The Effectiveness Analysis of the Online Tools for Engineering Faculty Needs

Ismail Fidan[1], Jianbiao Pan[2], Leijun Li[3]

[1]Tennessee Tech University, Cookeville, TN 38505/
[2]California Polytechnic State University, San Luis Obispo, CA 93407/
[3]Utah State University, Logan, UT 84322

Abstract

As the use of Internet is increasing dramatically, many faculty members are using it in their teaching, research, and services. The Internet also provides faculty easy access to employee benefits and other information. Many universities are using or plan to use online teaching. Lately, many editorial and funding agencies have also started to initiate online review and decision-making system. These systems have eased the burden on both reviewers and agencies. In this study, a survey was prepared and conducted to investigate the effectiveness of the online tools for faculty needs in authors' institutions and some other United States universities. The current online tool practices are presented and survey findings are summarized in this paper.

1. Introduction

Nowadays faculty members spend most of their time in front of computers and rely on the electronic communication via Internet for their daily work. The use of technology, in particular the Internet, has changed and will continue to change the conventional engineering education regarding the roles of faculty members at all levels including teaching, research, and service[1]. This paper first presents the online teaching, research and service practices. Then the survey findings are summarized.

2. State of the Art

2.1 Online Teaching Practices

One of the missions for faculty members is to educate their students the best way possible. Their teaching techniques should challenge, educate, and promote the students' innovative thinking[2]. The lecture-based format of teaching, which currently predominates in engineering education, may not be the best way to achieve these goals[3]. Through the lecture method, an instructor introduces students to course work by producing notes on a chalkboard or overhead projector. The instructor then hopes that students can regurgitate this collected information on their homework or examinations. Some classes have accompanied laboratory practices where students can gain hands-on experience. However, the lecture-based teaching may not meet all students'

needs. For example, some students (i.e. disabled, shy) sit quietly in a lecture room through the whole semester/quarter. They may not actively participate in question-and-answer sessions in a traditional classroom. Online tools such as email, chat, and discussion board could provide alternatives for traditional teaching. These students may receive more personal attention by communicating with their instructors by emails, discussion boards, and/or chat rooms than the traditional teaching.

Another advantage of the online teaching is that it offers diversified learning methods[4]. Web-based courses not only allow a student to receive the information at his/her rate of comprehension, but also allow the flexibility to access course materials at anytime from anywhere, that benefits students who miss a class and fits students' schedule better. Online tools can also provide both visual and audio learning. The diversified learning methods may meet the needs of students with different learning styles. For example, videos, three-dimensional models, color pictures or animations could make concepts or terms, which were difficult for students to understand, easy to learn now. Such online tools have become the tools of choice for many educators around the world in their regular class practices now[5].

Today the online teaching has been widely used in courses with no laboratory component, mainly for distributing course syllabi, notes, assignments and solutions[6]. Online delivery of laboratory components is a challenge that many universities are facing[7]. With sophisticated Internet-based media and communication tools, it is possible for an instructor to remotely deliver lab sessions to his/her students[4]. The development of Web-based laboratory setups allows one to perform selected experiments remotely from a distant computer[8].

It seems that online teaching offers a satisfying alternative to lecture-based traditional teaching. But online instruction may increase faculty workload, since it takes faculty extra time in preparing lecture notes and answering emails from students. This may limit some faculty members' use of online tools. In addition, criteria for evaluating quality and effectiveness of online teaching have not been well established.

2.2 Research Practices

Faculty members routinely write grant proposals and review scholarly publications. Online tools may facilitate faculty members in performing these kinds of activities. Many grant, publication, and library agencies have automated themselves with the web-based systems so that the lag time faced before has been decreased significantly. Lately, conducting peer-review processes for the research proposals and technical publications have also been placed on the Internet. For example, National Science Foundation (NSF) has started implementing a FastLane system in 1990s and now all NSF proposal submissions are required through FastLane. FastLane is an interactive real-time system. "The purpose of FastLane is to experiment with ways to use the WWW to facilitate business transactions and the exchange of information between NSF and its client community including researchers, reviewers, research administrators, and others doing business with NSF"[9]. Just a few years ago, IEEE created its manuscript center to automate the manuscript submission and peer-review processes[10]. More than dozens of journals and transactions' entire submission and review have been handled through this manuscript center since then.

2.3 Service Practices

Other than teaching and research activities, faculty serve on the department, college, and university level committees. They participate in the decision making process of many subject matters. Some of the committee tasks have also been carried to web. The application/selection/coordination of scholarships, web for parking violations control, admission process follow-up, and online calendar/course scheduling are practiced and documented in web environment and all parties who are in charge can access and input the process flow.

3. Survey Results

To investigate the effectiveness of the online tools for engineering faculty needs, a survey was created by the authors and e-mailed to 90 engineering and engineering technology faculty members in 35 universities in the United States. A total of 41 surveys were received.

Some of the basic questions included in this survey are given in Table 1. Each question was designed in the way that some sub-questions can be asked based on the faculty's answer to the main question. For example, if a faculty member's answer was *Yes,* to the question "Do you conduct any online teaching", the associated question was *how do you conduct it*? The choices to this associated question were as follows:

- *Through Self-designed webpage*
- *Use Blackboard software*
- *Use WebCT software*
- *Any others*

Table 1: Partial List of the Survey Questions developed by the Authors

Teaching
Do you conduct any online teaching?
Do you post your semester or final grades online?
Do you have any personal websites?
Do you use any online support tool in your classes?
Research
Have you done any online peer review for any journal, grant agency, or conference?
Have you done any online technical paper downloading from any online source?
Do you use COS, EI or other databases for grant and technical data searches?
Service
Does your Institution have online scholarship acceptance/rejection structure, and review system available for the students?
Does your Institution have an online system for the employees to check your salary, benefits, insurances and deductions etc., to download any forms you need?
Do you use any online calendar for your scheduling?

Scale

1: Low (dissatisfied) 3: Medium 5: High (Very satisfied)

Then the faculty member was asked to evaluate his/her choice of online tools by grading the follow-up question: "Your satisfaction with Online Teaching Tools". Finally, the last part of the survey question was to ask the faculty member to provide his/her comments on online teaching practices.

The results of survey questions are summarized in Table 2. Based on the survey results, 61 percent of the faculty who returned the survey uses web-based teaching. Survey results also show that two third of faculty members have personal webpages. 44 percent of the faculty surveyed post student grades online, while only 38 percent are using online support tools such as material selector, unit converter, and formula finder.

Table 2. Summary of Survey Results

	Percentage of Faculty	Satisfaction Level (out of 5)	
		Mean	Standard Deviation
Teaching			
online teaching	61%	3.7	0.9
post student grades online	44%	4.5	0.7
online support tool	38%	4.0	0.7
Research			
online journal or conference paper review	25%	4.6	0.6
online technical paper downloading	70%	4.6	0.6
Online paper databases	55%	4.0	0.7
Service			
online scholarship acceptance/rejection	20%	4.4	0.7
online system for the employees benefit	71%	3.9	0.9
online calendar	25%	3.8	1.1

The majority of faculty (more than 90 percent) who conduct online teaching use commercial software such as WebCT and BlackBoard. Among them, two thirds uses WebCT and one third uses BlackBoard. One faculty individual surveyed uses a publisher webpage for online teaching. Only less than 5 percent of the faculty surveyed uses a self-developed webpage for online teaching.

It seems faculty members are very pleased with online grade posting tools. They said it was easy to use and students appreciated it a lot. The advantages of posting student grades include student can track their performance by themselves; less error prone and faster.

The use of online support tools, e.g., material selector, unit converter, formula finder, simulators are relatively low. It seems that those, who have used online support tools, are happy with them.

The use of such tools, however, is believed to be dependent on the type of classes and the disciplines.

Though only 25 percent of faculty uses online paper review or proposal review, they are very happy with the online review tools. Current journals and conferences using online review include IEEE Transactions, IEEE conferences, ASME Journals, ASME conferences, ASEE conferences, IMAPS conferences, and NSF Fastlane System. The percentage of faculty members who conduct online reviews for journals reflects the number of journals that provide web-based review services and require the reviewers to do online reviews. As more journals switch from traditional hardcopy-based submission and review practice to more efficient online review practice, faculty members who conduct online reviews will grow rapidly.

The survey results show that the use of online tools for research is not as common as that for teaching. While many factors may have attributed to this result, one relevant factor may be the faculty member's position statement. In general, a faculty member in a research intensive institution spends more time in literature search, grant writing, paper submission, and paper review, and therefore, is more familiar with online search tools.

In addition to teaching and research, online tools are available for faculty services such as online calendars, web-based admissions process and scholarship selection. The majority of faculty surveyed use online personnel services such as Web-based Calendar and they are satisfied with such services. The survey results also show that only 20 percent of the faculty members have used online admission and scholarship selection. This result may be due to two reasons. One reason is that many universities may not have the online tools for admissions and scholarship selections. The other reason could be that some faculty members surveyed have not been involved in such services. It is believed that online admission and scholarship selection will grow up in the near future as more institutions start to deploy such online services, and move away from their traditional practice.

4. Conclusions

Online teaching, research, and services have been gaining momentum in many universities. The online tools greatly support the faculty teaching and research needs.

Most faculty members use commercial software for online teaching and they are pleased with these tools. Online teaching is able to provide various learning methods to meet students' diversified needs. Some faculty commented that online teaching cannot replace the regular classroom since they seem to be happy with their conventional instructional practices. Based on the survey results authors believe that both lecture-based traditional instruction and online teaching will co-exist. Developing an online educational module will take a lot time at the beginning. But, faculty members also believe that it will eventually lower down their course preparation rate. This extra burden may have prevented some faculty members from practicing online tools.

The results of the survey indicate that online tools for research and services are not as common as that for teaching. Authors believe that the tools would be popular when more online systems are deployed such as online paper review and online scholarship application systems.

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Biographical Information

ISMAIL FIDAN
Dr. Ismail Fidan is an Associate Professor in the Manufacturing and Industrial Technology Department, College of Engineering, Tennessee Tech University, Cookeville, TN. Dr. Fidan received his PhD in Mechanical Engineering from Rensselaer Polytechnic Institute in 1996. His teaching and research interests are in computer-integrated design

and manufacturing, electronics manufacturing, rapid prototyping, e-manufacturing, online teaching, and manufacturing processes.

JIANBIAO (JOHN) PAN
Dr. Jianbiao (John) Pan is an Assistant Professor in the Department of Industrial and Manufacturing Engineering at California Polytechnic State University, San Luis Obispo, CA. His teaching and research areas include electronics manufacturing, electronics and optoelectronics packaging, lead-free solder, and computer aided manufacturing. He received a Ph.D. in Industrial Engineering from Lehigh University, Bethlehem, PA.

LEIJUN LI
Dr. Leijun Li is an Assistant Professor of Mechanical and Aerospace Engineering at Utah State University, Logan, UT. Dr. Li received his PhD in Materials Science and Engineering from Rensselaer Polytechnic Institute in 2000. His teaching and research interests are in joining of advanced materials, materials processing and manufacturing engineering, and mechanical properties of materials. He has over 30 technical publications in welding, materials science, engineering failure analysis, and engineering education.