The Web as a Student Communication Medium: What's Different?

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Abstract: With the goal of exploring the usefulness of the World-Wide Web as an aid to class infrastructure, a variety of classroom functions were carried out through web pages in two undergraduate courses in the MIT Media Lab. This paper describes the structure of the courses and analyzes the different behaviors and communication styles that arise from using the web instead of traditional classroom methods.

Introduction

Much work has been done to incorporate the World-Wide Web into classroom life by using it as an information resource or by using it as a basis for long distance collaborative learning [WWW'94; Virtual Library]. In our courses we* were interested in using the web to replace some of the routine activities of any individual course. We will describe the structures and goals of the two courses, introduce the concept of information flow, and then discuss the differences that arose as a result of using the web instead of traditional classroom methods. Using the web encourages both different styles of learning and different behavioral roles for the students and teachers.

The Courses

Both courses were undergraduate offerings in the MIT Media Lab. One was MAS134 *Story: Representation and Process* (hereafter called *Story*), a course that analyzed the representation of information in hypertexts, images, film, and television, as well as teaching the students how to manipulate each medium. This class was taught by Professors Haase and Davenport with the author as teaching assistant. There were 16 students. The address of the home page for this class is `http://mas134.www.media.mit.edu:8001/`.

The other course was MAS123 *Tools for Thought*, a course that focused on the type of knowledge that is embodied within various systems with which we interact. The "tools" with which we interact with a given system often contain artifacts of the knowledge assumed within the system. Systems included physical world (in which we use tools like hammers and toasters), the domain of complex systems (in which we use simple generalizations to understand a situation that contains thousands of variables, like traffic patterns), and the domain of language (in which we use a set of common assumptions to understand each other). This class was taught by Professors Resnick, Brand, and Cassell, with the author as teaching assistant. There were 14 students. The home page for this class is at `http://mas123.www.media.mit.edu/courses/mas123/`.

Two main goals for web use in the courses were to encourage more sharing of ideas by having student presentations readable by all the students and to encourage better integration of the course material throughout the semester by having all past projects easily accessible. Thus, all

* The use of "we" throughout the paper refers to the author as well as the Media Lab faculty who designed and taught the courses described below: Professors Ken Haase and Glorianna Davenport in MAS134 and Professors Mitchel Resnick, Matthew Brand, and Justine Cassell in MAS123.

student projects were "turned in" on the web. Although project presentations were usually presented "live" in front of the class, they were recorded with video or photograph and then archived on the web post hoc. In *Tools for Thought* we also focused on the students' learning through the process of building hypertexts (an activity which can encourage a stricter organization of one's ideas than a linear essay) and through indexing each other's pages (an activity which illustrates which ideas are related). Gordin et al. [submitted] give a good summary of the advantages of such practices and of networking within classes and schools in general.

Note that having all students' assignments available to the entire class raises a privacy issue. We did not make grades public (which we considered a blatant violation of privacy), but all the student work did include the students' names. This situation (as opposed to anonymous displays of work, for example) could be seen as unduly pressuring the students to do well in front of their peers. We concluded that this pressure was not as severe in our courses since the assignments and presentations were all relatively creative or based on the interpretation of texts. Such pressure would be significantly higher in a course that demanded exact answers. Making all responses to a physics class problem set public, for example, could be severely embarrassing for a student who was not able to complete it.

Our Setup

In *Story*, each student had a computer account on the Media Lab's UNIX network. Any files that the students put in a certain subdirectory within their account could be seen by the web server. In *Tools for Thought*, we had only two user accounts, one for faculty, and one for students. The students had their own directories within the one student account, but all files were changeable by any student. This system was easier to maintain for a web environment, but it required mutual trust on the part of the students. The system worked well despite our doubts, perhaps because students had computer accounts on the campus network where they could do most of their work before copying the final files to the *Tools for Thought* student account.

In both classes the students were familiar with at least basic UNIX commands already, but many had to learn HTML (the language for writing web pages). We gave the students access to an image scanner and encouraged them to use it to make images for their pages, but the recently growing trend of deeming web images of prepublished graphics to be copyright violations has made the scanner somewhat less important. (A reader outside of MIT will be unfortunately unable to view those projects on the current course web pages in which students used prepublished images.)

Information Flow

There are basically three types of people that interact in a classroom setting: teachers, students, and outsiders. The outsiders usually play a smaller role in the course, and might be principals, parents, other teachers, or students from other classes. We categorize different types of communications between these three groups of people as different types of information flow. A typical course contains both one-way flows, like a lecture, and two-way flows, like classroom discussions (See Figure 1). The different information flows described below are parameterized by the type of person involved (student, teacher, or outsider) and by the chief directionality of the flow (one-way or two-way). Note that by labeling the type of communication that is taking place, an information flow also describes the roles that the participants are playing.

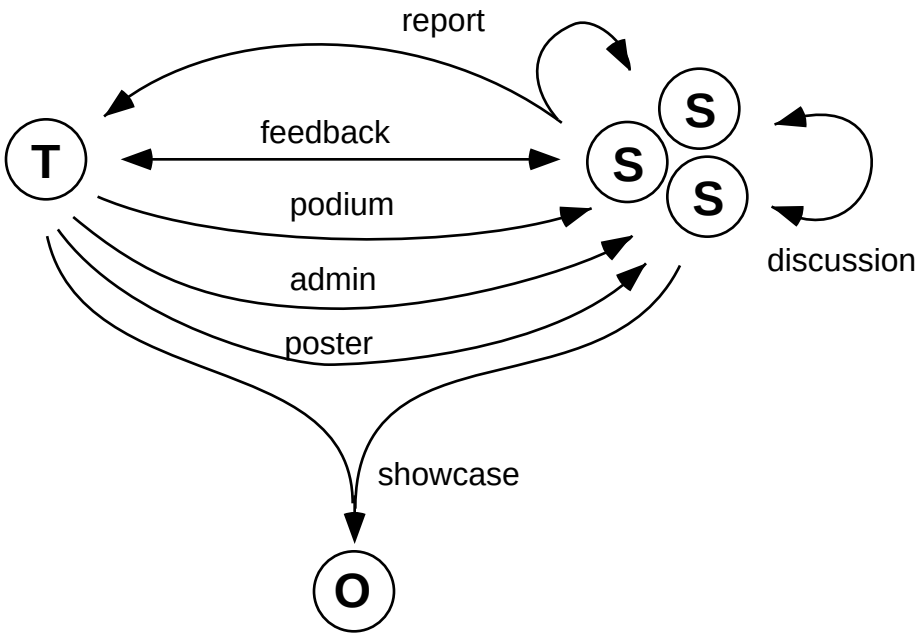


Figure 1: Various types of information flow that can exist between teachers, students, and outsiders.

We suggest that any class could be described as containing most of the information flows below, though the percentages of each flow differ across classes. It is exactly such a difference that we see in our web-based classes when they are compared with traditional classes. Because the web more easily accommodates some information flows over others, we noticed that those types of communications and their corresponding behaviors prevailed in our classes. Below we describe different types of information flow and note the web-based behavior differences in terms of each one.

One-Way Flows

Administrative: Teacher –> Student
This category includes assignments, notices about upcoming classes, and various other logistic information. Because these forms of information are usually textual, they can easily appear on the course web page. The syllabus, the list of readings, and the assignments were all available on-line. In *Tools for Thought* we also had a "What's New" page that was updated weekly to hold the most relevant subset of the administrative information. We were hoping to spend less time in class on such administrative issues by having this material on-line, but we found that it was nevertheless best to introduce each new assignment "live" in class, simply because students often had clarifying questions about them.

Podium: Active Teacher –> Student
This category consists usually of lectures that a teacher gives and that one or more students absorb. The term "active" implies that the teacher is trying to convey specific information with the presentation. Most traditional classes contain a large percentage of Podium communication, and ours did as well, though we also had many Discussions (see below). Because the web doesn't easily convey high-quality video yet, Podium information on the web might consist of copies of a teacher's lecture notes.

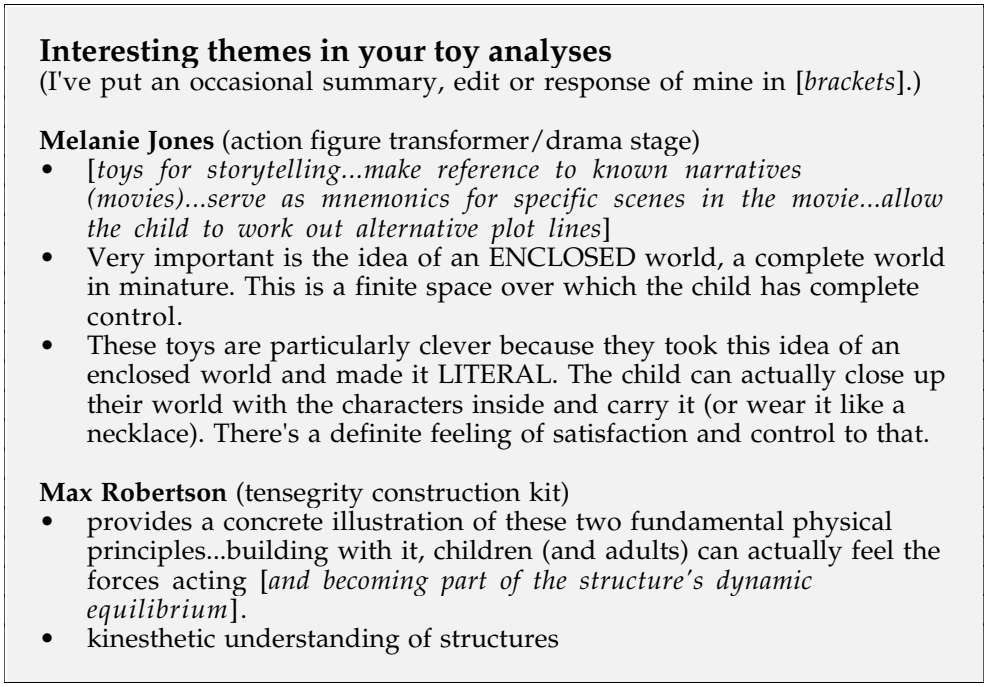
Poster: Passive Teacher –> Student
This category is defined by information sources which are meant to be browsed or skimmed over more than carefully attended to. A traditional example would be a poster of the solar system that appears on a classroom wall. A teacher might place it there to arouse general curiosity rather

than to convey specific facts. Eye-catching graphic icons that play a similar role are easy to include in web pages, and satisfying the desire for further information is much easier (simply clicking on the icon) than in the classroom (looking something up or asking someone).

The display of students' past work can play a similar role, in that the teacher may hope that students keep in mind what they did in the past as they work on their current project. While such presentations of past work often take up precious wall-space in a classroom, it is always easy to add more web pages.

Report: Student –> Teacher and/or Student –> Student
This category includes the various presentations that students make, such as homework, term papers, or spoken project reports. Like the Podium presentations, these can be put on the web with varying degrees of ease. Note that on the web, however, all presentations can be made viewable by all the other students as well as by the teacher. This condition rarely occurs with term papers or homework in a physical classroom.

Showcase: Teacher and/or Student –> Outsider
Though rarer, this form of presentation often can be seen on the walls of a classroom before parents visit. Teachers and students may both participate in displaying examples of past work in a form that can be understood by outsiders. A similar process takes place if a teacher creates any sort of archive of the class, either for his or her own future reference, or for the use of future teachers. This type of information flow is significantly different than the Report style in that an archive usually assumes less knowledge about the class. On the web, the teachers and students will adjust the interface and link structure of their web site before they make the site public and Showcase their work.



Interesting themes in your toy analyses
(I've put an occasional summary, edit or response of mine in [*brackets*].)

Melanie Jones (action figure transformer/drama stage)

- [*toys for storytelling...make reference to known narratives (movies)...serve as mnemonics for specific scenes in the movie...allow the child to work out alternative plot lines*]
- Very important is the idea of an ENCLOSED world, a complete world in minature. This is a finite space over which the child has complete control.
- These toys are particularly clever because they took this idea of an enclosed world and made it LITERAL. The child can actually close up their world with the characters inside and carry it (or wear it like a necklace). There's a definite feeling of satisfaction and control to that.

Max Robertson (tensegrity construction kit)

- provides a concrete illustration of these two fundamental physical principles...building with it, children (and adults) can actually feel the forces acting [*and becoming part of the structure's dynamic equilibrium*].
- kinesthetic understanding of structures

Figure 2: An example of Feedback; Professor Brand summarizes student responses by quoting and linking directly to them on a web page (student names changed).

Two-Way Flows

Feedback: Teacher <–> Student
In a class this type of flow could happen when a teacher summarizes the general trends within the latest series of student projects, and the students add their own opinions. On the web this form of exchange can arise when a teacher critiques student projects and includes links directly to them. Professor Matthew Brand gave particularly good feedback by building web pages that quoted a salient idea from each student's response to a given assignment. An excerpt from such a page is in Figure 2. On it he summarizes the overall themes in the student responses, and then quotes (and comments on) some of the main ideas from each student's paper. Because the student papers are on-line, he can link directly to them as well. The Covisualization Project at Northwestern University reports a similar process with its web-like school network [O'Neill and Gomez, 1994].

To some extent this summarizing process is harder for the teacher, in that he or she must consider the student projects as a whole, as opposed to grading the individuals alone. Indeed some teachers expressed frustration with the inability to scrawl comments in the margin of a student's "paper" in traditional fashion. In terms of educational value, though, the ability to synthesize the students' responses so easily was seen as a great advantage. A teacher could always print out a copy of the web page if he or she wanted.

> ...It seems that the exploratory stage used by many of the groups led directly into a decomposition-type of solution. (Jeff) pointed out that ..."we didn't know we were going to construct this device until the concept manifested itself from seemingly non-connected parts." (Matt) notes that "as apparently useless as they seemed on their own, these (the smaller individual constructions) would eventually become the building blocks for the machine." I find this aspect very interesting as it is typically assumed, and was noted by (Neil) that we can't build a tool unless we know what we're building first. ...

Figure 3: An example of Discussion; a student links directly to other students' work

Discussion: Student <–> Student
This flow of information happens most in class discussions as students propose ideas based on others' ideas. Teachers can also take part, but only on a non-leadership basis (otherwise it becomes Feedback). On the web, this behavior can be seen when students react to each others' web pages or include cross-referencing links between them.

In *Tools for Thought*, we asked students to make journal entries on each topic of class discussion. We encouraged them to make links to other students' journal entries along the way if appropriate, but often, because doing so requires some careful reading of the other entries, students didn't make such links until assigned specifically to do so. We later gave the "Associative Trail" assignment, however, which did mandate making such links; students were told to pick a theme from the course and write a web page that analyzed how all course participants discussed the theme in their journals. An excerpt of one student's Associative Trail can be seen in Figure 3. In this excerpt the student reports on the thought processes that he and three others experienced as they worked on an assignment to build "a calculating machine" with a kit of toy gears.

We also offered students a web page that displayed accumulated comments on a certain topic and allowed the reader to add comments, simulating a USENET news group or mailing list. The idea was that students and teachers might hold a discussion on the page over a period of weeks, with new comments being added whenever someone had time to read the latest opinions. This interface was hardly used, however, because (most likely) many students talked with each other around the building anyway, and they could talk with teachers before and after class. The discussion web page seemed unnecessary. Some students did find the scripts that created this

comment page useful in their own pages, however; they could use them to allow the reader of a particular journal entry to make comments or annotations on that entry. The comments would then appear inserted within the author's original text.

Although many see the web as a boon to remote collaborative learning, we found that despite excellent technological resources, collaborative learning happened most naturally when students were in the same room together. When students in *Story* had the assignment to write a hypertext narrative, for example, they reported exciting collaboration as they worked in a cluster of several computers; students would ask for comments from each other and learn from what other students had created. Similarly, when the students in *Tools for Thought* had an assignment to build a simple robot creature out of building blocks and a small computer, they learned from each other mainly because they worked together in the same robot lab.

Conclusions: What's Different?

We see the main differences between a traditional course and our web-based courses falling into two categories: different learning methods and different roles on the part of the participants. In terms of learning methods, we believe that the assignments to write hypertexts and to cross-reference them with other hypertexts led students to think more broadly about the issues at hand than they might have in a course in which each student works independently from others. Also, we suggest that having a permanent and easily accessible record of past projects (both a student's own and those of others) leads to a better apperception of the overall themes of the course; traditional courses often allow students to forget each assignment after completing it.

In terms of the different behaviors that arose, having an archive of past projects can not only encourage positive peer pressure among students to be creative as each develops his or her own portfolio, but also let the students play a role as critic, commenting on each others' projects. From the teachers' point of view, the web allows one to give very customized feedback to student presentations. The teachers usually found it easier to evaluate students at the end of the term as well, since all the students' work accumulated on the web.

References

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