Collaborative Web-sites for English Composition

Jochen Rick, Mark Guzdial, Karen Carroll
College of Computing
Georgia Institute of Technology

Lissa Holloway-Attaway, Brandy Walker
School of Literature, Communications, and Culture
Georgia Institute of Technology

Abstract

CoWeb is a collaborative learning environment used in many classes at Georgia Institute of Technology. We present evidence of the success of the tool in supporting learning at a low cost in one environment (freshman-level English class). Furthermore, we cite evidence of active resistance to collaboration in other domains (such as engineering and mathematics) that make it difficult to achieve the same effects there.

Introduction

CoWeb (Collaborative Web-site) provides an extremely simple model for collaboration (on-line, asynchronous). It is a web-site where (to oversimplify) each page is editable by simply clicking an *Edit* button on the page and new pages can be created by simply referencing them in the page's text. Through over a dozen iterations in the last three years, CoWeb has had features added and the interface streamlined to fit well into classroom use [2]. Over 100 class CoWebs are now in use at Georgia Tech. A wide variety of educational activities have been invented by teachers for their classes [3], and we have catalogued some 25 core activities that we see tailored to meet specific class needs [4].

This study examines the use of CoWeb in freshman-level English classes and considers its use in other classes. In particular, we want to show both learning and cost effectiveness. By engaging students in collaboration, we can leverage the large numbers in classes to create greater opportunities for discussion, reflection, and (consequently) learning. Because the increased opportunity for learning is coming from the students themselves, the cost for the institution does not need to rise any further than simply providing oversight for the process. Thus, for relatively low costs (cost efficiency), significant improvement can be made in class performance (learning efficiency).

Learning Effectiveness

Learning effectiveness is the amount learned in relation to the cost for achieving that learning (i.e. time on task). In this section, we show our evidence for learning through use of CoWeb. Then, in the next section, we show that this learning benefit is achievable at a low cost.

To do this, we studied two sections of an English 101[1] class, taught by the same teacher. The first section (n = 24) used CoWeb to complete various assignments[2]. The comparison section (n = 25) did the same activities, but the students work individually: highlighting text in the prose, adding margin notes. As the same activities were done by each section, student cost (effort) is near identical.

In English composition, CoWeb is used for an activity called *close reading*, where a prose or poem for discussion is posted, and students comment upon by inserting links directly into the prose or poem. Students then comment upon each others' comments, and even use the same technique to comment upon each others' essays.

---

[1] English 101 is a fictional course number, but the course is the Georgia Tech version of English 101.
[2] The CoWeb section was chosen at random and students did not know a priori which section would used CoWeb, so selection bias was minimized.

Through surveys, we find that the CoWeb section had significantly better attitudes toward collaboration than did students in the comparison section (Table 1). In addition, the CoWeb section received higher grades (grade breakdown: 7 A's, 10 B's, 3 C's, others F or W) than the comparison section (grade breakdown: 19 B's, 3 D's, others F or W), which indicates better performance and suggests better learning.

Statement	**CoWeb Section**	**Comparison Section**
I would rather work independently on assignments than in groups or teams.	3.83	2.81
I feel like working with others on assignments is more helpful than working alone.	2.00	2.75
I found it useful to relate my work to that of others.	1.56	2.50

Table 1: Attitudes toward Collaboration, where 1 is strongly agree and 5 is strongly disagree. $p < 0.05$ on a two-tailed t-test for all of these statements.

We recognize that grades are not a careful measure of performance, and they are too large-grained to inform us about where any learning benefit may have come from. As such, twelve students were selected randomly from each section and their work rated by various criteria (Table 2). Five assignments were rated: two close reading assignments based on student-generated chat sessions (rated for the first 6 criteria, which we refer to as *chat close readings*), two close reading assignments based on literature (rated for the first 10 criteria, referred to as *literature close readings*), and one formal essay (rated for all 15 criteria). To keep individual bias to a minimum, two raters (one the course instructor, the other a colleague in the same department) rated each assignment on a scale of one to four (four being highest performance); no significant differences were found in any of their ratings, and all criteria had better than 70% of the ratings identical. In each rating category, the CoWeb section outperformed the comparison section (in most, by a large statistically significant amount):

Category	**CoWeb Section**	**Comparison Section**	**Difference**
Engagement with Class Material	2.52	1.88	0.64
Foundation for Research	2.49	1.68	0.82
Reflective / Recursive Writing Practices: Authorial voice	2.30	1.58	0.73
Reflective / Recursive Writing Practices: Reflection and Exploration	2.24	1.49	0.75
Critical Vocabulary: Understanding	2.30	1.54	0.76
Critical Vocabulary: Application	2.28	1.33	0.95
Formation of Critical Questions: Engagement with Topic	2.39	1.94	0.44
Formation of Critical Questions: Quality of Questions / Arguments	2.24	2.21	0.03*
Critical / Close Reading Skills: Analysis	2.29	1.97	0.32*
Critical / Close Reading Skills: Identification of Issues	2.36	2.06	0.31*
Research Skills: Locating Information	3.04	2.54	0.50

Research Skills: Using Information	2.75	2.00	0.75
Identification of Critical Sources	2.75	2.08	0.67
Engagement and Integration of Research Sources	2.71	1.75	0.96
Effective Use of Formal Essay Writing Conventions for Argumentation	2.79	2.21	0.58

Table 2: Writing Performance. $p < .05$ on a two-tailed t-test for all except *

In general, the students in the CoWeb section did significantly better on writing essays than the comparison section, particularly on issues of vocabulary and essay organization. Several categories show near 1.00 differences in performance; on a scale of one to four that is impressive. For instance, on critical vocabulary application, the CoWeb section average is between 2 (chosen when "the student deploys these terms where appropriate in his/her writing, but most are misused") and 3 ("the student deploys most of these terms where appropriate in his/her writing, but occasionally misuses them"), while the comparison section average is between 1 ("the student never successfully deploys these terms where appropriate in his/her writing") and 2.

Clearly, CoWeb seems to engender better performance; however, we also wanted to get an idea as to whether there was a cumulative effect of CoWeb use over the term. As such, we looked at performance over the term on similar assignments. If CoWeb has a cumulative effect, the difference in ratings (i.e. performance-gap) should increase over time. Figure 1 shows that for each of the two assignment types noted earlier, the performance-gap increased over the term, though not by a large margin (.29 and .07 respectively).

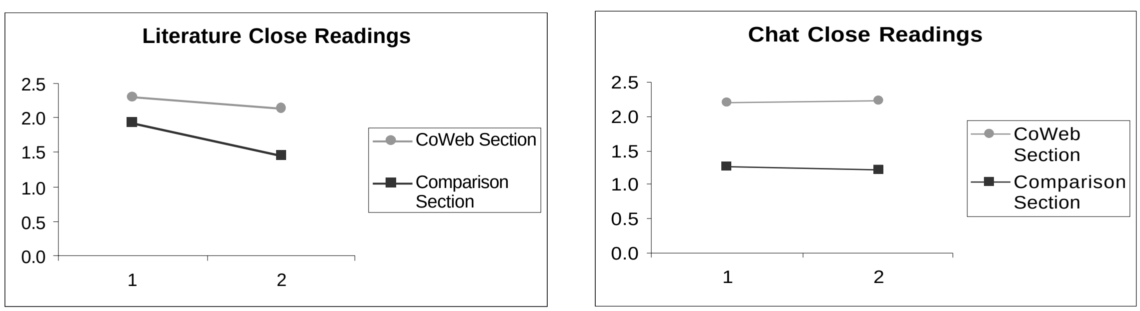

Figure 1: Graphs demonstrating the performance-gap between CoWeb and comparison section increases over time on two different types of assignments.

So overall, we conclude that CoWeb usage in close reading activities was effective for learning in this study. The performance of the students in the CoWeb section was significantly better by many key subject criteria over the comparison section. At the same time, attitudes towards collaborative learning improved. We speculate that these two factors are not independent; instead, as the use of collaborative learning proves beneficial, more learning will happen, which in turn improves the attitude towards collaboration. Furthermore, instead of just improving performance on the activity itself, CoWeb students show a cumulative learning effect.

Cost Effectiveness

Now that we have shown learning effectiveness, it becomes important to look at costs. We aim to show that CoWeb use has both low infrastructure and human costs.

Infrastructure costs are negligible. Though a server was bought for this study, that server can support at least a dozen classes over many terms. CoWeb is a cross-platform and lightweight server application that can be run on virtually any hardware (in some cases, old 486's), so even a $1000 server can easily support many classes. Student access to internet-enabled computers is essential for CoWeb use; at Georgia Tech, there was no need to provide any infrastructure for this since it was already present. Nor is use of that infrastructure markedly increased, considering that students would need similar amounts of time for other applications for the same class (i.e. word processing). At other locations where the infrastructure is not in place, that cost may be prohibitive; however, the infrastructure is becoming very common. The CoWeb software is open-source freeware[3]; thus, there are no software costs.

Administration costs too are negligible. Besides the tracking software (specifically used for gathering study data) and a couple of software upgrades (the CoWeb software is still actively being developed), the English professor (not a computer specialist) was able to administer the server without assistance. In total, the amount of administration time over the semester was less than an hour.

By far, the dominant cost factor in CoWeb use is teacher time. The professor for the two sections, using self reporting, averaged about 2.5 hours per week devoted to CoWeb usage; this is quite reasonable as it is about the same amount of time as an office hour. In addition to self-reporting, we used log files on the servers to track usage, and found that the self-reports matched the server recorded times to a high degree[4]. However, this does not give us a clear idea of how she spent that time or how student usage relates to teacher involvement.

In the term following our learning study, we again set up CoWeb to log usage time. We did this for two professors, teaching the same class (English 102[5]). The first professor (P1) was the instructor for the original class, and here taught the follow-up course (n = 24, with 1 W). The second professor (P2) was the second rater for the performance assessment. This was the first time this professor used CoWeb, using one CoWeb for three sections of the same class (n = 64, with 5 W). As she was getting used to CoWeb, P2 still relied on another web environment for the class; in contrast, all on-line activities for P1 were done with CoWeb. In the future, P2 plans to only use CoWeb. P1 and P2 did fairly different activities with their class and have different styles of using the technology, so this data is a good cross-section of teacher uses. Table 3 summarizes teacher and student time on CoWeb.

What is most notable is that in both cases the ratio of total time spent by students to total time spent by the teacher is similar (10.00 and 8.45). One way to think about cost effectiveness of an educational activity is to contrast the ratio of teacher to student time. By this criteria, lecture is cost effective. For each hour of teacher time input, there are *n* hours of total student time (24.00 and 21.33 respectively in our case) spent engaged in the learning activity. This number estimate is a bit high, considering it does not include preparation time for the instructor or absenteeism for the student. While lecture scores

---

[3] It can be downloaded from http://minnow.cc.gatech.edu/swiki

[4] In addition, we asked students (both experiment and comparison classes) to self-report their time spent outside of class. We found no difference between the classes in terms of student time, and the student time reports also matched closely the server recorded time.

[5] Again, English 102 is a fictional course name.

high marks on efficiency, it loses in learning effectiveness as student involvement tends to be passive. In contrast, one-on-one tutoring, as may occur during office hours, can be quite active and engaging. Unfortunately, one-on-one tutoring isn't economically feasible, with a ratio of 1.00 hour of teacher time to student time. The CoWeb ratios (around 9) on the other hand seem a reasonable compromise of the cost effectiveness of lower teacher time with the learning effectiveness of more active learning (constructing artifacts).

	P1	P2
Average Non-W Student Time	17.95 hours	8.13 hours
Total Student Time	412.84 hours	484.82 hours
Total Teacher Time	41.30 hours	57.35 hours
Total Student Time / Teacher Time	10.00	8.45
Teacher Time / Average Student Time	2.30	7.05

Table 3: Teacher and Student Time using CoWeb

Unlike lectures that have a high attendance level, time-spent using an educational technology can be highly varied. One scenario could have an exponential drop-off, with only a few students using the technology often. While the technology might have marked effects on these few students large enough to affect the class average, it probably wouldn't be considered a healthy situation in most schools. What we want to see is that the technology is reaching most if not all students.

To look at the distribution of usage across students, Figure 2 plots student time on CoWeb from most usage to least usage. The vertical axis is the number of hours spent in the CoWeb, and the horizontal axis represents different students, ordered in terms of the amount of use they spent in the CoWeb.

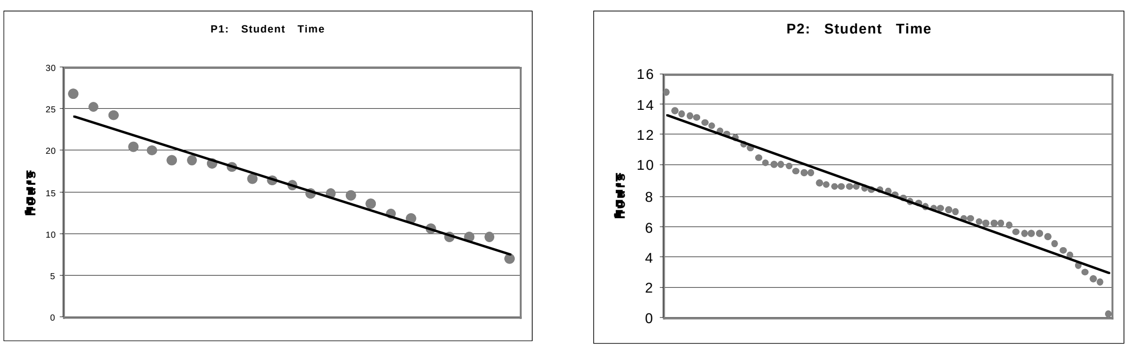

Figure 2: Graphs of Students' CoWeb Usage (from most use to least use)

What it show is that while usage varies quite widely, it does so in a near linear way (for both professors). Also, in both cases, there seems to be a grouping around the class average with only a few doing significantly less or more. For an activity, like homework, a roughly linear distribution with a few doing significantly more or less than the average seems acceptable.

Are some activities more cost effective than others (i.e. requiring less teacher time for equal student effort)? For instance, efficiency could then be improved by focusing on certain activities and dropping less efficient activities. To test this hypothesis, we recorded student and teacher time on CoWeb over the term (Figure 3—horizontal axis represents two week intervals over the course of the term, and vertical axis represents time spent in the CoWeb during that interval). After looking at the data, interviews with P1 and P2 were conducted to find out what activities occurred and how their time was spent.

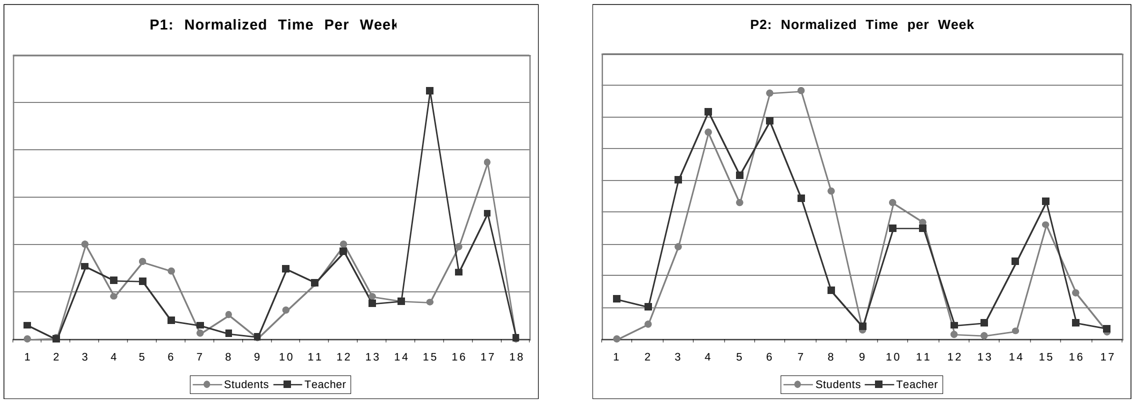

Figure 3: Graphs of Time per Week for 2 Profs. (Note: Week 9 is Spring Break)

A couple of conclusions can be drawn from this data. First, almost all of the time, the professor put in some of the effort before the students; this can be seen particularly well for P2, where teacher time seems almost shifted a week off the student time. So, a significant proportion of teacher time is spent on setting up the space; this observation was confirmed by P1 and P2 during the interviews. Second, teacher time is closely linked to student time for each assignment. The only exception is week 15 for P1, where she spent just over 10 hours on CoWeb; this time was mainly spent on grading. P2 did grading throughout the term. As such, there is no assignment for either professor which is far more or less efficient. One way to explain this is that the amount of time that instructors and students spend on an assignment is closely related to the point value of the assignment; so, the original hypothesis about more efficient assignments is flawed.

P2 mainly used CoWeb for one large assignment (weeks 2-12); also, students voluntarily used CoWeb to collaborate on their final project (a web-site; weeks 13-16). P1 used CoWeb throughout the term for multiple assignments; the largest student use came in weeks 15 through 17 for their final project (also, a web-site). Unlike P2, P1 allowed for students to do their web project entirely in CoWeb; four out of six groups decided to complete their projects entirely in CoWeb. So, students found interaction on CoWeb useful enough to use it instead of traditional web-site tools, such as Microsoft FrontPage™. As students tend to chose the most effective ways to accomplish their goals, this is further evidence of CoWeb's cost effectiveness (this time for students). Furthermore, P1 commented that the quality of the final projects was higher than previous classes as CoWeb-using students concentrated more on content than on looks. Although P1 has always stressed content over looks, students creating web-sites tend to focus much of their time on looks. Since most web-page creation tools allow you to "mess around" easily with looks, it is only natural that students would find this aspect interesting. In contrast, it is almost painfully to "mess around" with looks on CoWeb. Instead of this being a detriment, it is an advantage (in this case) for learning effectiveness. If CoWeb usage was not seen as cost effective by the students, they would not have used it for their final projects, and the final assignment would not have been as effective for learning, so it is important that a classroom technology be seen as cost effective by both instructor and students.

For P1, all class activities besides office hours and lecture (including grading), were conducted on CoWeb. Considering that lecture time was about 50 hours, roughly 40 hours spent on the class outside of lecture is quite efficient. The 41 hours observed through system logs also matches closely to P1's self reported time of 2.5 average hours per week spent on CoWeb for the previous term, where the learning effectiveness was closely examined. While CoWeb's interface is easy to learn and we have produced several guides on how to use it in the classroom, we expect a certain significant cost to be incurred from using a new technology for the first time. As P1 already used CoWeb before and had taught this course before, her level of efficiency (10.00 total-student-time-to-teacher-time ratio) may have reached a stable efficiency saturation point. In contrast, for P2, this was the first time to use CoWeb. As such, her total-student-time-to-teacher-time ratio would be expected to rise (slightly) over time as she feels more comfortable with the environment. Also, teacher involvement is highly dependent on teaching style. P1 views her CoWeb interaction as setting up the space for the students to work and then letting them "loose." In contrast, P2's style is one of tighter control of what goes on in the space; she is actively involved in the running of the activities. This difference in styles might cause P2's saturation efficiency to be somewhat below P1's. Even with different styles and uses, CoWeb usage remains cost effective for both instructor and student.

Where CoWeb has been Less Successful

We consider the previous results as a proof-of-concept that CoWeb can be used to achieve learning benefits at low cost. The interesting question to ask next is, "When is it not successful?"

CoWeb use has not been successful in engineering and mathematics classes. We have trialed many different CoWeb activities over the last three years. Our most successful activity was the *Puzzle* activity [4] where the teacher posts a challenging problem on their CoWeb, and offers extra credit for the solution or for posting a partial solution or leads that results in the solution. Approximately 40% of the class voluntarily participated in this activity, which is still a far cry from the 70-100% participation that we see with other kinds of classes (architecture, some computer science, English). Some anecdotes highlight the kinds of active resistance that we have seen:

- To encourage collaboration in CoWeb, we created a mandatory assignment that required collaboration between a chemical engineering and a mathematics course. The students in chemical engineering created simulations that generated data for the mathematics students to analyze, and then provide the results back to the chemical engineers. 40% of the mathematics students accepted a zero on the assignment rather than collaborate with the chemical engineers.
- One semester, we started using CoWeb in an freshman architecture course (n = 171) at the same time that we started in a senior chemical engineering course (n = 24). After ten weeks into the semester, the architecture students had generated over 1500 pages, with some discussion pages having over 30 authors. In the chemical engineering course, not a single student had made a single posting yet. In another semester, in a computer science course of 340 students, only 22 students participated.

- We had a hypothesis that part of the inhibition to participate in the engineering and mathematics class was a technical one. The content of many of these courses involves equations, and equations are difficult to post on the Web. If students couldn't *talk* in the modalities that were the most comfortable for them, it would make sense that they would avoid our tool. So, we created an applet-like tool that allowed users to create equations by simply dragging and dropping components from palettes, and then drop the equations into a GIF renderer for easy posting. We installed it in a CoWeb for a mathematics class and for a chemical engineering class. Faculty used it and praised it; not a single student even tried it in either class.

These anecdotes paint a stark picture of active resistance to collaboration. These students simply showed no interest in collaborating at all, and at times, willingly accept a decrease in their grade rather than collaborate. We don't see that students want to collaborate but are having trouble with the technology or with figuring out how best to collaborate—if that were true, we would expect to see students trying the technologies and more than 22 students out of 340 students posting. Rather, we see students actively avoiding collaboration. This is a significant problem, not only because these classes are missing out on the opportunity for better learning, but because the engineering schools accreditation board has mandated collaboration as a critical part of an engineer’s education [1]. The result is a mismatch between goals and students’ perceptions.

We have identified several factors that are leading to this resistance, drawn from surveys and interviews with dozens of students in mathematics, engineering, and computer science.

- In many classes, collaboration is not rational for the students. A majority of our students surveyed said that they found their classes or the field in general “competitive.” If a class is competitive and the grading is on a curve, collaboration is only giving up one’s competitive edge.
- Classes where CoWeb has been successful have mostly been design oriented classes (composition, software design, architecture) where there exists more than one correct solution to a homework problem. But in engineering and mathematics, homework tends to have only one correct solution, making collaboration look more like “cheating” to the students.
- Because of the competitiveness and pressure of the fields, students sometimes develop a “learned helplessness” view. When one student was asked why he didn’t engage in an on-line exam review session where answers to a sample exam were posted and debated, he responded, “I haven't posted about questions because I am confident that my answers are wrong” and another said, “I thought, I was the only one having problems understanding what was asked in the exam.”
- There may be faculty resistance. On the same survey, one student wrote “What was I suppose to do with it? Those who answered questions were severely criticized by [the teacher].” This suggests that teachers may not be viewing collaboration as a learning opportunity, but as an assessment activity.

To address these issues, we encourage engineering and mathematics faculty to take on more of a design approach in their classes (which ABET itself encourages) and to encourage reflective discussion. Competition is not necessarily a bad thing, but students need to see their peers as a resource for learning, in order for the kind of success we've seen in the English classes to transfer to the other areas.

Conclusion

Use of CoWeb in the introductory English classes studied seems to be a success, both from a learning perspective (the students were more able to engage the material in the right way) and a cost perspective (both fixed and variable costs were acceptable). Collaborative learning activities seem to be realizing their potential as a way of leveraging the numbers in the classroom to create a dramatically improved learning situation without a dramatic rise in costs. However, the challenge to using this approach in more classes involves addressing the active resistance to collaboration that we see in other classes.

Acknowledgements

Funding for this project is from the National Science Foundation Grant REC-9814770 and the Mellon Foundation. Our thanks to our collaborators: Pete Ludovice, Matthew Realff, Tom Morley, Akbar Ladak, Jim Greenlee, Joshua Gargus, Colleen Kehoe, Bolot Kerimbaev, Kayt Sukel, Craig Zimring, Sabir Khan, and David Craig.

References

[1] ABET, "Engineering criteria 2000: Criteria for accrediting programs in engineering in the united states," ASEE Prism, March, pp. 41-42, 1996.

[2] Mark Guzdial, Jochen Rick, and Bolot Kerimbaev, "Recognizing and supporting roles in CSCW," in *Proceedings of CSCW'2000*, pp. 261-268. 2000.

[3] Mark Guzdial, Jochen Rick, and Colleen Kehoe, "Beyond adoption to invention: Teacher-created collaborative activities in higher education," *Journal of the Learning Sciences*, vol. Accepted, in press., 2001.

[4] Collaborative Software Laboratory, "A catalog of CoWeb uses," Georgia Tech GVU Center Technical Report GIT-GVU-00-19, Georgia Tech GVU Center, 2000.