the *recipient* (Sacks et al, 1974) with the expectation that there will be further interaction, or contributions to a discussion forum depend on other contributions, a blog post is constructed as a self-contained communication that is broadcast to the rest of the class. At the time each post is constructed, factors that would make the contribution understandable at other times, in other places, are a significant element of how the post was developed.

To a certain extent, the reasoning and learning the students did during the semester vis-à-vis posts in the blogosphere can be thought of as a form of case-based reasoning (Kolodner et al 1996; Kolodner et al, 2003). The entire collection of posts for a single assignment forms a case base. Each post "practices" the same method or technique with a different example, thus an individual post for a homework assignment on, for example, writing a questionnaire, with the commentary it accrues, can be viewed as a case. Because the students can, and do, collaborate while the posts are being written, the cases are collaboratively produced. The meta-content for, and commentary on, each post further enriches each case.  Indices for retrieving content were created both as the post is developed ("encoded and inserted") and each time it is retrieved ("retrieval time") (Kolodner et al, ibid). Indices that were added as each case/post was "encoded and inserted" into the case base included the assignment tag and the name of the author of the post.   Any time a student read a post, she could create an index to it by bookmarking it or just remember it or the search term she used to find it. The iterative refinement of each post/case as it was developed and the reuse of these cases for other endeavors are characteristic of the case-based approach to reasoning and learning.

## Representational Space

From a larger perspective, the instructor organizes a course into a hierarchy of topics and subtopics.  A sequence of instruction can be defined by a traversal of the topic tree; earlier topics of the instructional sequence prepare the students for later learning activities (Gagné, 1973).  Any traversal will have both breadth and depth components (Collins et al 1991). The breadth components give the student a map of the terrain that they will be covering over a sequence of learning activities.  The depth components enable the students to acquire details of the targeted skills and knowledge and a more nuanced view of their application.  A course that has a sequence that is organized as breadth-first can develop in stages. Students make multiple passes through the same material, gradually deepening their understanding and improving their skill. Each stage of learning produces representations for the next stage of learning.

In the HCI course, at the level of curriculum, the term project is an iteration of working with the methods and skills taught in the first part of the course. During the first stage of instruction, the students collaboratively worked at learning techniques, methods, and argumentation of HCI. During the project stage, the students developed skill and knowledge in more depth than what they attained from the less contextualized homework assignments.

Over the course of the semester, the work of the instructor and students can produce a large representation space in which learning activities can develop. Within any single learning activity, providing

good representations for the students to work with has significant positive effect on both reasoning and learning (e.g., Larkin & Simon, 1987; Zhang & Norman, 1994; Scaife & Rogers, 1996; Suthers, 2005). Learning from multiple external representations has great additional value (Ainsworth, 2006): alternate representations can be complementary, students differ in their preferences, different tasks work better with different representations, and multiple representations encourage strategic thinking.

Across learning activities, each new activity depends on the representations created earlier in the semester. Representations produced earlier in the semester can coordinate and mediate subsequent learning activities, which produce additional alternate representations. As new representations are added to the shared space, it gradually becomes enriched. The gradual accumulation of these sorts of representation, the enrichment of the space in which the class operates, is a significant element of the effectiveness and efficiency of student learning.

The orchestration of the course has direct bearing on the media and form of the representations. For the HCI class, the students had access to many different kinds of representation: blogosphere content, reading material, electronic and hard copies of the lecture slides, in-class handouts, each student's private notes and the "remembering" of lectures and in-class exercises.

In the study presented in this paper, we will especially be interested in how well the blogosphere content functioned as a representational space both within learning activities and across stages of learning. Using the blogosphere as a forum for collaboration has direct bearing on the potential for sharing and re-using content as the students acquire skill and knowledge. Did the production of content enable collaboration and the formation of common knowledge amongst the students? Did the students leverage the content produced in one activity for another? Did the content of the blogosphere support the transition of learning to the project based stage?

## Evaluation

There are three parts to the evaluation of the functioning of the blogosphere as representational space. First we look at the student doing homework before the term project was introduced. There were five assignments during that period. Each of the assignments emphasized skills and methods for designing interfaces. A survey of student attitudes and preferences is presented as well as quantitative data of the reading behavior of the students. Each time a student clicked on a post to access the full text of the post and any comment it had received, as opposed to previewing the post by hovering, we counted it as a read. Unfortunately, reading behavior data was lost for the last 12 days of the semester. During this period the students were finishing up their projects and final reports. Despite the loss of data, the evidence shows that many students continued to be leverage the accumulated content of the blogosphere during the latter part of the semester.

The second part of the evaluation examines the reading behavior of students in the blogosphere as they transitioned from the first stage of the course to the term project stage: the students first individually wrote drafts of the term project proposal and then they wrote, as a team, a more formal and complete proposal outside the blogosphere. Again, both survey and data on reading behavior are presented. The third part of the evaluation briefly looks at blogosphere activity after the term project proposal was finished.

### Doing Homework

Midway through the semester, we gave a survey questionnaire to the class on their work in the blogosphere. The questions were on a 5-point Likert scale. For each question we calculated the average response and also the percentage of students who agreed/strongly agreed (see Table 1). Most of the students (69%) believed that they were learning more by doing the homework in the blogosphere (question 1). As they did their homework, a majority of the students browsed in the blogosphere to interpret the assignment, viewing how other students approached it, and looking at how it was presented (questions 2-4).

Table 1: Blogging in general.

| QUESTION | (AVERAGE; % AGREED/ STRONGLY AGREED) |
|---|---|
| I believe I am learning more by doing homework in a blogosphere than I would be by doing it alone. | (3.88; 69%) |
| I browse in the blogosphere to help me interpret the assignment. | (3.96; 76%) |
| I browse in the blogosphere to see how other students are doing the assignment or part of it. | (4.04; 80%) |
| I browse in the blogosphere to see how other students are presenting/formatting their posts. | (3.76; 59%) |

The numbers in Table 1 are for the class as whole.  We compared those numbers to those of the non-native speakers.  The non-native speakers in the class were even more positive about the value of doing homework in the blogosphere than doing it alone (4.29, 86%).  They also agreed/strongly agreed more often that they were using the blogosphere to help interpret assignments (4.14, 76%), see how other students did the work (4.05, 85%) and presented their answers (4.10; 76%). One non-native speaker, a Masters student, said that the blogging work was better for developing her English than the ESL course that she had been required to take.

We also did a quantitative analysis of the reading behavior of the students, dividing it into three phases: the week long period the students had for completing their post for a given homework assignment, the 3-day official period for commenting (students are assigned two homework posts to comment upon), and the period afterwards that ended on the last day of the semester.

Table 2 shows how much reading, on average, each student did of the posts of other students during three different phases (columns) in the lifetime of a post – these data is for the first five posts, i.e., the homework assignments the students did before they started their term project. For each phase we calculated the average number of posts read per student per post (reads). Because a single post might have been read more than once, we also calculated the average number of different posts read (unique) by each student for each assignment. The "reads" number tells us how many times, for each assignment, on average, each student accessed cases in the case base, and the "unique" number, how many different cases/posts were accessed.

The data is divided into quadrilles (rows), from the most active readers (1st quadrille) to the least active (4th quadrille); there were 12 students in each quadrille. The quadrilles were recomputed for each phase; thus accounting for different styles of use. *All data reported in the table excludes the numbers for students reading their own posts.*  As an example of how to read the table, in the first row, each student in the first quadrille read on average 24.92 posts during the time they did their assignment, and they read 15.40 different posts.

Table 2: Reading behavior during the three phases of a post/case.

|  | Phase 1: While doing each HW | | Phase 2: While commenting | | Phase 3: Thereafter | |
|---|---|---|---|---|---|---|
|  | Reads | Unique | Reads | Unique | Reads | Unique |
| 1st quadrille | 24.92 | 15.40 | 22.19 | 6.90 | 10.26 | 5.81 |
| 2nd quadrille | 11.60 | 8.42 | 9.07 | 3.51 | 4.00 | 2.40 |
| 3rd quadrille | 6.42 | 5.22 | 7.04 | 2.79 | 2.92 | 1.72 |
| 4th quadrille | 3.08 | 2.61 | 4.19 | 1.60 | 1.18 | 0.71 |

During each phase, many of the students actively used the blogosphere content. During the time the students were composing their post, the 12 most active users of blogosphere content read almost one third of the posts by other students, and the second quadrille roughly 16% of the posts. During the commenting phase, the most active readers read 6.90 different posts, two of which were formally assigned to them to comment upon.

Kaptelinin & Cole (2002) describe a "life cycle" of intersubjectivity within the classroom. In the first phase (pre-intersubjectivity), students engage in individual activities that are externally coordinated. In the second phase (intersubjectivity), the students begin to work and play together. In the third, and last, phase (post-intersubjectivity), the group work is over but the "residue" of their shared activities impacts their individual work or other collective activities. Table 2 shows that the blogosphere enables the class to share a computer-mediated collaborative intersubjective experience (phase 2) that the class can use as basis for their term project work (phase 3). Because the students had collaborated as they worked on the first five assignments, during the workshop period of the class, they were better prepared to continue to collaborate even across teams: the students had done a lot of sharing during the first stage of the course and had created a large representation space that could be leveraged for other learning activities.

## Transitioning to the Project: Writing the Draft and the Formal Proposal

Students were given two weeks to write a term project proposal.  At the end of the first of the two weeks, each student posted an abbreviated version of the project proposal. Table 3 summarizes the data during the week the students were writing the draft proposal.  The term project description was handed out after the comments were due for post 5, so all the data is for the additional reading students did after the due date for comments. The most active readers, on average, read the draft proposals of other students 21.08 times (11.75 unique) while writing their own drafts.  There were also a large number of students that read post 5 on scenarios.  The most active readers of post 4 on data gathering, sampled that case-base a little bit, on average 3.42 total reads and 2.75 different posts.

Table 3: Reading behavior while composing the draft proposal.

|  | Data Gathering | | Scenarios | | Draft | |
|---|---|---|---|---|---|---|
|  | Reads | Unique | Reads | Unique | Reads | Unique |
| 1st quadrille | 3.42 | 2.75 | 15.33 | 6.75 | 21.08 | 11.75 |
| 2nd quadrille | 2.17 | 1.33 | 6.58 | 2.67 | 8.92 | 6.75 |
| 3rd quadrille | 0.17 | 0.50 | 4.08 | 1.25 | 5.08 | 4.00 |
| 4th quadrille | 0.08 | 0.00 | 1.25 | 1.33 | 2.17 | 0.92 |

After the students turned in their draft proposals, they had one week to complete the team version of the project proposal. At the time the students wrote their formal term project proposal, there were many representations available, both inside and outside the blogosphere. We surveyed the students to see what resources (representations) they felt were useful for developing scenarios and writing the data gathering plan for the proposal.  See Table 4 for a summary of results. Not surprisingly a high percentage of students agreed/strongly agreed with the utility of the draft versions of their initial scenarios (84%), with the average of 4.40 on a 5-point Likert scale; ditto for writing the data gathering plan (4.23; 81%).  But other representations were also clearly valuable for students in the class.

Table 4: Value of different representational resources.

| RESOURCE/REPRESENTATION | SCENARIOS | DATA GATHERING PLANS |
|---|---|---|
| Draft proposal written by student | (4.40; 84%) | (4.23; 81%) |
| Relevant homework post | (4.14; 84%) | (4.09; 71%) |
| Lecture notes | (3.65; 67%) | (3.58; 56%) |
| Another student's homework post | (3.55; 57%) | (3.40; 49%) |
| Another student's draft proposal | (3.29; 43%) | (3.44; 52%) |
| Required reading | (2.63; 31%) | (2.77; 31%) |

Figure 1 shows the distribution of students who agree/strongly agree that one or another resource was valuable in preparing either the scenario or data gathering portions of the term project proposal.  The resources are listed from top to bottom, in reverse chronological order. All of the resources were valuable to somebody. For example, even though readings and lecture notes happened before the post on scenarios (or data gathering), they continued to have value for many of the students when they were writing their the final version of the project proposal; this was despite the fact they had already compiled some of the content into their draft proposals.
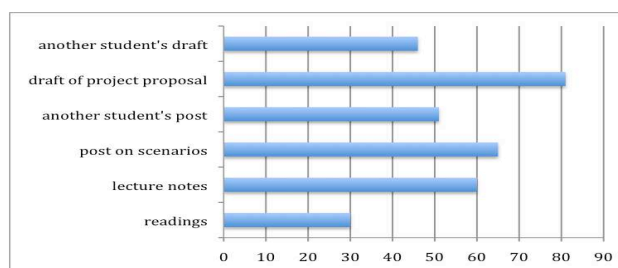


Figure 1. Distribution of students that agree/strongly agree with value of a given resource.

Table 5 shows the reading behavior data during the week the students wrote the formal proposal. There were 16 team proposals; the numbers reported are normalized for the size of each team.  The first row shows the reading of the most active readers during this period.  The second row shows the average amount of reading per team.  The third row shows how much on average each student in the class read in the blogosphere.  The draft proposal numbers include the commenting period for the draft proposal assignment (commenting on two posts was required) and teammates reading each other's posts (as opposed to, for example, emailing copies to one another).  The average team size was 2.88.  Subtracting these factors from the analysis of student reading of the draft proposals, the students in the 1st quadrille read 10.37 unique posts, other than the posts they were required to comment upon or the posts of their teammates.  In a similar vein, the average for all teams was an additional 8.51 posts, and the average for individual students was 2.87 additional posts. It was not possible to do this analysis for the total reads. These data shows that many students continued to sample the blogosphere beyond what was required.

Table 5: Reading behavior while composing the team version of the project proposal.

|  | Data Gathering | | Scenarios | | Draft | |
|---|---|---|---|---|---|---|
|  | Reads | Unique | Reads | Unique | Reads | Unique |
| 1st quadrille of individual students | 1.08 | 0.75 | 1.58 | 1.58 | 40.25 | 15.25 |
| Average for all teams | 1.44 | 1.06 | 3.25 | 2.13 | 53.06 | 22.56 |
| Average individual student | 0.48 | 0.35 | 1.13 | 0.75 | 18.56 | 7.75 |

## The Blogosphere after the Team Proposal

There were four posts written after the due date for the formal proposal.  Two of the posts were skill building, and the other two posts were progress/reflection reports; we did not do an analysis of the reflection posts.

The first skill building post was completed before the time it was relevant for the project, so for this post, the students did an analysis of an application or website other than the one they were working on for their term project.  Students continued to "lean" on the blogosphere content (numbers not shown): the numbers for the 1st quadrille are commensurate with the numbers for the 1st quadrille of students for the posts that were written before the term project started; the numbers for the other quadrilles were slightly lower. The second skill building post was at the end of the semester, so the students could do the assignment by applying the techniques to data from their term project, and this is what they did.  Unfortunately the data for how much reading the students did as they wrote this post was lost.  However, given the difficulty of the assignment there is no reason to believe that the students did less collaborating as they wrote, and they might have done more.

Table 6 shows how much reading the students did of the first five posts after the team proposal was finished. The numbers show that a quarter of the students continued to find the representational space of the blogosphere a useful resource while the students worked on their project and then wrote their report.  As to which assignment (case base) was most relevant, it depended on the student.  The students undoubtedly were doing more reading than is reflected in this table for two reasons: the last 12 days of reading data were lost, and during the workshop period, teams of students, collocated in the classroom, may have been reading together.

Table 6: Reading posts 1-5 after the formal proposal was due.

|  | Posts 1-5 | |
|---|---|---|
|  | Reads | Unique |
| 1st quadrille | 14.33 | 12.33 |
| 2nd quadrille | 4.25 | 3.25 |
| 3rd quadrille | 0.42 | 0.33 |
| 4th quadrille | 0.00 | 0.00 |

## Concluding Remarks

In the study presented in this paper, the blogosphere was a representational space that supported sharing and collaboration throughout the semester, while enabling students to maintain autonomy and ownership of their own work. The data shows that there was significant use of the blogosphere as a representational space to support learning both within and across learning activities.

Many students collaborated as they did their homework. The collective work of the class collaboratively produced a case-base for each homework assignment, with each post, and its accrued comments and meta-content, functioning as a case.  After the due date for a homework, the students continued to read the collected posts for that assignment, both during the official commenting phase and thereafter.

As the students transitioned to the project stage of the course, the survey data shows that many students had a preference for using the blogosphere content created earlier in the semester.  The students individually wrote drafts of the project proposal as a blogging assignment, and they wrote a more formal team project proposal outside the blogosphere.  In both parts of the transition, large numbers of students continued to use the blogosphere content to support their work.   During the project stage, despite the loss of the last 12 days of usage data, the data shows that at least 12 of the students were very active readers of blogosphere content.

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