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The Usability Testing and Redesign of a University Department Web Site

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Abstract: This research addressed the assessment, redesign and usability testing for a departmental web site at a major University. The primary objectives for the research were to gain an understanding of "user" requirements,to incorporate these requirements into a newly designed prototype for the web site, and to provide recommendations for College wide modifications to other deparmtent web sites. A usability test was performed on the prototype to validate that key technical and functional capabilities had been implemented. Key participants included in the usability testing and requirements definition included current students, prospective students, parents, alumni and administration. Jeffrey Rubin's methodology for conducting usability testing was utilized and cognitive design principles from Donald Norman were incorporated into the prototype.

Keywords: Usability Testing, Cognitive Design Principles, Prototype, University, Web Site, Department

Introduction

WEB SITES HAVE become an integral component of the recruiting and marketing processes for universities. As identified in Pew's major moments survey data from 2005 (Horrigan & Rainie, 2006), over 17m Americans indicated that the Internet played either a crucial or important role in their selection of a college or university. Poock (2005) cites work by Hoeflich which found that the Web was instrumental in the selection of programs for students considering graduate work, while Christiansen et al. (2003) confirms that most students use this technology in their college search and selection process. In addition, Ashburn (2007) reported that in a web survey of 7867 high school students in 2007 that 84 percent said "they used colleges' Web sites most heavily in their research" (p. 1) of programs.

Recognizing the criticality of the their web site as a means of communicating effectively with prospective students, the College of Arts and Sciences from West Virginia University (WVU) decided to perform a usability test for their Statistics Department Web Site. The Dean selected this site for testing since it had recently been redesigned (February 2007) to incorporate a university template, college standards and departmental requirements.

Four key questions addressed by this study include:

- What content is considered mandatory and important by prospective students?
- What navigation approaches are most effective to insure user satisfaction?
- What issues exist with current content?
- How should information be organized to meet the needs of multiple constituencies?

The purpose of the usability test was to identify content, format, presentation and navigation changes necessary to meet the needs of prospective students and other key constituencies. Results from the testing process will also serve as input to other departmental web redesign efforts underway at the university and to benefit others in the academic community.

Literature Review

Research has been conducted relating to the general usability of web sites (Nilsen, 2000; Palmer, 2002), the characteristics of effective graduate school web sites (Poock, 2005), information seeking behaviors (Sandvig and Bajwa, 2004), and the use of university wide templates (Petersen, 2006). A number of other studies have examined the usability of university library web sites (Vandecreek, 2005; Dickstein and Mills, 2000; Harpel Burke, 2005). A final area to be discussed relates to findings in cognitive psychology that can influence how a web site or other user interface should be designed. Each of these research areas are discussed briefly below.

With respect to web site usability, Palmer (2002) confirms the applicability of prior usability research indicating the importance of navigation, content, consistency, ease of reading, arrangement of information, speed and layout. In addition, Palmer indicates the importance of offering feedback mechanisms and the ability to answer user questions as other factors that influence user acceptance.

According to Mitra, Willyard, Platt and Parsons (2005), "it is more important that the web site em-

phasizes what the contents are rather than how they are presented" (p. 18) and that what makes a web site most attractive "are the basic textual content of the site and how well the site responds to the specific interest of the user" (p. 18). Other research conducted by Poock and Lefond (2001) argues the importance of organizing web sites by target audience, displaying relevant content, using terminology that is familiar to students, and reducing the number of clicks required to access information. In a subsequent study that addressed graduate web sites, Poock (2005) found the most sought after information to be application criteria, faculty bios/research interests, financial aid and description of programs. The least sought after information cited by Poock was graduate school and program rankings and placement of graduates.

Focusing on university web sites, Sandvig and Bajwa (2004), confirm that users are goal oriented, that they are usually looking for specific information, that they are impatient and that the typical user "quickly scans a web page and clicks on the first link that approximately matches what they are seeking" (p. 15). In a survey of current students, the two most sought after information items were on-line course registration information, library catalog information and academic program descriptions. The preferred search method for the students in the study was browsing (72%) versus search and other (28%).

Another area of web research addresses the use of academic templates and usability for university libraries. Peterson (2006) confirmed that a majority (94%) of college and university web sites use academic templates. Components such as images, logos and other brandings were the most frequent type of template typically found in the header of a web page in over 90% of the institutions. In addition to the header portion of the web site, the footer or bottom of the web page also has seen the adoption of templates in over 65% of the sites investigated. With respect to library web site design, Dickstein and Mills (2000) provides examples of guidelines including "keeping screens simple", "think like a novice", "keep language consistent across pages", "keep important information above the fold", and "don't use the edge of the screen for important links" (p. 151). Many of these findings are consistent with the general and academic web site usability approaches previously defined.

Lastly, research in the field of cognitive psychology provides valuable insight into the characteristics of successful web sites and other user interfaces. "Seven key principles for transforming difficult tasks into simple ones" identified by Norman (2002, pp. 188-189) include use both knowledge in the world and knowledge in the head, simplify the structure of tasks, exploit the power of constraints, design for error, make things visible and get the mappings right, and bridge the gulfs of execution and evaluation.

Methodology

A usability testing methodology identified by Rubin (1994) provided the framework for conducting this study. Considered to be a user centered methodology, this approach recognizes the need for user input throughout the process. Other studies (Ward, 2006) have successfully used this approach to validate the usability of web sites in an academic environment. The steps in the methodology included: defining objectives, developing the test plan, selecting and acquiring participants, preparing test materials, conducting the test, debriefing the participants and developing findings and recommendations. The research is qualitative in nature.

Two usability tests were conducted. The first test was performed using the existing Statistics Department website (Attachment A) while the second test was based on a new prototype for the Statistics Department website that was developed after the initial test was completed. The prototype (Attachment B) was designed to include components of the original site along with participant feedback, external research findings and administrative requirements. This second level of testing performed on the prototype confirms and provides additional validation of the findings from the initial usability test.

For both the initial usability test and the second test based on the prototype, a "thinking aloud" (Rubin 1994, p. 217) technique, combined with interviews, focus groups and survey documents were used to gather user feedback. With the thinking aloud technique, participants were asked to speak aloud their thoughts as they viewed and navigated around a web site. Their thoughts were recorded by an observer for subsequent analysis. The thinking aloud protocol has been found to be an essential tool "for evaluating and redesigning complex multi-layered websites" (Turnbow et al. 2005, p. 226).

In usability testing, Nilsen (2000) suggests that the number of test users can influence the identification of usability problems on a web site. He suggests that having 15 users would enable the identification of 100% of the problems, while a test can be considered trustful (85% of the problems identified) if there are at least five users. With the 12 participants in the first test and the six participants in the second test, Nilsen would predict that between 85% and 100% of usability problems would be identified through this research.

Usability Test –Original Web Site

The Dean of the College and the Department Chair were interviewed to define their requirements and

priorities for the web site. In addition, interviews of the marketing and web services group were conducted to insure compliance with university standards and information needs.

Each of 12 users/prospective students participating in the testing process was provided an instruction sheet that described the testing process and that requested their feedback. They were asked to explore the Statistics home page, search for information important to them both on the home page and on related links, and to "think aloud" in the presence of the observer about their experience. After reviewing the web site and searching for information, a content survey document (Attachment C) that identified key types of information of potential interest to prospective students was given to each participant for completion. Each participant was then asked to rank the importance to them as prospective students of the information types on a five point Likert scale. Also, they were asked to identify any information that should be added to the website or made more accessible (e.g. move content to home page, add a content category or link). After completing the review and feedback forms, each participant was then interviewed to obtain their thoughts on their likes and dislikes on the site and its navigation.

The participants in the initial test consisted of five undergraduate students from a discipline other than statistics, five graduate students from the statistics program, one graduate student from another field, an alumnus, a parent, and support personnel from marketing and information technology. The Dean and Department Chair defined the goals and the primary users intended for the web site (i.e. prospective students). In addition, they identified students at both the graduate and undergraduate level to participate in the interviews, and facilitated the involvement of marketing and information technology personnel. The researcher selected three participants who had no association with the university. All of the participants represented prospective students with the exception of the parent who had two children who were in the process of evaluating college programs.

Twelve interviews/observations were conducted. None of the interviewees had previously seen the Statistics web site prior to the study. The participants were selected to provide a mix of local and remote, domestic and international, male and female, and undergraduate and graduate students.

Usability Findings- (Original Website)

This section summarizes the key observations and feedback obtained from the initial usability test. Findings relating to the importance of different categories of content, participant observations, web site characteristics, content, and navigation are discussed in the following paragraphs.

Of the 12 participants in the test, nine completed the survey document (Attachment C) that rated the importance of different types of content that they felt should be on the web site. The categories of program information (e.g. courses and course descriptions), financial aid and contact information were designated as being the most important. Other categories such as job information, program duration, request for information, research, application information, and links to the University web site were also identified as being of high importance or mandatory by over 2/3 of the participants.

Although participant observations indicated that the site had a simple structure, a reasonable navigation approach and contained portions of the information deemed important by the user, there were a number of issues and recommendations for change that were identified. These are discussed further in the content and navigation sections.

With respect to web site characteristics, a task hierarchy which shows the relationships between the Home Page and its primary linked pages is depicted below in Figure 1. The left most column of the figure shows the primary tasks on the Statistics home page while the columns to the right indicate the other linked pages that can be accessed by a viewer. Note that no additional links are provided for the WVU and ECAS Home pages since the participants were not asked to evaluate these portions of the site.

Figure 1: Tasks Hierarchy- Statistics Home Page

Statistics Home					
Admission	Admissions	Undergraduate	Graduate	International	
Computing	Unix Account Help Page	Unix Tutorials	Lab & Server Information	Questions and Comments	
Consulting	Under Development				
Courses	Undergraduate	Graduate	Online Ideal	Multiple Links	
Development	Need For Support	Developmental Priorities	Foundation Accounts		
Faculty	Professors	Associate Professors	Assistant Professors	Visiting Assist Professors	Other Categories
Programs	Undergraduate Minor Statistics	B.S. Industrial Math and Stat.	M.S. Statistics	Graduate Minor In Statistics	CDDM PHD
Research	Under Development				
WVU Home					
ECAS Home					

From a technical perspective, the web site has been designed to support multiple browsers and platforms (e.g. PC and MAC) that utilize either lower bandwidth or high speed internet connections. Accessibility requirements have been factored into the design to allow for an expanded audience and complex graphics that would slow access have been eliminated. Some technical issues existed including the inability to print from the home page, the inability to request information without having an email address, and the inability to view subsequent levels in the task hierarchy without having to click and access the level. The department did utilize the university template for the heading format and for links to other parts of the university's website.

The next key area addressed in the usability test involved the content available on the site. Certain categories on the site such as consulting, computing, and development had little or no meaning to the prospective students and in fact slowed their browsing of the site. These categories and other information were targeted at other constituencies such as alumni or current students but were intermingled amongst the other categories that were deemed important by prospective students. Participants also noted that key information that they were seeking was either not available on the site or not easy to find as they reviewed the site and its links. Examples include financial aid information and job information. Lastly, content such as a mechanism for contributing to the university was expected to be on the site at the request of the dean but had not been included in the design.

A second aspect of content deals with the complexity of the content presented. Although most of the content relating to courses was cited as being concise and meaningful, suggestions were made to simplify and enhance the "Why Statistics" and "Welcome" sections of the home page. In addition, other content categories on the site such as consulting and computing were not viewed as relevant by the prospective students. Terms such as program (as opposed to majors and minors) were used on the site but were not widely known by the users. Abbreviations such as ECAS were also used on the site but were not understood.

Another dimension of content on the site involves how it was presented. Participants commented about the graphics that were used on the site and suggested that they should be updated to a more current theme. The historical pictures displayed although intended to represent a theme of tradition were misinterpreted by students as being somewhat outdated.

Because all of the important categories of content were not displayed on the home page, the participants needed to navigate through the site to find the desired content. The home page navigation was primarily by functional category (e.g. academics, consulting, etc) and required multiple clicks to reach the level at which the content was maintained. The navigation was made more difficult by the fact that the home page categories did not include the major areas of high importance to the participants. As a result, it was necessary to link to multiple pages and levels to locate the desired information.

Four of Norman's (2002) cognitive principles were observed in the web site design. The first principle "use both knowledge in the world and knowledge in the head" (p. 188) is reflected in the use of browser technology for navigating through the web pages and in the general understanding of academic terminology that is employed on the site. Secondly, the

principle of "simplify the structure of tasks" (p. 188) can be seen in a relatively narrow list of tasks that can be performed followed by a shallow list of lower level pages that are accessible by the site. "Exploiting the power of constraints" (p. 188) is the third principle which is demonstrated in the site navigation approach which limits users to specific actions and pathways when selecting a task. The final principle, "design for error" (p. 188), leverages the power of constraints. In only a few cases does the home page permit a user to perform a task that was not intended.

Website Redesign

The website was redesigned and a prototype was developed based on participant recommendations from the initial usability test, research findings from other studies, cognitive design principles outlined by Norman (2002), and the incorporation of administrative requirements outlined by the Dean and Department Chair. Studies have confirmed that "cognitively designed home pages lead to better comprehension than non-cognitively designed home pages, regardless of whether the home page is primarily graphics-based or text-based" (Dalal, Quible, and Wyatt, 2000, p. 607).

The prototype was created using the NetObjects Fusion software product (version 8.0) which allowed for downloading the entire department web site (85 pages) onto a personal computer where modifications could be made. Once the design changes were made and tested, a fully operational web site was published on the personal computer and was used as the basis for the second usability test. Standards from the university regarding web page headers were retained in the prototype.

Changes to the web site included grouping information for each intended user type (e.g. future students), revising the text to improve clarity and meaning, restructuring the content presented on the home page to focus on information prospective students found most important, and changing the navigation to support rollover menus that minimize clicks. New user categories of "future student", "alumni and friends" and "faculty and students" were introduced into the site to focus the attention of users, to improve access and to minimize browsing time.

In addition to the cognitive design principles (Norman 2002) that were observed in the original web site design, the redesign incrementally focused on "making things visible" and "getting the mappings right" (p. 189). This was accomplished by changing wording of content to be consistent with user expectations (i.e. getting the mappings right) and by adding new content categories to make the information more visible. Lastly, changes in task descriptions were made to help "bridge the gulfs of execution and evaluation" (Norman, 2002, p. 189) while changes to site navigation were made to more closely link user expectations, content and roles. These changes made information more visible and accessible for the intended user group.

A summary of the major changes included in the redesign and the rationale for the changes (e.g. research or usability findings) can be found on Attachment E.

Prototype Usability Test (Redesigned Web Site)

The prototype usability test was structured to obtain written and verbal feedback from the participants regarding their views on the content and accessibility of information from the web site as well as their ability to successfully use navigation pathways (menus) that were implemented in the redesign. Similar to the initial usability test, think aloud observations were recorded, survey documents were completed, and each participant was interviewed to gather additional insights.

The major questions or problem statements that were investigated in the usability test are listed below.

Problem Statements

1. Does the WVU Statistics Home Page identify the key types of information viewed as being important by prospective students?
2. Is the terminology used on the site understandable by the intended audience?
3. Is the description of "Statistics" meaningful for prospective students?
4. Does the "Why Statistics" section of the Home Page provide a good rationale for prospective students to consider the program?
5. Does the Home Page provide an easy means of requesting further information?
6. Do the users find the navigation approach (with rollover menus) easy to use and understand?
7. Is the appearance of the Statistics Home Page visually appealing and understandable?
8. Does the site provide easy access to other University web pages?
9. Are users able to find key information using the site navigation approach?
10. Does the Home Page address issues identified during the design phase? (e.g. is the site considered an improvement)

Usability Findings (Prototype Usability Test)

All six of the participants of the test indicated that the redesigned home page with the new menu structure and navigation targeted to the "Future Student" was easy to use. In addition, they found that the information contained on the site was understandable and consistent with their information needs. In a survey response, all of the participants responded that they either agreed or strongly agreed that the terminology was understandable and that the home page provided an easy means to request data. In addition, the participants indicated that they were not confused by including information for other constituencies (e.g. alumni and friends) on the web site. Survey results for the prototype usability test are included as Attachment F.

Three of the six participants also participated in the initial usability test. They all found the redesigned web site to be easier to use and that it contained the majority of the information that they felt was important for a future student. The "future student" menu structure, the simplification of the wording on the site, and the use of common terms such as major and minor were all viewed positively based on survey and interview feedback.

Performance data recorded during the observation process indicated that five of the six participants used the new targeted menu structure (by role) first prior to accessing links that were on the left of the page thus supporting prior research regarding student preferences. In addition, all of the participants were able to utilize the menu structure successfully and were able to access lower level links with no problems.

Relationship to Prior Research Findings

The usability studies in this research have confirmed a number of findings from prior research (Poock and Lefond, 2001; Poock 2005; Sandvig and Bajwa, 2004; Mitra et al. 2005) including prospective student preferences for roll-over menus, the need for grouping of content by major constituency, and the usage of terminology that is familiar to the student. In addition, the visibility of content deemed important by students and the ability to navigate quickly to more detailed information was viewed as very important.

In contrast to previous studies, prospective students in this study identified their most important information needs as being program information, program duration, financial aid, contact information and job opportunities. Different priorities were placed on the categories in prior research which may reflect either changing student needs or differences in the participant groups.

Another difference from prior research relates to the two step testing and validation process that was used. By incorporating usability findings, research findings and cognitive design factors into the second test, a much higher degree of user satisfaction was achieved. The research also suggests that a properly designed web site can serve multiple constituencies.

Conclusions and Limitations

A usability test was performed on the existing Statistics department web site at WVU to determine if it met the needs of prospective students as well as the needs of the administration. Based on external research findings, cognitive design principles and feedback from students, the administration and the Universities technology and marketing groups, the Home Page of the web site was redesigned and a second usability test was conducted.

For prospective students, the research confirmed that content such as program information, financial aid, contact information and job opportunities was considered to be very important while other content such as development, alumni information, consulting and computing was considered less so. The ability to navigate quickly to the desired content through the use of rollover menus and the grouping of content by role or constituency was also confirmed as improving the usability of the web site and making information access easier. In addition, through the simplification of wording and using terminology that is familiar to students (e.g. major and minors) in the prototype, prospective students found the content presented to be more meaningful and understandable. The research also confirmed that content for multiple constituencies could be presented on the web site and not cause confusion for the intended audiences. The proper structuring of content coupled with efficient navigation approaches supported the co-existence of different potential users.

Since the primary focus of the research was on prospective students, opportunities exist for further research. Additional exploration and testing could be performed to determine if the results would differ for international students and for different age groups including adult learners. Another area of research could involve evaluating the needs of other constituencies of a departmental web site including alumni and friends, faculty, and current students. Although a framework was established for including their requirements into the web site design, validation was not performed to confirm that the stated information categories represented their needs.

This research provides a template for assessing the usability of university departmental web sites and guidance for their redesign. Key insights from this study regarding the importance of content, nav-

igation approaches, and the organization of content can serve other departments with their key redesign activities to meet the needs of their most important customer… the prospective student.

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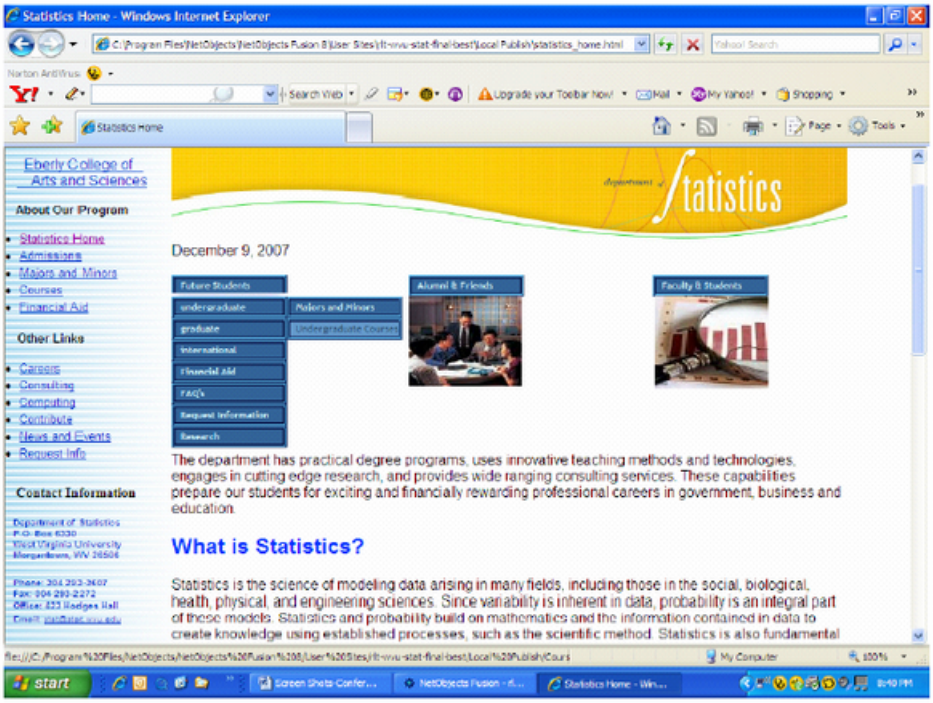
Appendix A: Current Statistics Home Page

Appendix B: Statistics Department Home Page Prototype



Appendix C: Content Survey Document

I M P O R T A N C E					
Information Need	**Not At All**	**Low**	**Medium**	**High**	**Mandatory**
Program Information (courses and course descriptions) Prerequisites					
Program Duration/Credits Required					
Program Faculty and Biographies					
Request for Information					
Financial Aid/Graduate Assistanceships					
Contact Information					
Department Information					
Research Activities- descriptions					
Career descriptions relating to major					
News about the program and Awards					
Alumni News/ Successes					
Submit application					
Other					

Appendix D: Content Survey Document

I M P O R T A N C E					
Information Need	**Not At All**	**Low**	**Medium**	**High**	**Mandatory**
Program Information (courses and course descriptions) Prerequisites		U		U	UUGGGGP
Program Duration/Credits Required		U	U	UUGG	GGP
Program Faculty and Biographies			UUUUGP	GG	G
Request for Information			UUG	UUG	GGP
Financial Aid/Graduate Assistanceships				UUU	UGGGGP
Contact Information			G	UG	UUUGGP
Department Information			UGG	UP	UUGG
Research Activities- descriptions		G	UU	UGGGP	U
Job Opportunities			G	UUUUG	GGP
News about the program and Awards/ Events		G	UUUP	UGGG	
Alumni News/ Success Stories		GG	UUUGGP	U	
Consulting	G	UGGP	UU	UG	

Jobs/ Career Information			GG	UUGG	UUP
Development	GGP	UU	UGG	U	
Computing	GP	UG	UG	UUG	
WVU Home Page Link			UU	UGG	UGGP
Other (include additional on back of form)			U		UUGGGP
Legend U-Undergraduate Student G-Graduate Student P-Parent					

Appendix E: Proposed Changes to Original Home Page

Change Recommendation	Change Description	Basis for Change
Navigation by Role	Implement menu structure by role (future student, alumni, student, and faculty) with rollover menus.	Research Prototype Test Results Make things visible- Cognitive Factor Simplify the Structure of Tasks- Cognitive Factor
Content Categories	Implement new content categories for financial aid, careers, contribute, news and events and request information. Include FAQ and research on rollover menus.	Interviews Research Prototype Test Results Getting the Mappings Right- Cognitive Factor
Terminology and Text Simplification	Change terminology to majors and minors from program. Revise "welcome" and "why statistics" to improve relevance. Eliminate abbreviations for Eberly College.	Interviews Research Prototype Test Results Bridge the Gulfs of Execution and Evaluation – Cognitive factor
Information Presentation	Update graphics to a more modern look. Eliminate text that refers to links. Eliminate historical background of department.	Interviews Research Prototype Test Results
University and College Requirements	Maintain links to University Site. Maintain link to Eberly College Home Page. Include category for contributions. Maintain color scheme and official logo. Future student description (versus prospective student)	Organization Requirement Interviews
Technology	Eliminate "old" Home Page that appears on slow communications connection.	Interviews Design for Error-Cognitive factor Prototype

Attachment F: Prototype Survey Results

Future Student Role	Total Responses	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Sure
Home Page identifies and displays information important for future students.	6	5	1			
The terminology used on the Home Page is understandable.	6	5	1			
The description of "Statistics" is meaningful.	6	4	2			
The "Why Statistics" section provides good reasons to consider the program.	5	3	2			1
The Home Page provides an easy means of requesting information.	5	5	0			1
Navigation to other Statistics web pages is easy. (rollover menus)	5	4	1			1
The Home Page is easy to use and visually appealing.	6	4	2			
The Home Page provides easy access to other WVU sites.	6	4	2			
I was able to find links to key information from the Home Page.	6	5	1			
Key information that a future student requires cannot be located from the Home Page.	6			2	4	
I believe the Home Page should have information that is only relevant to me (future student) as opposed to providing information for current students and alumni.	6			2	4	
I did not find it confusing to have information on the Home Page for alumni, faculty and alumni.	6	4	2			

About the Author

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Mr. Totterdale is a retired partner from Accenture(a global consulting organization). During his career at Accenture, Mr. Totterdale provided consulting and technology services to a number of large global organizations in the areas of finance and supply chain management. Mr. Totterdale has continued to provide consulting services to start-ups and middle market businesses primarily in the Western Pennsylvania area. Mr. Totterdale is currently a Doctoral student in the Communications and Information Systems program at Robert Morris University in Pittsburgh. In addition, he currently serves as a guest lecturer at Carnegie Mellon University and is a member of an Advisory Board for the College of Arts and Sciences at West Virginia University.

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