

**WEB PAGE CREATION AS AN ALTERNATIVE TO THE  
WRITTEN REPORTS IN  
AN ADVANCED MANUFACTURING COURSE**

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**Abstract**

As a part of an undergraduate advanced manufacturing processes course, students are required to perform in-depth research into an assigned manufacturing process. Over the past three semesters, students have presented their results in the form of a web site rather than in written format. The assignment gives students the opportunity to gain detailed knowledge of a process, to work with a classmate in a team effort, and to experience creation of an alternative means of communication. Each semester, the students were surveyed on their experience with this format versus previous experience with paper-based team reports. This paper provides the results regarding the effectiveness of the assignment in terms of teamwork, creativity, and learning.

**Introduction**

Effective oral and written communication skills are important for students to develop as they matriculate through an engineering program. They must effectively communicate within teams on an interpersonal level as well as being able to convey results of research and analyses through written reports and oral presentations. The proliferation of the web as a communication tool has added another dimension to communication skills where students should have a basic level of awareness and proficiency. The challenge for educators is to help students develop these skills within the context of engineering subject matter.

Engineering educators have implemented a variety of web based tools to enhance their courses. These tools have included web based communication [1], web based instruction [2], and web based laboratories [3]. Most of these methods focus on information flow from the instructor to the students. Peer to peer communication is rarely addressed by course instructors. Gehringer [4] utilized the web to perform peer grading of homework assignments. Hailey et.al. [5] studied the use of the world wide web for peer to peer communication on design teams. However, the need for engineers to communicate effectively through technical writing on the web is growing. Many

engineering employers use internal and external webs for business communication. Therefore, instructors must develop engineering students' ability to effectively communicate on the web.

In an Advanced Manufacturing course in the Manufacturing Engineering program at Miami University in Oxford, Ohio, an assignment was developed to allow students to perform research into a process not covered in other manufacturing courses. Because not all processes that students are likely to encounter in their careers can be covered in the curriculum, it is important that students gain life-long learning skills to introduce themselves to different technologies. For several years, the end result of the research was a written report and oral presentation to the class. In an effort to enhance learning, team skills, and communication skills the assignment was modified having students work with a partner and prepare a web page report rather than a paper based report. The oral presentation to the class was maintained. To assess the effectiveness of the approach, students were surveyed each of the three semesters that the process topic assignment was given in the web report format.

### **The Process Topic Assignment**

In the process topic assignment, the students were required to research a manufacturing process and learn about the principles, limitations and equipment of the process as well as the applicable OSHA regulations. The students were required to convey the technical information through a web page and class presentation. Members of the class were expected to access each other's web pages and listen attentively to the presentations to gain a basic understanding about the variety of manufacturing processes that were researched.

The ability to create a web page is not a prerequisite skill for the course. Therefore, a basic introduction to Dreamweaver [6] software was presented to the students in an interactive session where the students developed the main page for the assignment. Dreamweaver provides students with a non-browser specific web page development tool. The development tool allows the students to create pages in a higher-level graphical user interface (GUI) while maintaining the ability to view the source HTML code. Thus, students with no experience in developing web pages are able to quickly create new pages while gaining insight into the base language that provides the basic structure for the page. The assignment is collected electronically. Students submit the assignment either through e-mail or a turnins network directory.

The research assignment was divided into several sections. The students were assigned a section of the Tool and Manufacturing Engineers Handbook (TMEH) [7] on a nontraditional manufacturing process area and were to select a process from within the assigned area. The initial web deliverable was a topic introduction and OSHA summary. The students were to post the following web pages

- Base page. The page contains the subject title, student names, course number, course title and the instructor. It also includes links to a topic introduction page, OSHA page and reference page.
- Topic introduction page summarizing the key information from the assigned topic pages. This page is intended to put the selected detail topic into prospective relative to processes of similar type.

- Summary of OSHA requirements. The applicable OSHA regulations were to be researched and summarized on this page.
- References page. At this point the references page would include the TMEH and OSHA regulations

The next step in the assignment was the process technical summary. The students were to research the selected process using at least one additional textbook, manufacturing reference book or journal article for each person on the team in addition to any web references. The web page was then updated to include

- Technical Summary page. This page explains the process including diagrams to clarify concepts.
- Links to the new pages from the base page and updated references.

The students receive feedback on this page to update it prior to project completion. This page would be posted later for review by the class as a study guide on the process.

The next step of the assignment has students performing more detailed research of the process applications. Each student was required to summarize an application oriented journal/trade magazine article. Students in the spring 2001 semester section had an additional element added in defining an application and comparing equipment from two manufacturers for use in the application.

New requirements for the site then included

- Summary of application article pages. These pages gave examples of the process.
- Equipment/Manufacturer's comparison page. This page compared equipment from two manufacturers for a defined application.
- Links to the new pages from the base page and updated references.

The final requirement for the process topic assignment was presentation of the process to the class. Members of the class were required to read the technical summary material posted on the web for the day's presentation topics. To motivate the students to be familiar with the posted material, a short multiple choice quiz was given to the students just prior to the presentations. The presentations then provided a brief overview of process principles while focusing on the applications and equipment.

### **Student evaluations of the assignment**

After completion of the process topic assignments, the students in all three semesters evaluated the effectiveness of the assignment and were asked to make comparisons to their experiences with the more typical paper format for research documentation. A total of 53 students, ranging in number from 11 to 24 students/semester completed the survey instrument which asked about their previous experience developing web pages and their level of agreement with several statements on a five point Likert scale. Most the students had very limited previous experience with web pages. Students had produced an average of 0.7 web pages in previous classes in

college, an average of 0.4 web pages outside of college classes, and only an average of 0.2 web pages to document a research topic in college.

A summary of the statements and responses are provided in Tables 1 - 3. As the results were similar across sections, they are combined.

The students were asked several questions about their preparation for the web-based assignment as shown in Table 1. Since most students had very limited experience creating web pages, they were asked how difficult they found the Dreamweaver software. The majority of the students, 71%, agreed or strongly agreed with the statement “I found Dreamweaver easy to learn and use”. Only 12% of the students disagreed with the statement. 55% of the students did indicate, however, that creating the web page was more difficult than writing a paper. This appears to be the result of having to structure the material in a manner that they were unaccustomed to rather than to be technological problem. It was unclear how the web format impacted a number of students in performing the research for their topic. Most students, 77%, were neutral or disagreed that the format influenced their research methods, but 23% indicated that they performed their research differently.

Table 1. Preparing the Assignment  
Responses to Web Assignment survey

	Strongly Agree/Agree	Neutral	Disagree/ Strongly Disagree
I found Dreamweaver easy to learn and use.	71%	17%	12%
Creating the web page was more difficult than writing a paper.	55%	15%	30%
Creating the web page required more team effort than writing a paper.	60%	28%	11%
The web page allowed more creative element than writing a paper.	92%	6%	2%
I performed my research differently than if I had been writing a paper.	23%	32%	45%
I found that creating a web page detracted from the effort I applied to the research topic content.	35%	21%	44%

In creating the assignment, one of the goals was to foster a level of team interaction that is often missing in the “divide and piece together” approach that students often take to group reports. Creating a web page together appears to have facilitated working more closely with a partner. In response to the statement “Creating the web page required more team effort than writing a paper.”, 60% of the students agreed or strongly agreed. This likely occurred in creating the web page itself rather than in enhancing learning on the process topic. 92% of the students surveyed indicated that the web page allowed a more creative element than writing a paper but 35% said that creating the page detracted from the effort applied to the research topic content.

An important aspect of the assignment was that students obtain a basic level of knowledge about their classmates’ process topics. To do this they were required to read, and were tested over, the technical summary information of the class web sites. The survey data, as shown in Table 2 indicated that they did not have difficulty accessing the web pages and 60% of the students browsed beyond the information they were going to be tested on. 91% said they enjoyed looking at the other team’s web sites more than they would have the alternative, reading their

papers and 85% obtained ideas that they could use in future websites. The students tended to compare their web pages during the assignment and obtain ideas from each other, thus fostering peer-to-peer learning. This peer learning effect was not evident during the research paper approach. The students overwhelmingly, 79% positive response, felt that the web format was an effective tool for learning the topic information.

Table 2. Reviewing the other teams' sites  
Responses to Web Assignment survey

	Strongly Agree/Agree	Neutral	Disagree/Strongly Disagree
I had difficulty accessing the classes web pages.	4%	15%	81%
I enjoyed looking at other team's web sites more than I would have reading their papers.	91%	8%	2%
I obtained ideas from the others sites that I would use if I were to create another web site.	85%	11%	4%
I browsed through the classes' web pages beyond the information that I was going to be tested upon.	60%	17%	23%
The web sites were an effective tool for learning the topic information.	79%	17%	4%

In general, the survey data showed that the students took pride in their work more so than they would have in a paper, and most felt that their site was better than most of the other web sites. Most the students, 68%, agreed that they would choose to create a web page over writing a paper on a subject and almost all, 94%, felt the web pages were a good change of pace. The responses to the general questions are shown in Table 3.

Table 3. Questions in general  
Responses to Web Assignment survey

	Strongly Agree/Agree	Neutral	Disagree/Strongly Disagree
My web site was better than most of the other web sites.	58%	36%	6%
I take more pride in the web page than I would have in a paper.	77%	17%	6%
I would choose to create a web page over writing a paper on a subject.	68%	15%	17%
The web pages were a good change of pace.	94%	6%	0%

The survey tool did not solicit student comments. Four students commented on the specific software used for the web site development. These remarks either recommended other software tools or specified areas of difficulty (such as creating links) encountered while using the software. One student comment received in course feedback referred to the assignment as follows: "Other things such as making a web site and learning about OSHA were very valuable as well."

## **Instructor Perspective**

The introduction of web based research assignments presented new challenges and advantages for the instructor when compared to a research paper assignment. Some issues encountered include assignment administration, plagiarism concerns, and student focus.

The web-based approach to the manufacturing topic research facilitated the assignment logistics by eliminating the collection, compilation, and redistribution of technical summaries. Instead, the instructor's web page was amended to include a table of the class topics that were linked to the student web sites. This allowed the technical summaries to be available to other students in the class in less than ½ hour from the technical summary deadline. Instructor evaluation of the web sites presents a challenge in that the sites are a dynamic entity on the student's network space. This was handled by obtaining copies of the pages at the assignment deadline while allowing the online version to evolve if the students desired to further upgrade the web sites. An advantage to the grading process is that the instructor can verify that the assignment is complete from a remote location. The web based research sites were easily accessed from the instructor's home facilitating grading during off hours.

The proliferation of information on the world wide web provided students with a wealth of information already in web format in which to reference. It was found that students did not view this information as formally as hard references in terms of plagiarism. Students required more reminders than with a paper to properly reference their sources. The advantage of being able to facilitate visual learning on the web site with images, graphs, and figures is tempered by the need for the students to maintain references to the sources. The students tended to use more images than in papers and were less accustomed to citing the sources of images.

A web based research project also required the instructor to more strongly emphasize the quality of reference sources. Students tended to rely on web based resources for information. The validity of the information in comparison to a textbook or applicable journal articles is often not considered by the student. The availability of engineering journals on the web appeared to increase the student's use of journals. A benefit of the web-based approach was that the visitor could connect to reference articles that were from web-based journals. This was not possible with the former paper based approach.

A final instructional concern of the web page assignment was that some teams focused on the web page creation instead of learning about the process topic. Student teams were surprised when their grade reflected the web site content more than their effort that created a flashy web site. During the third semester that the process topic web pages were assigned, the instructor emphasized the content vs. web site as a part of the verbal instruction for the assignment. This added emphasis produced the desired result of more depth of content and less elaborate web pages.

## Conclusions

Assigning research to be presented via web pages is a valuable part of the overall undergraduate engineering experience. The student's ability to produce a high quality research paper is a required outcome of their education. However, the ability to be able to communicate through a variety of media is an important outcome as well. The world wide web has become a valuable tool for technical information in the business community. Engineering graduates with experience in organizing information for dissemination on the web are better able to thrive in the current workplace.

In general, students viewed the web-based research project as a positive experience. The approach increased team interaction, increased the level of self-directed learning, and fostered creativity. Students tended to interact with class members regarding the assignment outside of the team boundaries. Furthermore, students viewed the resulting pages as a good learning tool for the information presented.

Lastly, an instructor must prepare to adjust to the web based assignment. Switching to a web based research assignment from a research paper requires the instructor to increase the level of verbal instruction associated with the assignment. Once an instructor gains experience with the web based presentation of the research topics, the administration and evaluation of the assignment does not tend to increase the instructor's workload for the course.

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## **BIOGRAPHICAL INFORMATION**

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Michael Bailey-Van Kuren received his Ph.D. in Mechanical Engineering from Georgia Institute of Technology before joining the Department of Manufacturing Engineering at Miami University in Oxford, OH as an Assistant Professor. Industrial experience includes positions in design and quality engineering with Belcan Corporation and Raytheon Company. His primary research focus is the application of robots to automated demanufacturing.

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