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**Discovering User Information Needs:
The Case of University Department Websites**

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Abstract

University department's web pages are the focal point for a wide variety of users, including prospective students, current students, parents, staff and alumni. We provide a task analysis of what each user group will look for on university department websites. This analysis is based on analysis of existing sites, hardcopy materials, user search query logs, and interviews with users. Good task analyses are reusable as a design aid. Checking a site to ensure that common users' tasks can be performed will help ensure completeness of a site. Further reflection on these tasks can enhance the clarity and consistency of the procedures used when providing navigational aids. We use the task analysis to show that five existing university sites provide good but varying amounts of support for these tasks. This analysis of university websites can be applied more generally to other websites, such as a corporation, non-profit or an e-store.

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1. The increasing role of the Web for university departments

University department web pages are the focal point for prospective students, current students, parents, staff and Alumni who want to explore the university. Users visiting these sites expect to find particular pieces of information, perhaps most notably contact information for various people within the department, but also a wide range of information.

One would want to use a university's website for many reasons including looking up a staff member's phone number, getting directions to a building, application materials and procedures, and much more. People are visiting university department websites in large numbers. Data from Penn State's School of Information and Science Technology website indicates that the domain ist.psu.edu registered over 640,000 page views from over 116,000 unique visitors in 2001 alone (based on the Webtrends 2001 report for ist.psu.edu). Nielsen/Netratings reports that there are an estimated 450 million users of the Internet, and that at any given time approximately 250 million of them are actively using it (www.nielsen-netratings.com). With so many people using the Internet, it is important for university departments to provide the right information to their users who are increasingly online.

There currently is a wide divergence in styles and content of university department sites. This could be due to a difference in department philosophies and the wide range of tasks each department must support. Certain departments will prefer a flashy design, while others will prefer a more straight forward approach. Content will vary simply because different departments have different information to present, and some may put more or less effort to their design.

There is likely, however, numerous common users and tasks all of these sites should support. We believe a task analysis is the first place to start to create a successful department website. To know what content to provide to users, we must first determine how they want to use department websites. Our task analysis is a set of tasks that could be supported for university department website users. Our analysis should be reusable by others. This analysis could be generalized and re-specified for use on other types of websites, including non-profit, corporate, e-store, or university athletics sites.

The list of user groups and tasks is likely to be difficult to keep in mind, and would be difficult to generate alone in a single setting. We present here a task analysis of what users look for on university department websites. We developed this through a wide range of analyses, including

reviewing existing department websites, departmental hardcopy handout materials, search engine queries, and by interviewing users to see what additional information they require.

We compare this task analysis to a sample of current department websites to show that it generates useful suggestions, as well as using the comparison to improve our task analysis. We conclude with a guide on what to do with department websites after they are built including maintenance and marketing.

Please note that this report focuses only on task analysis, and does not cover design elements of websites. Refer to other resources on website design to apply our task analysis. We suggest such references (Brinck, 2002; Fisher, 1997; Raskin, 2000). We will start by defining task analysis, and then discuss the items each approach found.

1.1 What is task analysis

Task analysis refers to a family of techniques for describing various aspects of how people work. Reviews are available (Beevis, 1999; John & Kieras, 1996; Schraagan, Chipman, & Shalin, 2000). The fundamental component of task analysis is gaining a deeper understanding of the goals people are trying to achieve. Task analysis uses the goals to be achieved by the user as a means of determining how efficiently the goals are accomplished. It offers an approach for overcoming the challenge of correctly acquiring the essence of the user by defining their tasks, and, in this case the information they will wish to acquire from a university department website.

Task analysis can be used during the design process because it acts as a road map for a design team. In each portion of the design, the task analysis can be used as a guide to answer the question: “Does the design support the tasks?”

In order to begin task analysis for a website there are three fundamental steps to follow. Initially, the designer needs to know who the users are (what groups of users will be using the site). Next, they need to consider what information the user groups will need to access, creating a list of tasks that different users will perform using the website. Finally, the designer would note the pages most frequently viewed by the users and the tasks that these pages accomplished, and modify their design appropriately. This report does not attempt to address task frequency or how best to support these tasks as an aggregate.

1.2 Approaches for building a task analysis

In order to build a successful task analysis, we must determine what information the users are looking for. Typically, users are studied directly and formal manuals and processes are used to generate a normative model of use. The users in the case of university department websites are geographically dispersed and are diverse in many ways. Therefore, a wide range of approaches are needed to enumerate their tasks.

This report provides a preliminary list of tasks that will serve as a good guide for what information should be included on a university department website. This list can be used to improve existing designs. It will also be quite useful when creating new sites.

2. Generating a task analysis for department websites

To generate our initial task analysis we will use a variety of methods, including analysis of departmental hardcopy materials, analysis of existing sites, reviewing web search engine logs, and asking existing users. The resulting task analysis is not complete because user groups and tasks are continually evolving, but it appears to be useful already.

2.1 Analysis of existing sites

We present in Table 1 a listing of the types of users that we are able to enumerate. Some users will fit under multiple categories. This is a problem that we have not tried to detangle yet. This list is likely to be incomplete, but provides a somewhat wider range than we ourselves have thought of on any one occasion. As department websites are developed, it would be productive to keep these user groups in mind. Further analyses can expand this list.

We began our task analysis by looking at a sample of existing department websites, and extracting a list of tasks that they support. (In section 3 we will compare these websites based on the individual tasks they support.)

We initially visited two department websites at Penn State – the School of Information Science and Technology (IST) and the Department of Computer Science and Engineering (CSE). We examined these websites for tasks they supported and noted these tasks in a list. As new tasks were discovered with other approaches, the list was augmented. This analysis served as the initial draft of the task analysis. (This is presented later in Table 7 if you wish to skip ahead.)

Table 1. An unordered and non-exclusive list of types of users of university department websites.

Current Students

Prospective students- undergraduate, graduate, local, national, international

Faculty/Staff -- in the department, at the university, at another university

Alumni

Parents

Donors

Research consumers

Research program managers

Press

Prospective faculty

State legislators (for state schools)

Disabled users

2.2 Analysis of hardcopy materials

It can be inferred that a website user would be looking for information obtainable from other sources/media. Therefore, we extended our task analysis by examining hardcopy materials already handed out by various departments.

2.2.1 What we did

We collected an informational packet from the Penn State School of Information Science and Technology's (IST) Director of Communications directed towards prospective students, as well as a graduate brochure from Penn State's Computer Science and Engineering (CSE) Department. The following types of information were encountered: website printouts, printed brochures, pictures, and directories. The IST informational packet contained nearly 150 pages of various materials. Table 2 describes them. The packet from CSE was similar.

2.2.2 Tasks supported

The hardcopy materials we reviewed supported most tasks that a prospective university student requires, such as admissions information, campus information, faculty listings, and an introduction to the given program. The hardcopy materials provided by the School of IST and by the CSE Department displayed significant parallelism to their respective websites. In fact,

the IST packet contained several printouts from the IST website. The websites were more likely to contain up to the minute breaking news or updates, where the hardcopy materials contained many more pictures and were laid out with a more intricate graphical design. A complete listing of tasks from the hardcopy materials is shown in Table 3. These tasks are merged with the tasks from the first analysis in the final table of tasks.

Table 2. Documents in School of IST's "Blue packet".

Document	Pages
Construction plans	3
About IST	2
IST Building Information	11
Purpose of school	14
IST Faculty	19
IST Press Releases	6
Internship program	5
BS Degree Guide for First Year Students	23
Fundraising Campaign	11
Brochure	4
Enrollment figures	4
IST Solutions Institute	6
Bachelor's degree information	21
PhD Program	14

2.2.3 Summary

One striking conclusion was the observation of website printouts in the collection of hardcopy materials. This tells us that there is significant overlap between the hardcopy materials and the websites supporting them. The analysis also suggests that handout designs may be influenced by the website. From this we conclude that hardcopy materials and department websites should be designed to work together.

Table 3. Tasks found from analysis of hardcopy department materials.

Construction plans
Faculty list
Message from Dean
Press releases
First year coursework
Degree options
Internship program
Employer involvement in coop program
BS degree guide for first year students
Phone numbers
Major requirements
Advising contact information
Related degrees
Campus list
Vision Statement
How to donate to department
Campaign/fundraising goals
Purpose of school/mission statement
Enrollment figures (student/faculty)
Expected abilities
Student biographies
Campus/classroom pictures
Alternate media
PhD program
Map of university
Admission information
Scholarship information

2.3 Analysis of search queries

Website search queries can also show us information that users are looking for, particularly topics that they have difficulty finding on a website. A search query for a certain topic tells us that the user wanted information on this topic, and it suggests that this topic was not easily

found using traditional hyperlink navigation on the site. Or maybe a user knew exactly what he wanted to know, but didn't want to navigate through many pages. Search queries can be faster than hyperlink navigation, especially if you're using sites that do not provide information in the structure users expect. By determining the most popular queries to a site, we can discover what information users want from that site.

2.3.1 What we did

We examined search query logs of Penn State's homepage, provided to us by the Penn State webmaster to augment our analysis. We compiled a listing of the 250 most searched for phrases in the search logs from the Spring 2002 semester at the Penn State website (www.psu.edu). The logs represented over one million search queries.

The queries were typically short phrases. We classified the top 100 phrases into three categories, and of these categories we list only the most popular searches in that category. The largest category was phrases related to registrar functions. These tasks are supported by the registrar in the US colleges and by departments in the UK and other cultures. Table 4 provides a listing of these tasks.

2.3.2 Tasks supported

The queries in the first group shown in Table 4, were related to the registrar and registrar-related topics. All of these items are provided by a centralized registrar's department in the US, so we do not include them in our task analysis. In other countries, such as the UK, several of these topics would be relevant to include on a departmental website, and should be included to create a more local task analysis for such sites.

The next group of queries is shown in Table 5. This list is of topics that department websites might reasonably be expected to include, and that some users are not finding directly from department (or university) websites, or prefer to use a search engine to find.

The third group of searches was for colleges and departments within the university. Table 6 lists the colleges and departments most searched for from the PSU search engine.

Table 4. Registrar-related tasks, grouped by keyword including synonyms.

Search keywords	Number of searches
Registrar	6,284
Final exam schedule	6,184
Transcripts	5,073
Courses	2,379
Course schedule	2,111
Summer courses	1,417
Course availability	944
Course descriptions	587
Scheduling	527

Based on this table, we added to our full task analysis a listing of courses offered by the department; a map indicating the location of the department (and its teaching and research facilities); career services if offered through or with the department; significant programs in the department (the *junior core* is a set of courses in one of the colleges at Penn State); minors and other degree programs; and finally, links to the syllabi of the courses offered by the department.

Table 5. Items for department websites.

Search keywords	Number of searches
Courses	2,379
Campus map	2,295
Career services	2,292
Junior core	1,966
Online courses	1,090
Minors	444
Physics 201	359
Econ 333	294

2.3.3 Summary

Departments can fruitfully monitor the most common items searched for in their website. This listing will suggest what topics are hard to find and what topics are not yet included.

The second group of queries, shown in Table 5, indicates that users were looking for department websites. Ideally, users coming to a university's website would be provided help to find department sites. University webmasters will have to assist in this. This is a problem that we have noticed on multiple universities' websites. A department's website cannot directly address this task, but the department webmaster might be able to ensure that their site is correctly listed, so that it comes up in search engines, particularly the one provided by the department's university. We know that this is not always the case at our own university.

We found many instances of people looking for departments and colleges within our university. This suggests that (a) department webmasters should check that they end up in search engines and (b) Penn State's website does not provide a clear link out to individual colleges and departments. How users view the university and how it views itself may be different, and therefore a task and needs analysis for university websites might also be useful and interesting.

Table 6. Colleges and departments searched for.

Search keywords	Number of searches
ROTC	1,178
Physics	803
Chemistry	777
Psychology	621
Smeal (Business college)	548
Economics	514
Political science	505
Econ	440
College of Education	403
Biology	400
Engineering	355
Anthropology	354
Chemistry department	319
College of Communications	314
Schreyer (Honors college)	296
Chemical engineering	270

The final category included items that might be supported by department websites. Note that many queries are related to finding courses offered by various departments.

2.4 Open interviews of users

We interviewed thirteen users of university department websites. These users included current students and prospective students (8), as well as staff (1), parents (3), and alumni (1). We showed them our preliminary list of tasks, and asked them to tell us what additional tasks they thought should be supported.

All of the interviewees specified that they wanted contact information on a department website. They wanted phone numbers and/or email addresses for a wide variety of people in a university department. This was already included in our list, so it must indicate a strong desire for this information.

The interviewees also came up with the following new tasks to support: schedule for finals, local information (weather, etc), and intramural sports related to the department (which we read more generally as “social organizations and clubs”). While more users could be interviewed, the number of suggestions per interview at this point is rather low. The last six users could not provide additional tasks.

2.5 Final, summary of tasks

The full task analysis is shown in Table 8. The headings represent sets of topics, not the analyses reported here that we used to populate the table.

Remember that this list is only to be used as a guide, and that particular department’s websites may not require all of these features, and some departments may also want to provide information not on that list. For example, a community college might not need to include information about graduate programs. Smaller schools might not have internship programs. Additionally, there may be information you want to display on your website that is not on this list. This list should therefore only be used as a guide. It is, however, intended to be a fairly complete list, useful for checking designs. Also note, some topics are listed twice as they are grouped that way by existing designs, or, more importantly, by users.

We can now imagine automatically checking websites to see if they provide this information, and in the next section we do this by hand to test its usefulness, as well as a way to extend the task analysis.

Table 7. Set of website tasks to support all users.
(* indicates tasks found by the analysis in section 3)

Introductory

Welcome message from the Dean/Head of Department
Message from the Dean/Head of Department
About the college
Purpose of school/Mission statement/ Vision statement
Publications, full or sample

People

Bios for faculty, support staff, administrators, alumni, graduate students, undergraduate students, associated faculty, friends of the department, teaching staff, post-doctoral fellows, visitors

Listings of categories (e.g., Faculty)

Contact information/Directory

Points of contact for:

- General information
- The web
- Admissions
- Research
- Press
- Records
- Student Affairs/Internships
- Study Abroad

Programs

Undergraduate/ Graduate
Research
Outreach
Study abroad
Internships/Cooperative Education
Associated Conferences
Institutes, Centers, and Labs
Distance Learning Seminars and Certificates
Rankings *

Policy

Alumni relations
Multicultural affairs/Diversity
Corporate relations
Administration
Academic

Table 7 (Cont.)

Current events

- Calendar of events
- Current issues
- Press releases
- News and media

Prospective students

- Admission requirements
- Advising site
- What graduates can/will do
- Campus and classroom pictures
- Research topics
- Student organizations and clubs
- Mentoring
- Visiting
- Applications *
- Summary of reasons to come *

Financial matters

- Scholarship information for all groups of people – undergraduate, graduate, post-doctoral
- Gifts/How to donate
- How to be a coop partner
- Campaign/fundraising goals
- Job openings *

Physical location

- Address of college (email, fax, phone)
- Campus maps/maps for coming from a distance
- Find a building (offices, classrooms, labs)
- Virtual tour
- List of campuses (for multiple campus programs)
- Building(s) plans

School resources

- Enrollment figures (student/faculty)
- Schools/departments
- Labs, Centers, Institutes
- Other resources (this may vary widely from horse barns to pre-schools to particle accelerators)

Table 7 (Cont.)

Specific majors

- Major requirements
- Degree options
- Course offerings
- BS degree guide for first year students
- Related degrees
- Achievement expectations
- Minors *

Specific courses

- Class announcements
- Assignments
- Lecture notes **
- Schedule
- Syllabus
- Class message boards and mailing lists
- Assignment due dates
- Assignment solutions
- University regulations related to the course (e.g., Americans with Disabilities Act)
- Grades **

** - We have mixed feelings about including these two topics. Current writing in this area is at best mixed about the actual utility of these two types information. It is argued by some that providing lecture notes leads to less processing by the student and providing detailed feedback as a score emphasizes the wrong type of learning, but some university course sites do include these.

Web features and support

- Search
- Contact webmaster
- Link to university homepage and other associated centers and units
- Related links
- Frequently Asked Questions (FAQ) for Department
- Student Resumes
- Merchandise

Alternative views

- Text-only view
- Alternate media available upon request
- Alternate language (i.e., Spanish)

3. Comparison of task list with existing department websites

To test our information needs task analysis we examined university department websites in detail to see how many of the tasks they supported. We expected to discover if sites already supported all the tasks, and we also hoped to find some further tasks that we may have overlooked.

3.1 Sites Examined

We selected websites that sampled several domains. First of all, we tried sites from three different universities – Penn State, University of Illinois, and Rutgers. Secondly, we chose four different disciplines within these schools – Information Science and Technology (IST), Psychology (Psy), Electrical Engineering (EE), and Business (Bus). This approach let us examine both technical and less-technical disciplines.

Each of the sites selected have a well-done university department website. They accomplished this using slightly different designs. We chose these sites because we have affiliations with them, except for Rutgers which was chosen as a similar sized site as the IST site.

3.2 Methodology

For each site in the set, we visited the site in June 2002 and determined if it supported each individual task, marking the corresponding table entries “yes”, “no”, or “not available” as appropriate (These sites may have changed since then). It was always possible to note if the task was supported because the sites were always well organized or small. The results are shown in Table 8. Occasionally we would also find new tasks at these sites, we recorded them in Table 8, checked the other sites for them, and included them in Table 7 (as indicated with the asterisks).

The lack of an item may indicate a place for improvement or it may indicate a difference in focus of the department of websites, or it may simply not be applicable.

The first website in Table 8 is Penn State’s School of IST website (ist.psu.edu). This is probably the newest site to be built on our list, and is one of the most complete. The IST website covered 78 of the 90 tasks we discovered.

The next column in Table 8 is the Psychology website at Penn State (psych.la.psu.edu). This is a simply designed website full of features, but not cluttered. It is designed with accessibility in mind (for instance, it is designed to be completely viewable in a 640x480 display). The Psychology website covered 46 of the 90 tasks. Some of the tasks might not be supported because it is a site for a department and not a larger unit such as a school.

Our final Penn State site was that of the Electrical Engineering department (www.ee.psu.edu). The Penn State Electrical Engineering site covered 56 of the 90 tasks. This analysis provides suggestions for topics they may wish to consider including on their website.

The Electrical Engineering site at the University of Illinois was our next stop (www.ece.uiuc.edu). This site went through a “facelift” operation within the past year. This site covered 62 of the 90 tasks. It also provided some interesting new tasks, perhaps based on that fact it is a large and prominent department.

Our final site was the Rutgers Business School (business.rutgers.edu). Due to its size and stature within its university it is probably most comparable to the IST site, as they are both schools, a larger academic unit than a department. This site supported 46 of the 90 tasks. The analysis makes several suggestions for where this site could be expanded to support more of user’s tasks.

3.3 Summary of comparisons

Comparing the lists of tasks to these 5 websites by hand led us to add seven new tasks in addition to explicit descriptions of where these sites could provide more information. A wide variety of tasks were supported on all sites, showing an emerging agreement and commonality in many aspects of website design.

There were also interesting differences. This suggests that different university departments have a different view about what is important to include on a department website. “Perhaps even more important, though, is informal support within and across departments and schools.” Most campuses have their own servers, system administrators, and technical support. This allows for a department to have an abundant amount of assistance when constructing their site (Block, 2002).

Table 8. Comparison of several department websites. (* indicates a new task added during our comparison) (n/a indicates not available) (■ indicates a supported task)

Task	PSU IST	PSU Psy	PSU EE	UIUC EE	Rut. Bus
Introductory					
Welcome from the Dean/Head of Department	■ s	no	no	■	■
Message from the Dean/Head of Department	■ s	no	no	no	no
About the college	■ s	■	■	■	■
Purpose of school	■ s	■	■	■	■
Mission statement	■	no	no	no	no
Vision statement	■	no	no	■ i	no
Publications, full or sample	■	no	■	■	■
People					
Bios for the several types of people	■	■	■	■	■
Listings of categories (e.g. Faculty)	■	■	■	■	■
Contact information	■	■	■	■	■
Directory	■	■	■	■	■
Points of contact for:					
General	■	■	■	■	■
The web	■	■	■	■	■
Admissions	■	■	■	■	■
Research	■	■	■	no	■ i
Press	no	no	no	■ i	no
Records	■	no	no	no	no
Student Affairs/Internships	■	no	■ i	no	■ i
Study Abroad	no	no	no	no	no
Programs					
Undergraduate	■	■	■	■	■
Graduate	■	■	■	■	■
Research	■	■	■	■	■
Outreach	■	no	no	no	■
Study abroad	no	■	no	no	no
Internships/Cooperative Education	■	■	■	■	■
Associated Conferences	■	no	no	no	no
Institutes, Centers, and Labs	■	no	■ i	no	■ i i i i i i i
Distance Learning Seminars and Certificates	■	no	no	no	no
Rankings *	■	no	no	■	■

	PSU IST	PSU Psy	PSU EE	UIUC EE	Rut. Bus.
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Policy

Alumni relations	no	no	no		
Multicultural affairs/Diversity	no		no	no	no
Corporate relations		no	no	no	no
Administration			no		
Academic			no		

Current events

Calendar of events		no			
Current issues			no	no	no
Press releases		no	no		no
News and media			no		

Prospective students

Admission requirements					
Advising site					
What graduates can/will do					
Campus pictures		no			no
Classroom pictures		no	no	no	no
Research topics					
Student organizations and clubs		no			
Mentoring		no	no		no
Visiting		no	no		
Applications *		no			
Summary of reasons to come *					no

Financial matters

Scholarship information for all groups of people		no			
Gifts/How to donate	no	no	no	no	no
How to be a coop partner		no	no	no	
Campaign/fundraising goals		no	no	no	no
Job openings *		no			no

Physical location

Address of college				no	
Campus maps					
Find a building (offices, classrooms, labs)	no	no		no	
Virtual tour		no	no	no	no
List of campuses (for multiple campus programs)		no	no		
Building(s) plans		no	no	no	no

	PSU IST	PSU Psy	PSU EE	UIUC EE	Rut. Bus
School resources					
Enrollment figures (student/faculty)	no	no			
Schools/departments (sub-units)	n/a	n/a	n/a	n/a	
Labs, Centers, Institutes		no			
Other resources (this will vary widely)		no			no
Specific majors					
Major requirements					
Degree options					
Course offerings					no
BS degree guide for first year students		no			no
Related degrees					
Achievement expectations					no
Minors *					no
Specific courses					
Class announcements					n/a
Assignments					n/a
Lecture notes					n/a
Schedule					n/a
Syllabus					n/a
Class message boards and mailing lists			no	no	n/a
Assignment due dates					n/a
Assignment solutions					n/a
University regulations related to the course					
Grades					n/a
Web features/support					
Search		no			no
Contact webmaster					no
Link to university homepage					
Related links					no
FAQ for Department					
Student resumes *	no	no		no	no
Merchandise *	no	no	no		no
Alternative views					
Text-only view		no	no	no	no
Alternate media available upon request		no		no	no
Alternate language (i.e., Spanish)	no	no	no	no	no

4. After the website is built: Marketing and maintenance

We examine here a few issues related to the broader context of supporting users including the dissemination of the website so that potential users can find it, and the maintenance of the wide array of information the tasks in Table 7. Fortunately, a wide variety of free and commercial services exist to help advertise a department's site, and there are useful ways to maintain a site.

4.1 Search engines

One of the most efficient advertising methods is to get one's site listed on search engines (Cheyne & Ritter 2001). Search engines, such as Google, are the first stop for many users who need information from the web. Many sites on the Internet offer to help you meet your advertising goal by automatically posting your site to several search engines at once. These services vary in cost and coverage, with costs in the range of \$0 to \$1,000+ per year, and coverage from four search engines to over four hundred thousand search engine entries and site listings (which are different).

Listing your site in search engines manually is a simple but time-consuming activity. Most search engines have straightforward submission forms, where you enter your website's URL and a few bookkeeping items. Therefore, Table 9 lists several of the most popular search engines and the URL for submitting sites to them. The difficult part of manual submission is finding the submission forms themselves.

There are also many tools that will automatically submit websites to search engines. Table 10 lists several that we have found.

Choose a website submission service with caution, and research which search engines the service submits to. A service that submits to thousands of search engines will not be useful if it does not include popular search engines such as Google and Yahoo! in its submission list.

We have firsthand experience with a few of these submission tools. The Mega Search Engine Submitter placed one of the author's sites in several search engines, and within days one of us was receiving an enormous volume of unsolicited commercial email (spam). The email largely came from one site, and we quickly removed ourselves from that site's mailing list.

Table 9. Do-it-yourself website submission to search engines.

Search Engine	Submission URL and Price
Altavista	www.altavista.com/sites/search/addurl_(free)
AOL	aolsearch.aol.com/add_adp (free)
Excite	www.excite.com/info/add_url (not free)
Google	www.google.com/addurl.html (free)
Hotbot	www.hotbot.com/addurl.asp (temporarily unavailable)
Lycos	www.lycos.com/addasite.html (not free)
MSN	listings.looksmart.com/?synd=zdd&chan=zddresults (not free)
Open Directory Project	dmoz.org/add.html (free)
Yahoo!	docs.yahoo.com/info/suggest/ (free)

Table 10. Example automatic website submission tools.

Service	Cost	Coverage
Addpro www.addpro.com	Free	20 search engines
Mega Search Engine Submitter www.global.gr/mtools/linkstation/se/engnew.htm	Free	50 search engines
Addme www.addme.com	Free	18 search engines
Microsoft's bCentral www.submit-it.com	\$29.95 \$49.99	2,000 search engines About 500 search engines
Ineedhits.com www.ineedhits.com	Starting at \$9.99	300 search engines
Frynge.com www.frynge.com/advert.htm	Starting at \$39.99	1,600 search engines
Search Engine Blaster www.searchengineblaster.com/	\$1 per day	400,000 search engines, targeted directories, classified ads

The following text is from that site's "Removal Request Page":

People, such as yourself, give us their email addresses in return for the free advertising that we give them. There is a disclaimer at the submission sites and in Our Terms of Service that your email address would be placed on a mailing list, sold, and given away. It is also made clear to you that you could have been removed from the mailing list at any time.

There were no readily identifiable disclaimers or caveats at the Mega Search Engine Submitter, warning that our email address would be used in such a manner. While this service posted our site to the most search engines when compared to the other free services, this is one example that more is not always better.

4.2 Beyond search engines

Posting a website to search engines represents only one step in a successful advertising journey. "As a whole, the World Wide Web displays a striking "rich get richer" behavior, with a relatively small number of sites receiving a disproportionately large share of hyperlink references and traffic"(Pennock, 2002). If a website is not listed near the top of search results, it will not be visited. Visits to one of the author's personal sites increased 600% when the site was listed in the top 10 sites of a directed reference site. Therefore, websites should be optimized for search engines.

One can consult www.submit-it.com/subopt_print.htm for a list of search engine optimization tips that will help boost a website's search engine ranking. These tips instruct a web designer how to structure the content of their pages to take advantage of how search engines look for information.

Another method of site advertising is directed banner ads placed on other sites. Free Banner Exchange (www.freebanners.co.uk/about_freebanners/) is a site that posts banner ads for free, provided that you post one of theirs on your site. Previous work (Cheyne & Ritter 2001) suggests this is not as productive as search engines, but it may be useful for new sites. Users, however, are unlikely to be widely enthusiastic about academic departments' either displaying or generating banner ads, and you may have difficulty reaching users. It may be more appropriate to provide links to related degree programs, providing context in a more subtle way.

Many themed resource sites exist, and they are generally glad to list sites. For instance, if developing a set of math resources on the web, submit the site to Merlot (www.merlot.org) and

Education Planet (www.educationplanet.com/topsites/math.html). Such resource sites exist for many topics, and in some areas they are very important. Maintaining such resources provides an explicit way to promote your programs and resources as well.

A feature that can be found on some department websites is genuine online content, that is, subject material resources. Departments already are repositories of knowledge and their websites can and should support this. Departments do not appear to be routinely providing this type of information. Existing examples of academic content sites include Merlot (merlot.org), discrete math teaching resources (acs.ist.psu.edu/discrete-math), and (Block, 2002). In time, we believe that department websites will do this more often. It is hard to describe in or table, however.

Many search engines also support directory references, including Google and Yahoo!. A math resource site could be submitted to Google's math directory (directory.google.com/Top/Science/Math/) and the Yahoo! math directory (dir.yahoo.com/Science/Mathematics/).

Perhaps a simpler method of spreading the news about a site is to mention it in other media. Use newsletters or publications in other media to advertise your site. Ask sites related to your site to post a link to your site, and in exchange post a link to their site. After all, this is why they call it the "World Wide Web".

4.3 Example application of these tools

We recently finished a discrete math resource website, acs.ist.psu.edu/discrete-math/ (Mudgett, Freed, & Ritter, 2002). Posting the site to several prominent Internet sites took under ten minutes and incurred no financial cost. Table 11 shows a list of advertising steps we took.

4.4 Maintenance

A successful department website requires as much maintenance as an average commercial website. Hyperlinks must be routinely checked to assure that they still work. Fortunately, software tools and services exist that can automatically check the hyperlinks on a website.

It is also important to maintain the content of a website by making frequent additions and revising content. This is particularly true for dynamic organizations like university departments. An updates page or update section on your homepage is a good way to keep users posted about new events.

Table 11. Example times to submit to various resources.

Task	Time Required	Coverage
Submission to bCentral free service	1 minute or less	Google, Hotbot, Webcrawler, Lycos
Submission to Merlot	5 minutes	Highly visible in math teaching community
Submission to Dmoz Open Directory Project	5 minutes	One popular open directory site
Put link on author's home pages, post announcement to discrete math teachers mailing list	5 minutes	Discrete math teachers across the country

Nielsen and others suggest that an annual maintenance budget be set that is equal to the initial cost of building the site (Brinck, 2002; Nielsen, 1997). Websites that become outdated decline in quality, so you should protect your investment by spending time to maintain it and keeping it up to date.

This task analysis explains why maintenance is required and takes so much effort. The topics in Table 7 and 8 are broad, and many of them will change frequently. We thus believe the most practical way to keep a website updated is to devolve the maintenance of the website from the webmaster to those who create or manage the information directly. This approach has the person maintaining the paper phone list also maintaining the web-based version. The task analysis in Table 7 describes half of the mapping that is required.

4.5 Other useful website features

Users may want to be kept informed of updates to a website. By signing up for “MindIt for Webmasters” (www.pumatech.com/mymindit_main.html), you can add a Mindit form to your website. This form allows users to enter their email address and thereby receive updates when your site changes.

Adding a search capability within your website is a very convenient feature for users. While we would like users to have access to information without search, search can be a powerful way to fill in gaps in a design. We found that the search logs can give rise to important suggestions for

website design. A variety of solutions exist, from a Google plug-in to your own site (see Google's WebSearch/SiteSearch page at www.google.com/services/free.html) to an externally-hosted search engine (see www.searchengine.com).

4.6 Summary

A service that submits your website to thousands of search engines will not likely generate many more visitors than a service that submits to only a few dozen but important sites. There are only a handful of major search engines, and thus the remaining search engines are mostly regional search engines, like "SearchFlorida.net".

The best marketing plan is to get listed on all the major search engines, as well as directed reference guides. We believe it is better to target your users by submitting to websites that they will visit, rather than blindly submitting to as many sites as you can.

5. Conclusions

We have created an initial task analysis of the audience and the tasks they perform with university department websites. The list was developed through several analyses, and while the tasks are not surprising on their own, their breadth suggests a wider and deeper use than we thought we would see when we started out to create this list.

The list of tasks provides useful suggestions for improving department websites. The results of checking existing department and school websites against our list suggested where the sites we examined could be improved, as well as where the task analysis could be extended.

Adding seven tasks after checking only five department websites suggests that several more tasks remain to be discovered. In addition to new tasks, new types of users could be discovered.

The existing task analysis is unlikely to be complete. As we saw by examining additional websites we found more tasks that some sites supported. Testing further websites is likely to help extend the analysis further. Our task analysis as we revise it to follow the continued use of the web is likely to evolve in the future to cover more tasks as well as more types of users. We note here several likely directions for this work.

The task analysis does not make direct suggestions about design. Some departments will want to emphasize specific features about themselves. Others, perhaps those whose academic

discipline is related to websites, will emphasize some aspect of the site itself, perhaps design, perhaps usability, or perhaps demonstrations of their work. Additionally, different assumptions about the users such as bandwidth (do they have dialup access or broadband access?) and the usage of the site (will the pages often be printed?), will give rise to differences in design. This is to be expected.

There is a cost to testing a website. It takes about an hour to work through the list of tasks and search the website to determine if the information is available. In the future, we can imagine that this task, like many in usability testing, could be automated. Cognitive models could be used as surrogate users (Ritter & Young 2001). Tools using cognitive models or artificial intelligence agents could be used to automatically check entire websites against our task analysis. These models would evaluate websites by visiting them and trying to perform a given list of tasks. We are working on this, but this approach is a long range task itself (Ritter & Young 2001; Ritter, Van Rooy & St. Amant, 2002; Salvucci, 2001).

Perhaps the largest lesson that we continue to relearn, is that the online world parallels the real world. The task analysis, taken as a whole, suggests that nearly all the constituencies of a university department now interact with its website, and that nearly all the tasks and work that departments do are mirrored on the website as well. This task analysis then, can be informed by the physical, administrative, and even social structures of a department, and can help support them in their tasks in turn. Increased use of this or similar hierarchy leads to super additive effects. As more departments provide more people can count on the web for information.

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