Using Online Tools to Enhance Classrooms: A Case Study with MaSH (Making Serendipity Happen)

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Abstract: The middle ground between distance learning and standard-issue classroom education is ripe for exploration. In particular, the Open Directory Project shows that groups of people can create their own portals onto the Web. MaSH (Making Serendipity Happen) is a system similar to ODP that also allows users to rank and comment on information, allowing students and teachers to quickly create course-specific resources, with the best information found by one shared by all. A case study using MaSH to support a computer science course for pre-majors suggests it encourages students to spend more time and learn more about course topics while providing an easy way for instructors to get feedback and assignments from students and learn more about their interests.

Introduction

A middle ground exists between distance learning and standard-issue classroom education where tools for computer mediated communication (CMC) could supplement the traditional classroom. Tools from e-mail lists to integrated course environments such as WebCT support dynamic learning environments tailored to the task at hand and to the student performing it. However, many classes do not use these tools. Even in computer science, they often serve only as a one-way conduit of information from teacher to student (and much of this information is electronic copies of paper documents). One likely—and valid—reason that teachers avoid using these tools is the mindset that using such tools gives them even more responsibilities. *Someone* needs to find and organize the information; *someone* needs to answer the students' questions; and *someone* is busy already.

Assumed above is that *someone* is the teacher but this does not have to be so. The World Wide Web is a ready-to-reap garden of information. The Open Directory Project (ODP), a Web directory similar to Yahoo! but built by volunteers, is one tool for the harvest. Teachers and students could use a similar tool, working together as a group to create course-specific resources. Making Serendipity Happen (MaSH) is such a tool, allowing groups of users to explore the Web and share their discoveries. Group members can create directory topics specific to the course and fill them with Web sites focused on their needs. In addition, students can discuss what they find and rank the sites within a subtopic, allowing everyone access to the most useful and interesting information. Students can use this information to learn more and do better work while teachers can use it to learn more about their students. By creating a focal point for common interest, students might event become more interested in the course.

This paper presents a case study in which MaSH supported a pre-major computer science course. It begins with work that contributed to the development of MaSH, then outlines the software itself and some design considerations in building such software. It then presents the results and lessons learned from the case study.

Related Work

The inspiration for MaSH came from the field of CMC and the observation that education is often viewed as a one-way transaction of knowledge from teacher to students. Computers provide a number of tools that could support education (Hiltz & Wellman, 1997, Khan 1997). However, "most course-based or learning sites simply post course

[1] This work was completed at James Madison University.

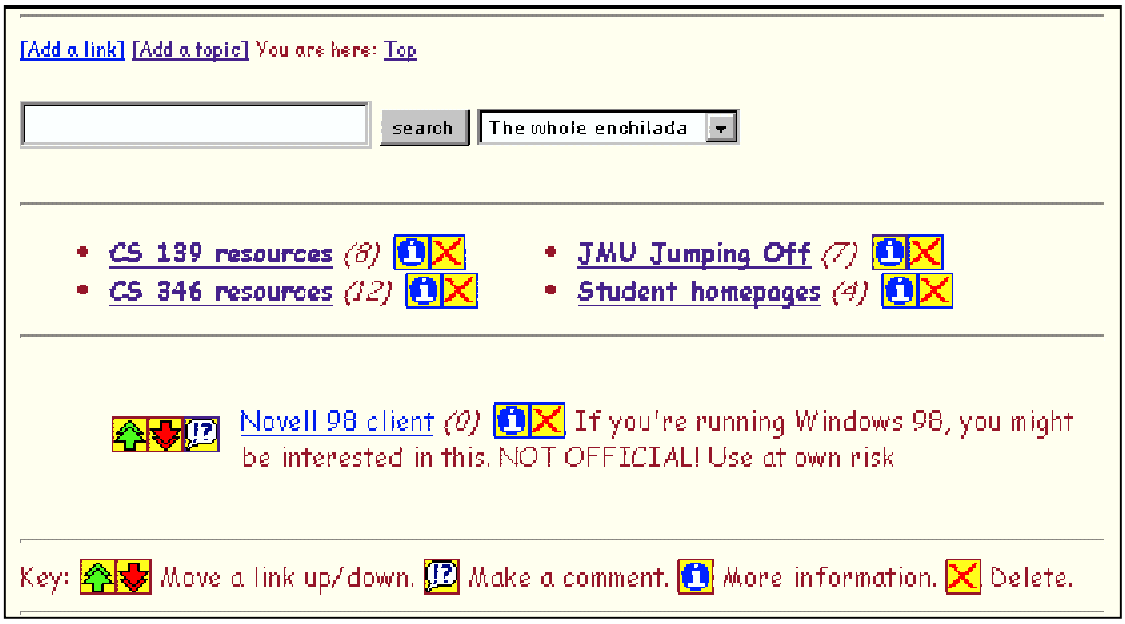
materials. Use of the Web as merely an 'electronic book' falls far short of the potential the medium affords" (Hill 1997). MaSH's vision is to use the Web as a resource that students can mine, organize, and share. To this end, it borrows from other solutions to the problem of finding information on the Web. In particular, it draws on The Open Directory Project (Skrenta & Truel, 1998), a Web directory similar to Yahoo! but created by volunteers and with no centralized editorial control. In ODP, the editorial control rests at the level of categories. To promote the feeling of a truly shared, dynamic resource, MaSH allows any student to edit any part of the directory.

The notion of quality is a notable omission from ODP; apart from a "cool site" indication, links in a category appear in alphabetical order. It would be better if students had tools to find the most useful information. Obviously, the directory will be more useful if the best information is readily available. More important, students should learn the skill of evaluating information (for quality, authenticity, etc.). Programs that provide these facilities already exist. A number of "recommender systems" take user input and ratings for a set of documents and then use that input to filter or rank other documents. The first such system, Tapestry, used text annotations, which MaSH uses to facilitate discussion (Goldberg et al., 1992). Most later systems use numeric ratings that are both easier to give and to process. Even so, users are notably reluctant to rate (Konstan et al., 1997). MaSH attempts to counter these problems by modeling ratings as moving links up and down in a list. This strategy requires minimal effort from users, and fits well with the Yahoo!-style interface to the directory.

Landon (2001) maintains a comprehensive directory for courseware tools, such as WebCT and CourseInfo, which support integrated distance learning environments. These tools are not as well suited for enhancing traditional classroom settings, however. Their power comes with a steeper learning curve that is another factor discouraging teachers from using computers to supplement their classrooms. Running a class involves a number of distinct tasks (Hartley et al., 1997). MaSH can support or enhance a number of these tasks, including increasing (and possibly measuring) student participation, allowing for submission of assignments online, facilitating discussions, and supporting collaborative research and learning.

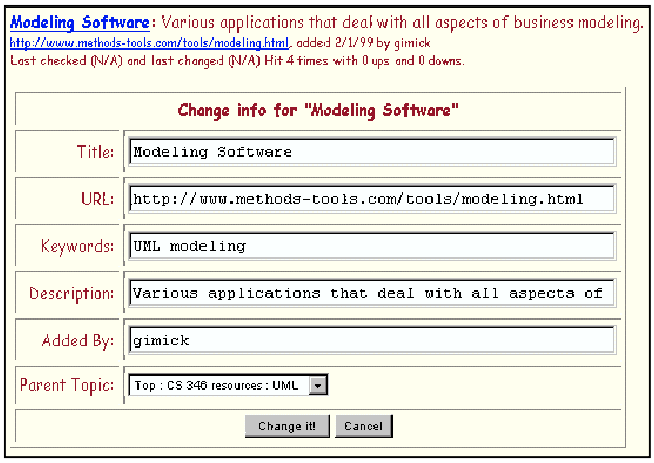
The MaSH Interface

The MaSH interface is similar to Yahoo!'s look and feel (Fig. 1).



Controls for moving, discussing, editing, and deleting links are readily accessible, and updates take place immediately. Simple keyword searches, within either the current category or the entire directory, are available. The controls for adding links and topics are not as prominent (see the top of Fig. 1). The icon legend appeared after some students found the icons confusing, particularly the icon for adding comments. Since Yahoo! has no public interface for adding links or categories, MaSH had to come up with its own (Fig. 2). Users can submit a title, URL, keywords, description, and parent topic for the link.

One concern was that the group would not come to a consensus on what was good and useful. Since the combined acts of all users determine the order of links, a link might yo-yo up and down as its champions and critics battled. The most difficult design decisions, however, involved identity and security. In the end, MaSH chose neither. Users can add links with their names, under an alias, anonymously, or even as other users. Nor are links owned—any user can edit or delete any link. In the small-group scenarios MaSH is intended for, the I believe that the gains in ease-of-use, simplicity, and shared ownership outweigh the cost in potential disruption and inability to collect detailed per-user statistics (which could be useful for certain educational applications, such as measuring participation).



Case Study

MaSH was used to support a course called "Being Productive With Computers" taught at James Madison University. The course targets students interested in becoming computer science majors but do not have enough experience using computers to go directly into the computer science program. The range of assignments for the course is broad, including a generous helping of Internet use, research, and exploration. About 140 students, mostly first-semester freshmen, took the course. Most students were able to use MaSH almost immediately, even though students received minimal instruction and some students had only minimal prior exposure to computers.

A number of course assignments involved MaSH. For the following assignments, it was required:

- *Neat Sites*: students were required to find an interesting Web site and add it to the directory with a comment. This assignment was to familiarize students both with the Web and with MaSH.
- *Areas of Computing*: students were required to populate a number of subtopics representing areas of study in CS (databases, theory, etc…), in order to learn what computer scientists do besides "program".
- *Submitting assignments*: students were required link to Web pages they created for two assignments, a My First Homepage assignment and a position paper on an ethical issue in computer science.

In other cases, use of MaSH was optional (but encouraged):

- *Supplementing lectures*: several subtopics pertained to lecture topics that students on which students needed more help (in particular, units on *HTML* and *number* systems).
- *Sharing links for research*: students wrote several papers throughout the semester; students were encouraged to use and add links to topics created for these assignments.
- *Discussions*: students could post comments in Q-and-A and course feedback topics.

Overall, MaSH received 54,916 hits (Tab. 1), with students viewing Web sites (the "View Link" action) 12,394 times (22.6% of total activity), navigating the directory (the "View Topic" and "Welcome/Help" actions) 38,329 (69.8%), and modifying the directory 4,193 times (7.6%). Sites visited and links added varied greatly by assignment (Tab. 2). In particular, the four assignments that had over 50 links added all required students to add links to MaSH.

Action	Count	Pct.
View Topic	38284	69.7%
Visit Link	12394	22.6%
Request Add/Edit	2150	3.9%
Add Item	1259	2.3%
Edit Item	416	0.8%
Rank Item	240	0.4%
Delete Item	128	0.2%
Welcome/Help	45	0.1%
Total	54916	100.0%

Table 1: Overall activity frequencies.

Topic	Hits	% Hits	Links	H/L
Homepage	7125	57.5%	189	37.7
Neat Site	1987	16.0%	236	8.4
Projects	1009	8.1%	53	19.0
HTML	899	7.3%	14	64.2
Numbers	321	2.6%	5	64.2
Areas	316	2.6%	130	2.4
History of Comp	258	2.1%	2	129.0
Discussions	185	1.5%	5	37.0
Sources	106	0.9%	2	53.0
Final Exam	92	0.7%	1	92.0
Position Papers	78	0.6%	23	3.3
Other	13	0.1%	3	4.3
Total	12389	100.0%	702	17.7

Table 2: Hits and links, by assignment.

In some instances, students used MaSH beyond the course requirements. For example, in the *Homepage* assignment, each student was required to post a personal Web page and to visit and grade the pages of three fellow students. The goal was for each student to learn about HTML, to practice evaluating others' work, and to learn more about a few of their fellow students. Students were enthusiastic about this assignment. Some created very ornate pages, and many students visited each other's pages far more often than required, as evidenced by the average of 40 visits per homepage. A similar pattern prevailed for the *Neat Sites* assignment, which was the first assignment of the semester. Many students contributed more sites than required, and students both contributed and visited links from this assignment throughout the semester. For the *Projects* assignment, groups of students had to post an informational Web site devoted to a computer science topic (e.g. DVDs, computer security). They were not required to visit other groups' pages—but many students did. All of these cases point to students learning and experiencing more than they otherwise could have if the course had not used MaSH.

Students also made heavy use of MaSH topics that contained supplemental information related to assignments. These topics included *HTML*, *Position Papers*, *Numbers*, and *History of Computing*. In each case except for *Numbers*, the instructor posted a few links. Students used these links heavily and added several of their own, particularly for the *HTML* and *Position Papers* topics. This suggests that students did more research about course topics and perhaps learned more about them than they otherwise would have.

Students used the evaluation features of MaSH (link ranking and comments) infrequently, ranking links 240 times and making around 300 comments. Several factors probably contributed: the icons were confusing, no assignments explicitly required evaluation, and there was no easy way to add a comment when submitting a new site. Even if these issues had not arisen, however, Avery and Zeckhauser (1997) argue that people will in general require some sort of external compensation in order to provide ratings in a recommender system. Ideally, teachers could design assignments that would help students internalize the value of providing ratings; however, tying them to grade is more likely to actually garner ratings. Students did use the comments to give course feedback in the *Discussion* topic, showing that MaSH can be a lightweight tool for adding asynchronous discussions to a class where the instructor wants to use the system for its primary purposes of sharing information.

Students occasionally made spontaneous use of MaSH. One student (who asked first) posted a link relevant to the take-home final exam. Another pair of students created and populated the *Numbers* topic. Students made heavy use of both topics. "Anonymous" created a topic that got some play, *Interracial Interaction*. It originally appeared with eight links. Most of the titles and descriptions were vague, like the link titled "Interesting: definatly [sic] worth looking at." The links mostly pointed to sites with racist views (e.g. the KKK). One might expect complaints, or perhaps angry discussion and comments attached to the links. This did not happen—the links received around 100 hits total with no comments added and no complaints received. Two of the links, however, disappeared, and anonymous students altered the rest to point to innocuous sites such as Microsoft. One link, originally described as "White Power", was changed to "white flower" and redirected to the Betty Crocker home page.

Lessons Learned

The most practical lesson learned from the case study is that MaSH can improve a classroom. MaSH gave students a way to find and share information on difficult topics and topics they cared about. Students used MaSH a great deal for these purposes, suggesting that many students spent more time learning about course topics than they otherwise might have. MaSH also gave students an outlet to comment on the course in a safe, anonymous way. For the instructor, it provided a means to receive honest and direct feedback, a convenient way to collect and review assignments electronically, and a way to let students help each other learn the course material.

The case study strongly suggests that use of the system depends on how, and how interested, students are in a topic. Three patterns of use emerged (Tab. 3). The first pattern includes high volume topics with many links and a moderate to high hit per link ratio. A second pattern covers topics that have a high average number of hits per link, but few links. The third pattern contains relatively inactive topics, which had a very low number of hits per link.

Pattern	Topics	Hits	Links	H/L
High volume	Homepages, Neat Sites, Projects, Discussions	10306	483	21.34
High hits per link	Numbers, History, Sources, Final, HTML	1676	24	69.83
Inactive	Areas, Position, Other	407	156	2.61

Table 3: Three distinct patterns of use indicate kinds of student interest.

The reasonable explanation is that these three patterns correspond to why a topic matters to users. High volume topics are those where users had an intrinsic or strong interest in the subject, such as publishing *Homepages* or visiting *Neat Sites*. High hits per link topics suggest an operational interest: the material was useful for some task, such as learning about *HTML* or getting help with the *Numbers* and *History* assignments. Students used these topics in a markedly passive way, with few contributions but many hits. The inactive topics appear to be topics that students did not see as useful or interesting. The *Areas of Computing* topic is a fine example. Students were required to add several links each in order to get credit for the exercise, but few used these links. Instructors could monitor the ratio of hits per link added to check the "health" of the system—too few or (when student contributions are solicited) too many hits per link suggest a topic that is not faring well.

The case study also supports the decision to forgo security and identity. At least in a small-group setting, problems involving deliberate sabotage of the directory or impersonation of identities were not severe—even in a computer science setting, where at least some of the students might have greater-than-normal skills at causing mischief. The one potential incident, the *Interracial Interaction* episode, showed a community policing (censoring?) itself: objectionable material went into the directory and was gone shortly thereafter. Hiltz and Wellman (1997) describe a similar incident while discussing the social dynamics of online communities, which they feel are much like those of communities in general—including having an unstated but clear social norm for behavior. MaSH enables these norms to form by providing every member of the community the ability to make comments, move links around, and delete links. Students can vote low-quality links downward, attack them in annotations, or just remove them.

Several conditions in the case study were necessary to the success of MaSH. Students must have access to computers, which would limit its use in low-budget settings. The course topic must be amenable to using information available on the Web. This is becoming less and less of an issue, as information from all disciplines migrates to the Web, but is still a consideration. The instructor must have access to a system on which to run MaSH (a Web server with CGI scripts enabled and the Perl language is sufficient). Finally, the instructor must ensure that students understand the value of the course topics and the value of a shared information repository.

Future Work

Although not needed in the case study, features for security and identity might be worth adding to MaSH. Imposing a short (5 to 10 second) delay when responding to users deleting or editing links would discourage all but the most dedicated miscreant from random sabotage. Moderation is already possible, simply by using the system as any group member would. Collecting recent activity in one place for review in a "what's new" page would make moderation easier and allow instructors to quickly get a feel for how students were using the directory. One caution, however, is

that moderation might have a chilling effect on participation from students whose contributions were deleted. Adding identity to the system would allow instructors to track and reward contributions, and to learn more about the interests of individual students. Again, however, this route is fraught with danger—the quality and use of conscripted contributions is uncertain, as shown by the Areas of Computing failure.

The interface has room for improvement. The "what's new" page described above would be useful for everyone, not just moderators. Better icons would help users, while controls for adding to the directory should be more prominent. Another way to solicit more content would be a small second window that made it easy to submit links while surfing, similar to the itList online bookmark manager's PuppyDog (Frankovitz, 2001). Finally, students would probably comment more if they could add a comment at the same time as they add a link.

Conclusion

MaSH was useful in teaching the course. It helped students share information and learn more about the course topics and about each other, while providing the instructor with feedback and easy access to student work. Further studies would show useful it is in other domains and at other levels of education, but MaSH can be a useful addition to the teacher's toolkit. MaSH can give members of any online community the power to benefit from each other's knowledge and effort—making serendipity happen.

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