Paul Vin-Cent Chang. The Validity of an Extended Technology Acceptance Model (TAM) for Predicting Intranet/Portal Usage. A Master's paper for the M.S. in I.S. degree. April, 2004. 36 pages. Advisor: Barbara Wildemuth.

This paper explores the validity of an extension of the Technology Acceptance Model (TAM) based upon additional constructs of social and facilitating factors taken from the Triandis model of choice. The extended model also incorporates age and user experience as external variables in predicting intranet/portal usage.

An intranet is defined as a network based on TCP/IP protocols (an internet) belonging to an organization, usually a corporation, accessible only by the organization's members, employees, or others with authorization. This study focuses on the intranet of an educational institution, the UNC Kenan-Flagler Business School. An online questionnaire was implemented to collect data concerning all variables in the extended TAM, including participants' use of the UNC Kenan-Flagler intranet.

The research indicates that the constructs from the Triandis model increased the predictive results of the TAM, but only slightly. The external variables of age and experience also proved not to be strong indicators of intranet use.

Headings:

- Intranets
- Web Portals
- Websites
- Human Computer Interactions
- Diffusion of Innovations

THE VALIDITY OF AN EXTENDED TECHNOLOGY ACCEPTANCE MODEL (TAM) FOR PREDICTING INTRANET/PORTAL USAGE

by
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A Master's paper submitted to the faculty
of the School of information and Library Science
of the University of North Carolina at Chapel Hill
in partial fulfillment of the requirements
for the degree of Master of Science in
Information Science

Chapel Hill, North Carolina

April, 2004

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Introduction

In today's corporate world, the principles of information and technology are so deeply rooted within its infrastructure that millions have come to depend upon them each and every day for tackling everyday tasks with efficiency and accuracy. Intranets have become so pervasive within the corporate setting that corporations are spending millions and millions of dollars for skilled IT shops to build these internal "portals". So dependent have we become on these corporate intranets that, without them, millions of workers would just close shop and call it a day.

As the number of portal sites continues to grow, competing for users as their "gateway to the web," are the companies behind them able to market to their target audience (namely their employees of varying age and interests)? Are corporations wisely investing their resources in intranet portals that their employees find useful and easy to use?

As Nielsen (2003) points out, technology accounts for roughly one-third of the work in launching a good portal; internal processes account for the rest.

Past studies have shown the huge generation gap in Internet usage. "In general, estimated Internet use tends to decline with age, with the largest declines found after age 54, and again after age 65." (Robinson, 2002) With the aging workforce retiring and making way for the technology savvy new breed of the computer-raised workforce, new studies have been made to custom fit the old and the new with their use of these new information technologies.

By studying the factors that influence this intention to use or not use an intranet, we can utilize the information in building/improving the new Kenan-Flagler intranet slated for release later this year. This study also would benefit the environment outside of the university as well. Environments such as corporate intranets and profitable Internet portals would also utilize the results of the study in tailoring their products towards their target demographic groups.

Background

> *"Users experience the usability of a site before they have committed to using it and before they have spent any money on potential purchases: The web is the ultimate environment for empowerment, and he or she who clicks the mouse decides everything."*
>
> *- Book jacket for Jakob Nielsen's (2000) Designing Web Usability*

What is an Intranet?

While most of the population of the civilized world is familiar with the Internet and the World Wide Web, the idea of an intranet remains for the most part unclear. A common search on one of the many available "search engines" that can be found on the web provides many definitions.

For example, Stauffer (2003) says that in general, the term portal describes a site that is designed to let users share information, usually in a personalized, customizable manner. He adds that it is part Extranet, part publishing, and that the trend is to create an e-commerce "wolf clothed in conversation, community and news." PCWebopaedia, self-described as "The only online dictionary and search engine you need for computer and Internet technology" defines an intranet as "A network based on TCP/IP protocols (an internet) belonging to an organization, usually a corporation, accessible only by the organization's members, employees, or others with authorization. An intranet's Web sites look and act just like any other Web sites, but the firewall surrounding an intranet fends off unauthorized access. Like the Internet itself, intranets are used to share information. Secure intranets are now the fastest-growing segment of the Internet because they are much less expensive to build and manage than private networks based on proprietary protocols." (PCWebopaedia) An intranet, as defined in the book, Building the Corporate Intranet, is a corporate network and the business applications that run on it that share the 'DNA' of internet computing technologies (e.g., Internet Protocol, browsers, Web servers) and exist behind the corporate security "firewall" (Guengerich, 1997, 2).

Based on the preceding definitions, the common ideas are that an intranet is based on Internet technologies and protocols that are on a private network, or within a firewall, that protects

its information from unauthorized users and the Internet itself. Its purpose is to share information belonging to an organization and to facilitate the sharing of this information. Nielsen asserts that intranets should be seen as your corporate information infrastructure, not simply as a way of moving bits around from servers to client computers, and not simply a way for employees to browse the cafeteria menu. They support many real job functions and can become the primary avenue that employees use to communicate with people in other groups within the organization and the way you find the information you need to do your job effectively and easily (Nielsen, 2000).

Internet Portals vs. Intranet Portals

Moon (2001) states that, the World-Wide-Web (WWW) is seen as an emerging new IT [Information Technology], with such potency that it has made individuals change their information access methods and organizations change their business strategy. Internet usage is expected to increase from about 200 million users at the beginning of 2000, to about 500 million by 2005, and by 2010, one billion people (Nielsen, 2000). Recognizing the success of corporate portals and the importance of a one-stop website for user loyalty, Internet companies began to see a market in vertical portals offering quick, personalized access to a multitude of diverse information sources covering specific topics or industries (Stauffer, 2003) .

General consumer portals like Yahoo!, Go.com and Excite represented the first round of rising Internet companies garnering an astounding amount of venture capital and generating highly publicized initial public offerings (Stauffer, 2003). Even Netscape, the one time chief threat to Microsoft, has now focused its efforts on developing THE Website that most users will use as their launch pad to the Internet.

Most of the literature and research available acknowledges an increase in portal sites as a new business model for attracting Internet users. Research has supported that the Web is now a powerful player in news and content delivery. Second only to the television in usage, the Internet's ability to deliver up-to-the-minute breaking news is seen as a viable alternative. The percentage of Americans on the Internet has seen a significant rise from 15.3% in 1997 to 58.5%

in 2002, sparking a rise in fears that it will divert time and advertising dollars from traditional media (Kaye, 2003).

Usability experts have conducted various and many extensive studies relating users and their web surfing habits. Most prominent among these experts has been Jakob Nielsen, and his book “Designing Web Usability” is seen by many as groundbreaking. Neilsen believes that the main goal of most web projects should be to make it easy for customers to perform useful tasks (Nielsen, 2000, 11). Traditional market research has been indicating recent trends that Internet portals will be the business sites of the future because of the abundance of new and continued users that access their services each day for news, email, chat and other customizable Web services. The portal concept of a one-stop entry point to an abundance of information resources emerged during the late 1990’s, bringing to mind names such as Yahoo!, Lycos, AltaVista, and Excite. Nielsen (2003) asserts that Internet portals relied on advertising, which doesn’t work well for informational websites, where users focus on content, not ads.

To that end, Nielsen (2003) summarizes that “intranet portals overcome many Internet portal limitations, and might be the best hope for productivity and a unified user experience that can tame the unruly chaos on internal company networks.” Intranets fall into the category of websites that are used within an organization strictly for informational purposes – a potential advantage over profit driven Internet portals.

Key advantages that intranet portals have, as recognized by Nielsen, are that they 1) save money, 2) provide a consistent look and feel that reduces the learning burden which in turn provides a more efficient environment for job performance, and, 3) because of a single login, present a unified security environment. However, based on studies that Nielsen had conducted, he found that almost none of the portals he studied had yet to achieve the goal of a single login, regardless of the fact that most help desk tickets involve lost passwords, and multiple login barriers that are disruptive to users. The key benefit to the use of corporate intranets lies in its cross-organizational communication capabilities.

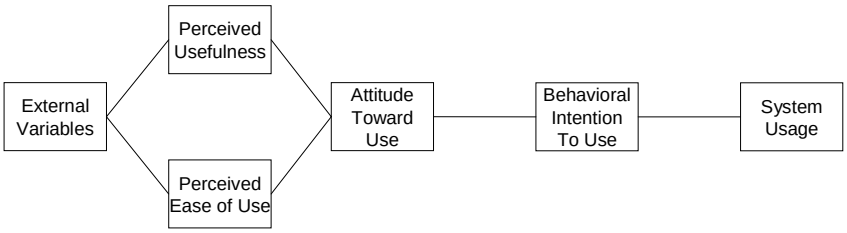
Intranet portals are funded through productivity increases by making employees more efficient at their jobs. The company pockets the gains and uses them to pay for the portal project

in the long run. The reuse of both a common template and common applications also represents a return on investment in the elimination of duplicated efforts, allowing developers to save countless hours and millions of dollars. The use of a personal login not only prevents unwarranted access to a network, but also allows for user-to-user customization based on individual user profiles. "Truly specialized services are rarely available on an intranet portal … (intranets) use existing databases to give users information relevant to their job, department, and specific location … intranet portals aim to replace the wild Web model with a tool metaphor, where a company's content and services work together instead of undermining each other (Nielsen, 2003)."

Factors Affecting the Use of an Intranet

The Technology Acceptance Model (TAM, see Figure 1), first introduced by Davis in 1986 and continues to be the most widely accepted theoretical model in the IS field, proposes that applications usage and adoption can be predicted based upon the factors of perceived ease of use (PEOU) and perceived usefulness (PU) (Davis, 1987). Understanding of the predictors of intranet usage could serve a multitude of stakeholders by helping them to recognize how to promote that usage (Lederer, 2000). The TAM is based on Fishbein and Ajzen's Theory of Reasoned Action (TRA). The TRA posits that an individual's attitude toward carrying out that behavior and an evaluation of the value of each of those outcomes influences social behavior. Behavior then is determined directly by the intention to perform, because individuals generally, behave as they intend to do within the available context and time (Moon, 2001).

Figure 1. The TAM



Davis (1987) defined perceived usefulness (PU) as "*the degree of which a person believes that using a particular system would enhance his or her job performance"* and perceived ease of use (PEU) as "*the degree of which a person believes that using a particular system would be free of effort*." These beliefs determine a user's attitudes towards using a system which in turn determine behavioral intentions and leads to actual system use. Previous research has demonstrated the TAM's validity across a variety of corporate IT systems.

According to Christopher Schroeder, CEO and Publisher of the Washingtonpost Newsweek Interactive, there is a new, younger, IT savvy audience seeking information via the Internet (Heckert, 2002). Research literature has supported that there is a huge gap in Internet use as a result of age. Children, ages two to 12, and seniors, aged 65 and older, lagged behind the national average in online penetration. (CRM, 2002) Estimated Internet usage tends to decline with age, the largest margins declining after age 54 and again after age 65 (Robinson, 2002). Based on a previous study that I conducted with researchers Nicholas Carr and Telemak Kamparosyan, through a survey trying to gauge Internet usage among several age groups and the tools that they used the most we found that among our 114 respondents, the survey indicates that Internet usage was greatest in the focus group of 19 – 29 year old respondents with 65% using the Internet's communication tools (including email, chat and IM) on a daily basis. Astonishingly, the under 18 group showed the least usage of the Internet. This can probably be attributed to the fact that these users are limited to use by their parents and do not have anytime access to the Internet because of parental control of content or applications.

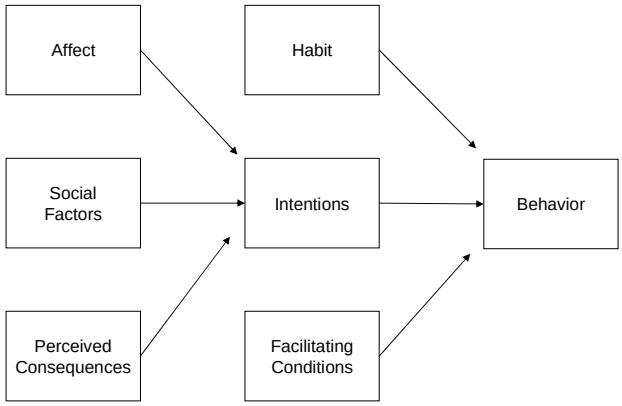
Prior experience was included as a construct in my extended TAM for determining intranet use because it is can be argued that having prior exposure and experience will increase users' perception of an intranet's ease of use or otherwise and usefulness or uselessness. If a user has already implemented an intranet in a prior job or educational institution, then it is believed that this experience was either positive or negative and can therefore affect the answers that are supplied for this questionnaire.

The fundamental benefit of experience in measuring intranet usage is increased speed of use and increased speed of adaptation and familiarization to a new, but similar interface and environment. Another added benefit of increasing experience, is that cognitive effort is decreased, proving that simple repetition improves task performance by reducing the cognitive effort required to perform the task (Alba, 1987). These two factors can greatly influence perceived ease of use measurements in this study.

Perceived usefulness measures can be influenced by prior attitudes with intranets as well. If a user found their prior experience with intranets to be beneficial, then it can be argued that the same user would find intranets in general to be beneficial and useful as an information tool within ALL organizations or vice versa. Some may have even become reliant upon their prior company's/educational institution's intranet for daily use.

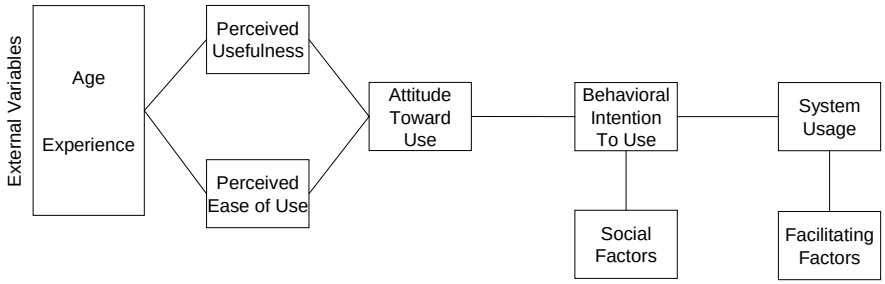
The Triandis model of choice (see Figure 2) outlines a relationship between attitude, intention, and behavior and postulates that the probability of performing an act, such as using an intranet, is a function of habits, intention to perform the act and facilitating conditions (objects or existing conditions that make an act easy). "On the other hand, the intention of performing a certain act is a function of the (i) perceived consequences of the act, (ii) the person's conception of what he or she should do or social factors, and (iii) what one would enjoy doing or pure affect (Chang, 2000)." For this particular study, the factors of affect and perceived consequences will not be measured as factors that affect intention. Social factors will be examined because of the climate of the test environment as an educational institution and will measure if the faculty has instituted required use of the intranet by students or whether management has required the use of the intranet for staff communication purposes.

Figure 2. The Triandis Model of Choice



This study will be an examination of the TAM enhanced by the factors of social factors and facilitating conditions introduced by the Triandis model of choice (see Figure 3). Social factors and facilitating conditions were included in the model because those factors are most prevalent within an educational environment and seen as a viable measure for business marketing practices. Social factors were defined as whether the subject perceived that their work group (faculty, staff, study group, professor) thought they should use the intranet and whether or not they would follow what others thought they should do. As educational institutions require students to purchase laptops, instructors have recognized the web as a fast and powerful way to convey up-to-date information. This would be an example of social factors that influence a student's use of the intranet. Certain tools for faculty and staff can also be found easily on the intranet, including on-line directories and room reservation tools. Facilitating factors were conceptualized as the school's available support and ease of access to the intranet; such facilitating factors are also prevalent in educational institutions because of IT needs. In addition, these factors are also viewed as the results of marketing, an important aspect of business and thus an important aspect for this study to include.

Figure 3. The Extended TAM



Hypotheses

As mentioned previously, the model for this research is an extension of the TAM enhanced by factors adopted from the Triandis Model of choice. The basic assumption is that social factors and facilitating factors will have a positive affect on an individual's motivation to use an intranet. In addition, the factors of age and experience are taken into account when formulating these hypotheses.

Hypothesis 1. There is a negative relationship between age and (a) perceived ease of use and (b) perceived usefulness for using an intranet.

Hypothesis 2. There is a positive relationship between experience and (a) perceived ease of use and (b) perceived usefulness for using an intranet.

Hypothesis 3. There is a positive relationship between perceived ease of use and attitude.

Hypothesis 4. There is a positive relationship between perceived usefulness and attitude.

Hypothesis 5. There is a positive relationship between attitude and intention to use an intranet

Hypothesis 6. There is a positive relationship between social factors and a user's intention to use an intranet.

Hypothesis 7. There is a positive relationship between intention to use and actual usage of an intranet.

Hypothesis 8. There is a positive relationship between facilitating factors and a user's actual of use an intranet.

Methodology

The data was collected based on the participation of the faculty, staff, and students of the UNC Kenan-Flagler Business School. In order to implement this research study, a questionnaire was created based upon several previous studies of the TAM and Internet/WWW usage and adapted online using Cold Fusion and a SQL database backend hosted on the business school's intranet server. The questionnaire data was collected on a seven-point Likert type scale and was active for three weeks. Built-in Microsoft IIS server security was relied upon to 1) prevent unwarranted access to this survey and data, and 2) capture user information to prevent duplicate entries (this data was inaccessible to me, reinforcing the users' anonymity). As an incentive for participation in this survey, but in no way influencing user input, three DELL 128MB memory sticks were given away in a random drawing.

Creating the Questionnaire Content

The data for this study was collected via an online questionnaire conducted in conjunction with and on behalf of the UNC-CH Kenan-Flagler Business School. Questions were selected from previous research surveys based on TAM and the Triandis model. The studies from Chang and Cheung (2000) and Moon and Kim (2001) were based on data collected from graduate students in business school. Most of these questions were derived from those studies. The Lederer, Maupin, Sena, and Zhuang (2000) study was collected from work-related Internet newsgroups featuring discussion of business, consulting, finance, law, science and technology. The Lin and Lu (2000) study was collected from undergraduate computer concepts students in Taiwan.

Based upon the previous studies listed above, questions were selected based upon their relevance to 1) Perceived Ease of Use (PEU), 2) Perceived Usefulness, 3) Intention to Use, 4) Attitudes Towards Using, 5) Current Social Factors for Use, 6) Facilitating Factors, and 7) Actual Use.

To avoid confusion as to what an intranet was, the definition provided by the PCWEBOPAEDIA (http://www.pcwebopaedia.com/TERM/i/intranet.html) was added to the top of the survey as well as a disclaimer indicating:

> *** The following questions pertain to your experience with the Kenan-Flagler intranet. Please take your time in filling out all of the questions. The server will time out in twenty (20) minutes, preventing you from using the back button to revise your answers. ***

The latter part of this note was added as a precaution, as after several observed tests with the survey never exceeded a time limit of ten (10) minutes to complete, with the user reading over each question completely and taking their time to make sure that the entire survey was completed before submitting its results.

The following are the factors measured by the survey and the questions used to obtain user response:

External Factors - Age was introduced as an external factor because the majority of studies already available relate age to Internet/WWW use. A correlation with intranet usage was hypothesized since intranets borrow so much of their technologies from the Internet. If age is a factor in predicting Internet usage, then is it not also a valid predictor of intranet usage. Given the environment at the business school, with students' ages ranging from undergrad BSBA majors to graduate MBA, was hypothesized that age would be a valid construct to look at when deciding to create an intranet that will appeal to such a broad range of student ages. The varying ages of the faculty and staff increased the importance of this variable even further.

Experience is another of those external factors that can be expected to influence technology acceptance. It was a valid construct to look at in this research because, again, the UNC Kenan-Flagler Business School presents a tremendous amount of diversity because of its faculty, staff and student population. One item was used to measure each of these variables:

1. What is your age?
   < 18 | 18 – 29 | 30 – 39 | 40 – 49 | 50 – 59 | 60+
2. I have had significant experience with using intranets/Portals in the past (seven-point Likert type scale) **

Perceived ease of use (PEU) - Using Davis' (1987) definition, perceived ease of use is "the degree to which an individual believes that using a particular system would be free of physical and mental effort (Davis, 1987, 12)." Based on this definition, it can be expected that the external factor of user experience could correlate with this construct since experience tends to bring about familiarity. The reliability of this construct was previously demonstrated in the study by Lin (2000) with a Cronbach's alpha value of 0.85, and a Cronbach's alpha value of 0.93 from the Moon (2001) study. The questionnaire implemented eight items, adapted from Lederer's (2000), Lin's (2000), Chang and Cheung's (2001), and Moon's (2001) original scales, by asking the extent to which an intranet met with the ease of use characteristics of an intranet based on a scale of 1 – 7 with the end points of "strongly disagree" and "strongly agree".

1. It is difficult to use the intranet without consulting others
2. Learning to use the intranet is easy
3. It is difficult to learn how to use the intranet to make it worth the effort
4. It is easy to find information on the intranet
5. The intranet allows easy return to previous display pages
6. My interaction with the intranet is clear and understandable
7. The intranet uses understandable terms
8. The intranet is easy to navigate

Perceive usefulness (PU) - Again borrowing from Davis (1987), perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance (Davis, 1987, 10)." The reliability of this construct was previously demonstrated in studies by Lin (2000) and Moon (2001) with Cronbach's alpha values of 0.88 and 0.93 respectively. The questionnaire implemented eight items, adapted from Lederer's (2000), Lin's (2000), Chang and Cheung's (2001), and Moon's (2001) original scales, by asking the extent to which an intranet met with the usefulness characteristics of an intranet based on a scale of 1 – 7 with the end points of "strongly disagree" and "strongly agree".

1. Use of the intranet can increase the effectiveness of performing tasks (e.g. communication) ….
2. The intranet supports the critical part of my tasks
3. Using the intranet enables me to have more accurate information
4. Using the intranet gives me access to a lot of information
5. I depend on other Web sites (e.g. studentcentral.unc.edu) for information
6. I can capture the complete coverage of current events after using the intranet

7. The intranet provides thorough information for my purposes
8. The intranet increases my daily productivity

Attitude towards using (ATT) - Attitude is measure of the user's evaluation of the desirability of employing an intranet. (Ajzen and Fishbein, 1980) A user's attitudes towards using a system are derived from a user's beliefs (derived from a user's perceived usefulness and perceived ease of use) as is consistent with the TRA. The reliability of this construct was validated by Moon's (2001) study, with a Cronbach's alpha value of 0.90. The questionnaire implemented four items, adapted from Lin's (2000) and Moon's (2001) original scales, by asking the extent to which an intranet met with the user's attitudes towards an intranet based on a scale of 1 – 7 with the end points of "strongly disagree" and "strongly agree".

1. I think positively about using the intranet
2. The intranet is a positive tool for the school
3. Implementation of the intranet is a wise idea
4. Using the intranet has been a pleasant experience

Intention to use (IU) - Behavioral intention to use is a measure of the likelihood a person will employ an intranet (Ajzen and Fishbein, 1980). Behavioral intentions are derived from attitudes towards using an intranet and lead to actual systems use. From the Chang and Cheung (2001) study, reliability of this construct was demonstrated with a Cronbach's alpha value of 0.78, 0.82 from the Lin (2000) study, and 0.87 from the Moon (2001) study. The questionnaire implemented four items, adapted from Lin's (2000), Chang and Cheung's (2001), and Moon's (2001) original scales, by asking the extent to which an intranet met with the user's intentions to use an intranet based on a scale of 1 – 7 with the end points of "strongly disagree" and "strongly agree".

1. I will make the intranet my homepage
2. The intranet is worthy of using
3. I plan on using the intranet on a regular basis in the future
4. I plan on bookmarking the intranet

Current Social Factors for use (SOCIAL) - Social factors are a user's agreements made with others or acceptance of local agreements to use an intranet. This includes previous and current experiences, beliefs, attitudes, ideals, roles, norms and values with which a human group views the human-made part of its environment. This construct is adopted from the Triandis model and is similar to Ajzen and Fishbein's subjective norm in their theory of reasoned action (TRA) from which the TAM was derived (Chang, 2001). From the Chang and Cheung (2001) study, reliability of this construct was demonstrated with a Cronbach's alpha value of 0.88. The questionnaire implemented four items, adapted from Chang and Cheung's (2001) original scales, by asking the extent to which an intranet met with the social factors to use an intranet based on a scale of 1 – 7 with the end points of "strongly disagree" and "strongly agree".

1. The business school management/curriculum requires me to use the intranet
2. Generally speaking, my peers have determined my usage of the intranet
3. Generally speaking, my superiors/instructors determine my usage of the intranet
4. Generally speaking, I would use this intranet without pressure from external social factors

Facilitating Factors (FACIL) - Facilitating conditions for intranet utilization were defined as support by the organization and ease of access to the intranet and its resources. Empirical investigations have shown that facilitating conditions can have significant effects on user intention, consistent with Ajzen's theory of planned behavior, which states that intention is affected by perceived behavioral control, a concept similar to the facilitating conditions in the Triandis model (Chang, 2001). This construct's reliability was demonstrated previously in the Chang and Cheung (2001) study where Cronbach's alpha was 0.84. The questionnaire implemented four items, adapted from Chang and Cheung's (2001) original scales, by asking the extent to which an intranet met with the facilitating factors for using an intranet based on a scale of 1 – 7 with the end points of "strongly disagree" and "strongly agree".

1. The intranet is available to me when I need it
2. A person (or group) is available for assistance with intranet difficulties
3. Specialized instruction regarding the intranet is available to me
4. Overall, the use of the intranet is very supportive

Actual Use (ACTUAL) - In the TAM, actual use is the end result of all of the other constructs. This construct's reliability was demonstrated previously in Moon's (2001) where Cronbach's alpha was 0.83. For this study, actual use was measured on a weekly usage scale as well as a user determined frequency of use range. There were two items used for measuring actual intranet usage.

1. How many times do you use the intranet during a week?
   not at all | less than once/wk | once/wk | 2-3/wk | several times/wk | once/day | several times/day
2. How frequently do you use the intranet?
   infrequent - extremely | quite | slightly | n/a | slightly | quite | extremely – **frequently**

After compilation of these questions for the questionnaire, it was important to arrange the questions to avoid redundancy in the survey for the user when answering. While it was apparent that several questions were asking for similar responses, the questions were selected in succession, one from each section until the list was exhausted to comprise the final survey to avoid repetitiveness. In the final survey, there were a total of forty-four (44) questions broken into groups of seven (if possible) to avoid having the Seven-point Likert-like scale scroll off of the user's screen. "The Likert technique presents a set of attitude statements. Subjects are asked to express agreement or disagreement of a five-point scale. Each degree of agreement is given a numerical value from one to five. Thus a total numerical value can be calculated from all the responses (CCMS Database)." In the survey that was used to conduct this research a Likert-like scale consisted of a seven-point scale (with the values Strongly Disagree, Disagree, Somewhat Disagree, Neither Agree Nor Disagree, Somewhat Agree, Agree, and Strongly Disagree).

After collection of the data, I will look at each of the constructs as a single value based upon the means of each of the values returned by the users for each of the questions used for measuring each construct. Therefore, there will be only one value used to represent perceived ease of use, one value for perceived usefulness, one value representing attitudes, etc.

The survey was then submitted as part of a research proposal to the IRB (Institutional Review Board) for approval. The consent form was presented on the first web page that study

participants viewed, outlining all precautions taken to preserve their anonymity and the purposes of the survey and how their data would be utilized (Appendix B).

Survey Implementation

Over a three-week period (March 8th – March 29th), the survey was hosted on the secure Microsoft server of the UNC Kenan-Flagler Business School. Participation was limited to the UNC Kenan-Flagler Business School population of approximately 3300 accounts and solicitation for participation was limited to a single link on the homepage as well as a single email message delivered during the beginning of the second week of the survey by UNC Kenan-Flagler IT Director, Susan Kellogg. Because the data from this research was also seen as a valuable tool to another university entity, as an added incentive, special permission was granted by the IRB to utilize a random drawing for three Dell 128MB USB storage devices. Users were informed in the consent form that all participants have an equal chance of being selected as the winner of one of these three gifts graciously provided by the UNC Kenan-Flagler IT director, thus not influencing their survey data in any way other than providing an incentive for their participation.

As outlined in the consent form, for security purposes, the survey relied upon Microsoft Exchange Server 2000 technologies. The survey was kept in a secure directory hosted on the UNC Kenan-Flagler Business School intranet server. Users trying to access the link logged onto the business school domain were granted access based on initial authentication to access the domain (the same as the intranet). Users accessing this link from off campus were either authenticated upon logging onto the UNC Kenan-Flagler Business School intranet or upon typing in the URL for the survey. Only valid accounts recognized by the MS Exchange database as Kenan-Flagler accounts were then allowed to access this directory. Coding for the survey was completed using the Cold Fusion programming language. In order to avoid duplicate entries, the user's account name was collected in a separate table from the actual survey data. This data was later discarded without ever having been viewed by the principal researcher.

Cold Fusion was chosen as the programming language because it had been the coding standard chosen for the UNC Kenan-Flagler Business School environment. In an effort to keep

all surveys similar and uniform, it had been decided that CFML (the Cold Fusion Mark-Up Language) would also be used for this survey. As part of the standards at the school, an entity-relationship diagram was necessary to outline and diagram the user interaction with the servers. In addition, it was necessary to submit a data dictionary as well as SQL scripts for generating the database.

As mentioned earlier, the first page that a user could view in this directory was the consent form. Here the user was greeted by name to make it a more personal invitation to participate. They were informed that their username would only be used to keep track of the fact that they had completed the form once and only once to avoid duplication of answers and efforts. Once they submitted the consent form, the self-posting form then placed a cookie identifying the user and allowing access to the actual survey. To access this feature of recognizing the user, the cgi.Auth_User variable provided by Microsoft Exchange server was utilized. It was the value of this variable that was then stored in the cookie for use that will be described later in this paper. Cold Fusion, upon submission of this consent form "dropped" the cookie and redirected the user to the survey which then checked for the existence of the cookie before allowing access. Therefore there was no way that a user could access this page without first submitting the consent form.

All initial scripting was completed on a development server to prevent accidental crashes of the external web servers due to non-terminating loops or other coding errors. The built-in validation functions of Cold Fusion were used to validate the client-side form submissions. Using a simple server-side script such as <input type="hidden" name="q01_required" value="You must answer question 1"> in reference to question number 1 and all subsequent questions, the web page would not allow the form to be submitted until it was filled out entirely. The only question that users were able to "not answer" was question 42 requesting comments and suggestions. For this question, a default of "NONE" was encoded into the form. However, if the user were to delete this value in the text area, an error message was generated. This question was prefaced with a disclaimer stating, "Enter NONE if you do not have any (comments). (1000 characters or less)." A JavaScript word counting application was used to control the size of this field.

Upon submission of this form, data were collected into two tables within a single SQL database. One table, named *invalidUsers*, was used to store the value of the cookie that was supplied by the submission of the consent form. The "Thank you" form served to notify the user of a successful form submission as well as removing the cookie, preventing other users from using this data. The *invalidUsers* table was made inaccessible to the researcher via the SQL Enterprise Manager. This prevented unauthorized access by the researcher to link the user and their form submission. The other table *intranetSurvey*, consisted of the data that were supplied by the user in the survey. As the primary key, an AutoNumber field was used that also tracked the number of submissions that had been made. The researcher was further denied WRITE and DELETE access to both of these tables to assure that the data were not fabricated or skewed.

Data Collection

During the initial week of data collection, an icon was placed on the front page of the UNC Kenan-Flagler Business School intranet. This icon worked very well (even to the researcher's surprise) in soliciting participation in the survey. During the first ten minutes of updating the intranet site with the icon, almost 20 users had already completed the survey. During the first week alone, almost 150 respondents took part in the survey without any email solicitation at all.

By week 2 participation levels had started to slow down, prompting the IT Director of the business school to send out the solicitation email. The reason for sending only one message, during the middle of the survey period, was to minimize "spamming" the UNC Kenan-Flagler community who, as a group, has been known for deleting mass emails. This email resulted in the immediate response level escalating during that day to over 100 additional respondents.

Drawing for the weekly winners of the Dell 128MB memory keys required the creation of yet another separate application. This application generated a random number between one (1) and the total number of respondents (based on a query of the *invalidUsers* table and returning a record count via Cold Fusion). Then, based on the username associated with the randomly generated number, the LDAP directory was queried to get the name of the user associated with the username. This raw data, including the random number and the username, was not available to the researcher. This drawing took place on Mondays in the presence of several other developers not associated with the research to guarantee anonymity of the winner. The winner was then notified via email and posted to the front page of the intranet in an updated version of the icon above.

Data Analysis

The data analysis for this study was first exported from the SQL database to a Microsoft Excel spreadsheet and finally imported into SPSS. The reliability (i.e. internal consistency) of each of the measures was investigated with Cronbach's alpha. Correlations among variable were calculated and the variables represented in each hypothesis were explored through regression analysis.

Results

A total of 372 records were collected for analysis. Upon initial examination of the data, two records stood out as falsified information, that of an 18-year-old full-time MBA student and that of a 99-year-old staff member. Those two records were expunged from the table before data analysis was carried out resulting in a final dataset of 370 total records. The final maximum age was that of a sixty-eight (68) year-old faculty member and the final minimum age was that of a nineteen (19) year-old BSBA student. A summary of the demographic data can be viewed in Table 1. As was expected, the MBA population provided the majority of the feedback because of time spent at the business school and time spent with access to the UNC Kenan-Flagler intranet.

Table 1
Demographic Characteristics

Age	Mean 31 years	Standard Deviation 9 years
Affiliation	Number of participants	Percentage
BSBA	58	16
MBAs (Total)	208	56
**Full-time	167	45
Executive MBA	24	6
Weekend MBA	11	3
OneMBA (International)	6	2
PhD	12	3
Masters of Accounting	15	4
**Staff	57	16
Faculty	20	5

** Represents number after removal of one record because of improbable data conflicts

The validity and reliability of the survey were assessed first. In order to improve the reliability of the variables to be included in the model, two adjustments were needed. The first question on the Intention to Use (IU) scale, "*I will make the Intranet my homepage*", was too restrictive when compared to the other questions in that factor category. Whereas the other three questions present some uncertainty about the user's future intentions, phrasing question one with the word "will" makes the choice to make the intranet the user's homepage seem more definite. Users more than likely already have the advantage of an Internet homepage from which they have become accustomed and dependent upon daily. The question is also more direct and not as open ended as the other three. Taking this into consideration, this question was removed from the dataset in an attempt to achieve greater reliability during data analysis.

The exact opposite was true of the fourth question on the Social Factors (SOCIAL) scale, "*Generally speaking, I would use this intranet without pressure from external social factors*". This question was too openly phrased whereas the other questions in this set gave the users a group to reference their opinions upon, namely their peers and superiors in the UNC Kenan-Flagler environment.

After omitting these two questions from the dataset, the reliability test was run again with results that were satisfactory. The results from the final round of reliability analysis are reported in Table 2.

Table 2
Cronbach's Alpha

Factor	Original alpha	Final alpha
Perceived Ease of Use	.5454	.8288*
Perceived usefulness	.7411	.7634*
Intention to Use	.5903	.6918
Attitude	.7447	.7447
Social Factors	.4347	.5700
Facilitating Factors	.6294	.6294
Actual Use	.8210	.8210

* Adjusted alpha as a result of reverse coded values for negatively phrased questions

To perform further analyses, it was necessary to create a new combined variable based on the averages of each of the seven constructs. A new variable was created based on each of the following constructs: perceived ease of use, perceived usefulness, intention to use, attitudes, social factors, facilitating factors, and actual use.

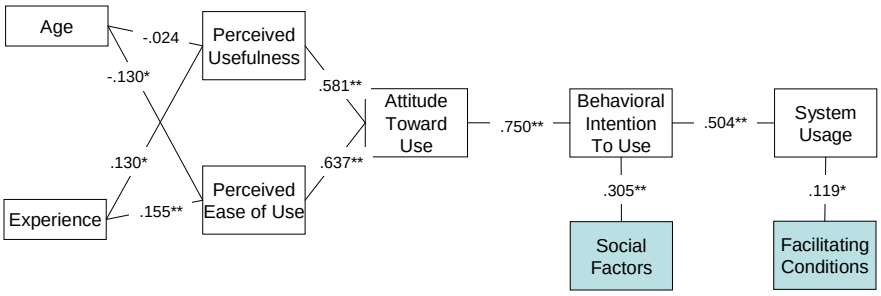
A correlation analysis was then run based on each of these constructs and the results are reported in Table 3. Those paths relevant to the study's hypotheses are shown in Figure 4.

Table 3. Correlations

	AGE	EXPER	PEU	PU	IU	ATT	SOCIAL	FACIL	ACTUAL
Age (AGE)	1								
Experience (EXPER)	-.071	1							
Perceived Ease of Use (PEU)	-.130*	.155**	1						
Perceived Usefulness (PU)	-.024	.130*	.515**	1					
Intention to Use (IU)	-.042	.234**	.488**	.669**	1				
Attitudes (ATT)	-.102	.205**	.637**	.681**	.750**	1			
Social Factors (SOCIAL)	-.215**	.060	.126*	.398**	.305**	.263**	1		
Facilitating Factors (FACIL)	.084	.024	.581**	.476**	.414**	.553**	.188**	1	
Actual Usage (ACTUAL)	-.048	.305**	.228**	.434**	.504**	.395**	.338**	.119*	1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Figure 4. Revised TAM with Bivariate Correlations



* Pearson's r is significant at the 0.05 level (2-tailed).
** Pearson's r is significant at the 0.01 level (2-tailed).

A series of regression analyses was also run on the data. Each linear regression analysis based on the relationships between a set of independent variables and a single dependent variable. Thus the resulting regressions were run with two independent variables and one dependent variable. The results of the analyses are reported in Table 4, and the standardized beta coefficients are illustrated in Figure 5.

Table 4. Results of Regression Analyses

A. Dependent Variable: Perceived Ease of Use

Variables Entered	R Square	Adjusted R Square	Sig.
Age*, Experience**	.038	.033	..001

B. Dependent Variable: Perceived Usefulness

Variables Entered	R Square	Adjusted R Square	Sig.
Age, Experience*	.017	.012	.043

C. Dependent Variable: Attitudes

Variables Entered	R Square	Adjusted R Square	Sig.
Perceived Ease of Use**, Perceived Usefulness**	.575	.573	.000

D. Dependent Variable: Intention to use

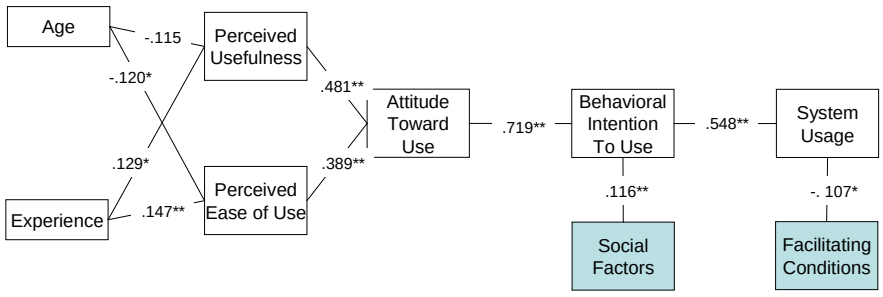
Variables Entered	R Square	Adjusted R Square	Sig.
Attitudes**, Social Factors**	.574	.572	.000

E. Dependent Variable: Actual Usage

Variables Entered	R Square	Adjusted R Square	Sig.
Intention to use**, Facilitating Factors*	.264	.260	.000

* Standardized beta coefficient is significant at the 0.05 level (2-tailed).
** Standardized beta coefficient is significant at the 0.01 level (2-tailed).

Figure 5. Extended TAM with Standardized Beta Coefficients



* Standardized beta coefficient is significant at the 0.05 level (2-tailed).
** Standardized beta coefficient is significant at the 0.01 level (2-tailed).

Discussion

The results showed a strong Pearson correlation among the original variables of the TAM. Perceived usefulness (Pearson's r = .681) and perceived ease of use (Pearson's r = .637) both correlate strongly with a user's attitudes towards the intranet. This data in addition to the R-square and adjusted R-squared values of .575 and .573 supports hypotheses 3 and 4, that there is a positive relationship between both PU and PEU with a user's attitudes towards intranet usage. Attitude showed a strong correlation with a user's intention to use an intranet (Pearson's r = .750), and a user's intention had a strong correlation with actual use (Pearson's r = .504). In addition, looking at the correlations when compared with all the possible constructs, the strongest Pearson correlation values were between the original TAM constructs. Therefore the TAM and all of its constructs are significantly positively related to predicting a user's acceptance of an intranet/portal.

Hypothesis 1 received only partial support. The relationship between age and perceived usefulness was not statistically significant. This finding was surprising given the results of previous studies regarding age and usage of the Internet/WWW. This discrepancy may be due to the fact that previous Internet studies incorporate a larger user base, including those under the age of 18 (pre-college) and those over the age of 65 (retirees) whose input can affect usage data. Everyone who has access to intranets can be assumed to be either in university environments or are active in the workforce. Regardless of age in this case, these users are expected to use intranets as a part of their educational or work experience.

The Pearson correlation values for the correlations between experience and perceived usefulness (Pearson's r = .130) and perceived ease of use (Pearson's r =.155) support hypothesis 2. The regression values from the data analysis back up the results from the correlations. R-square (r^2 = .017) and adjusted R-square (r^2 = .012) values for the analysis utilizing perceived usefulness as the dependent and age and experience as the independent variables were very low. This was also true when the dependent variable analyzed was perceived ease of use with low R-square (r^2 =.038) and adjusted R-square (r^2 =.033) values being

returned. It also indicated that prior experience is a stronger predictor of perceived ease of use and perceived usefulness than is age.

There were strong positive correlations for perceived ease of use (Pearson's r = .637) and perceived usefulness (Pearson's r = .681) with the construct of attitudes (Table 3). These relationships were a part of the original TAM and the current data supports the existence of these relationships (hypotheses 3 and 4 respectively). The regression analysis confirmed these findings. The highest R-square values in the regression analyses were found when attitude was the dependent variable and perceived ease of use and perceived usefulness were the independent variables. The regression analysis indicated that the relationship was stronger for perceived usefulness (β = .481) versus perceived ease of use (β = .389), as a predictor of user attitudes.

The strongest relationship between any of the constructs was between attitudes and intention to use (Pearson's r = .750, β = .719), affirming hypothesis 5. There was also a positive relationship between intention to use and the last construct of the TAM, actual use. The positive relationship was found in both the correlation and regression analyses (Pearson's r = .504, β = .548).

The new factors adopted from the Triandis model of choice also proved to have a role in predicting user acceptance, but were not as strong an indicator as any of the original TAM constructs. Hypothesis 5 and 6 were supported. Social factors were related to intention to use an intranet (Pearson's r = .305) and facilitating conditions were related to actual use (Pearson's r = .119), as hypothesized.

Social factors and facilitating conditions also contributed to high R-square and adjusted R-square values in predicting intention to use and actual use. Thus social factors can be effectively utilized in combination with user attitudes towards use to predict intent to use and facilitating conditions can be effectively utilized in combination with intention to use to predict actual use.

Conclusions

This study further solidifies the strong relationships between the original TAM constructs when predicting intranet usage. Perceived ease of use and perceived usefulness are important constructs when determining a user's attitudes towards intranets, attitudes, in turn, strongly predict intention to use and intentions strongly predict actual usage. However, two additional constructs from the Triandis model of choice, social factors and facilitating conditions, were found to enhance the validity of the TAM. While age and experience, two external variables, may have proven to be useful predictors of general Internet/WWW usage, they do not greatly affect the usage of intranets. This perhaps can be attributed to the fact that most intranet users are either within the workforce or engaged in higher education and are influenced by social factors such as peer pressure or workplace regulations. General Internet studies also include users who are younger than 18 (pre-college) and those over 65 (retirees), users who are not or no longer very active in today's workforce.

Looking at user comments regarding the current UNC Kenan-Flagler Business School intranet, responses could be mainly grouped into four categories: Interface Design Issues (perceived ease of use), improving and updating news sources (perceived usefulness), access issues (facilitating factors), and support issues (facilitating factors). These comments, in combination with the questionnaire results will provide empirical data useful to the further development of the Kenan-Flagler intranet and similar intranets in other universities.

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Appendix A. Acknowledgements

Without the help of the following individuals, this research would not have been possible:

Dr. Barbara Wildemuth (Project Advisor), Dr. Angel Bezza, Catherine Zimmer, Dr. Paul Solomon, and the UNC Kenan-Flagler Business School especially: Suzanne Corr, Susan Kellogg, Peter Smith, and Jimmy Wilson.

Appendix B: The Final Consent Form as Submitted to the IRB

Survey Participation Consent Form

We are inviting you to be a participant in a research study. You hereby consent to participate as a subject in a feedback survey conducted on behalf of the Kenan-Flagler Business School to identify user satisfaction with the Kenan-Flagler intranet conducted by Paul V. Chang of the School of Information and Library Science at the University of North Carolina at Chapel Hill.

NOTE: participation is open to anyone with a valid Kenan-Flagler account, regardless of computer expertise, age, etc.

- You understand that you will complete a survey with questions having to do with your personal interactions with the intranet, and questions concerning your future intentions to use the intranet based on improvements or suggestions that are made regarding its current usability.

- You understand that your participation is completely voluntary, and that you are free to withdraw from the study at any time you choose, without penalty.

- You understand that this project is not expected to involve risks of harm any greater than those ordinarily encountered in daily life. You also understand that it is not possible to identify all potential risks in any procedure, but that all reasonable safeguards have been taken to minimize the potential risks.

- You understand that the results of this survey will benefit you, the user, in the continuing development and improvement of the Kenan-Flagler Business School intranet for your needs.

- You understand that the results of this project will be coded in such a way that your identity will not be physically attached to the final data that you produce and that your username will only be used to track my completion of the survey and to prevent duplicate entries in the database on your part.

- You understand that the results of this research may be published or reported to government agencies, funding agencies, or scientific groups, but that your name will not be associated in any way with any published results.

- You understand that upon submission of your survey results, you will automatically be entered into a random drawing for one of three (3) memory sticks ($50 value), and that all subjects have equal odds in the drawing.

This survey will be available to approximately 3300 people, the size of the Kenan-Flagler population and will take approximately 10 – 15 minutes to complete forty-four (44) questions.

If you have any questions:

- You can contact me, Paul Chang, the principal researcher, at 919-962-6822 or by e-mail at paul_chang@unc.edu.
- You can also contact my advisor, Dr. Barbara Wildemuth, via email at wildem@ils.unc.edu.

Institutional Review Board Approval:

- The Academic Affairs Institutional Review Board (AA-IRB) at The University of North Carolina at Chapel Hill has approved this study.
- If you have any concerns about your rights as a participant in this study, you may contact the AA-IRB at (919) 962-7761 or at aa-irb@unc.edu.

By clicking the button below, I certify that I have read the above consent form and agree with its stipulations.

[I agree]

Appendix C. The Final Questionnaire as it Appeared Online

UNC Kenan-Flagler Intranet Survey

In·tra·net (*n*) - A network based on TCP/IP protocols (an internet) belonging to an organization, usually a corporation, accessible only by the organization's members, employees, or others with authorization. An intranet's Web sites look and act just like any other Web sites, but the firewall surrounding an intranet fends off unauthorized access.

Like the Internet itself, intranets are used to share information. Secure intranets are now the fastest-growing segment of the Internet because they are much less expensive to build and manage than private networks based on proprietary protocols.

-http://www.pcwebopaedia.com/TERM/i/intranet.html

**** The following questions pertain to your experience with the Kenan-Flagler intranet. Please take your time in filling out all of the questions. The server will time out in twenty (20) minutes, preventing you from using the back button to revise your answers. ****

1. I have had significant experience with using Intranets/Portals in the past
2. It is difficult to use the intranet without consulting others
3. Use of the intranet can increase the effectiveness of performing tasks (e.g. communication)
4. I will make the intranet my homepage
5. I think positively about using the intranet
6. The business school management/curriculum requires me to use the intranet
7. The intranet is available to me when I need it

8. I would utilize the intranet in place of traditional news sources (i.e. newspapers, t.v.) for up-to-the-minute news content if it were available
9. Learning to use the intranet is easy
10. The intranet supports the critical part of my tasks
11. The intranet is worthy of using
12. The intranet is a positive tool for the school
13. Generally speaking, my peers have determined my usage of the intranet
14. A person (or group) is available for assistance with intranet difficulties

15. I would utilize the intranet because I am able to access an abundance of reliable information tools from one source
16. It is difficult to learn how to use the intranet to make it worth the effort
17. Using the intranet enables me to have more accurate information
18. I plan on using the intranet on a regular basis in the future
19. Implementation of the intranet is a wise idea
20. Generally speaking, my superiors/instructors determine my usage of the intranet
21. Specialized instruction regarding the intranet is available to me

22. I would utilize the intranet because of its communication tools (e.g. email, discussion boards)
23. It is easy to find information on the intranet

24. Using the intranet gives me access to a lot of information
25. I plan on bookmarking the intranet
26. Using the intranet has been a pleasant experience
27. Generally speaking, I would use this intranet without pressure from external social factors
28. Overall, the use of the intranet is very supportive

29. I would utilize the intranet because of its customizability
30. The intranet allows easy return to previous display pages
31. I depend on other Web sites (e.g. studentcentral.unc.edu) for information
32. I would advocate for the creation of an intranet because of its convenience if the current intranet did not exist
33. My interaction with the intranet is clear and understandable
34. I can capture the complete coverage of current events after using the intranet
35. The intranet uses understandable terms

36. The intranet is easy to navigate
37. The intranet provides thorough information for my purposes
38. The intranet increases my daily productivity
39. I would suggest changing/improving the intranet

40. How frequently do you use the intranet?
    infrequent - extremely | quite | slightly | n/a | slightly | quite | extremely – **frequently**
41. What features/suggestions do you have for an intranet? (text area) **

42. What is your age?
    < 18 | 18 – 29 | 30 – 39 | 40 – 49 | 50 – 59 | 60+
43. What is your affiliation with Kenan-Flagler
    BSBA | MBA | faculty | staff | other
44. How many times do you use the intranet during a week?
    not at all | less than once/wk | once/wk | 2-3/wk | several times/wk | once/day | several times/day

[Submit my survey answers]