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An Evaluation of Website Usability for a Cover Crops Resource in the Southern Region

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An Evaluation of Website Usability for a Cover Crops Resource in the Southern Region

Abstract

With shifting demographics of agricultural professionals, online educational resources present opportunities for Extension and other natural resources faculty and personnel to use various tools for supporting agricultural producers in the 21st century using more modern technology. Traditionally, Agriculture and Natural Resource (ANR) Extension programming has used a variety of hands-on methods for teaching new, more sustainable farming practices, such as on-farm field days, workshops, farm visits, and demonstrations. While these traditional teaching methods are preferred among farmers, online support tools play a critical role in the overall decision-making process for farmers who are considering making changes to their current farming practices. Online educational resources, with mobile-friendly versions, can be used to assist Extension and Natural Resource Conservation Service (NRCS) agents meet the needs of their clients using more modern forms of technology, whether from the office or on-farm. This study employed two focus group discussions with Extension and NRCS agents and university faculty members to evaluate the usability of a cover crop website that could be used as a support tool for a variety of agricultural professionals. Four themes emerged from this study with reference to a simple, clean appearance; efficient browsing; process-thinking design; and mobile-friendly. This research will be used to inform the continued development of website tools to benefit farmers, producers, agents, and other stakeholders.

Keywords

website usability, online resources, new media

Cover Page Footnote/Acknowledgements

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Introduction

Agriculture and Natural Resource (ANR) Extension agents are public service faculty members of the land-grant system in the United States who, in cooperation with their respective land-grant universities or colleges and their local governments, extend the most recent research-based information from the universities out to the public audiences they serve (Campbell, 1998). As the nation continues to evolve from a manufacturing mindset to an informational society, it is crucial that Extension maintains its relevance with public audiences by meeting the new needs and challenges in a changing cultural environment (USDA NIFA, 2019). Traditionally, ANR programming uses a variety of hands-on methods for teaching new, more sustainable farming practices, such as on-farm field days, workshops, farm visits, and demonstrations that aim to improve agricultural producers' learning and likelihood of adoption of new practices (Franz, Piercy, Donaldson, Westbrook & Richard, 2009). While these traditional instructional methods are preferred among farmers, online support tools also play a critical role in the overall decision-making process for farmers who are considering making changes to their current farming practices. Online educational resources, especially those that are mobile-friendly, can be used to assist Extension and Natural Resource Conservation Service (NRCS) agents meet the needs of their clients using more modern forms of technology, whether from the office or on-farm. The current study was designed to evaluate participants' experiences and the overall usability of a new cover crop website that provides specific information for various agricultural production systems and physiographic regions within the southern region. Agricultural professionals provided feedback on their experience using the new website, specifically related to the content of the website, the general layout of the various webpages, and the design and functionality of the mobile version of the website. The feedback of users' experiences will help inform the content and website designers as they continue to build and improve the website.

Literature Review/Theoretical Framework

The Extension Service plays a vital role in disseminating timely, science-based information to agricultural professionals; however, regional support tools that can be accessed by farmers online help Extension fulfill their mission to create openness, accessibility, and service (USDA NIFA, 2019). While farmers consistently report that hands-on learning, demonstrations, farm visits, field days, discussions, and one-on-one interactions through the Extension Service are the most preferred methods for learning (Franz et al., 2009), a significant and growing number of farmers have indicated that using online resources as support tools help them learn and make critical decisions regarding their production systems (Franz et al., 2009). Online resources allow farmers flexibility with their time and pace of learning (Franz et al., 2009). Technological advances have changed the way in which people engage with and interact with content; in turn, technology has changed how people use and search for content (Sindhuja & Dastidar, 2009). "The key to acceptance is the user experience, or how the user experiences the end product. For greatest efficiency and cost effectiveness, relations between technology and usability should be maintained at momentum" (Sindhuja & Dastidar, 2009, p. 55). Research has shown website experience is greatly impacted by the ease of navigation, appropriate graphics integrated on pages, simplicity of design, and self-explanatory design and content (Procter & Symonds, 2001). While research has delineated a difference between a user's impression of a website and the actual usability of a website, impression "is generally the deciding factor on whether a user

remains at a WWW site after initial contact” (Procter & Symonds, 2001, p. 99). Both the structure for designing new media as well as the method for evaluating user experience with new media is defined through the Human-Computer Interaction framework (Katz, Blumer & Gurevitch, 1973; Dix, Finlay, Abowd, & Beale, 1998), which was used to guide this study.

Human-Computer Interaction

Human-Computer Interaction (HCI), the study of how computer technology impacts human work and activities, helps to understand how individuals utilize websites and the like (Katz, Blumer & Gurevitch, 1973). HCI is also used as a design discipline, where computer technology is created for maximum effectiveness, efficiency, and satisfaction (Dix, Finlay, Abowd, & Beale, 1998). Researchers in the field of HCI suggest that website design is just as important to online learning as is the content within the websites’ pages (Morrell, 2005; Webster and Ahuja, 2006). Successful website design will employ specific design attributes to influence positive user experiences that meet both informational and enjoyment needs (Huang, 2003). This can be achieved by improving the overall flow experience of a website, which is important because it gives users a general sense of control over the interaction, helps increase focus and curiosity, and influences users’ intrinsic interest or enjoyment in the resource (Trevino & Webster, 1992; Webster, Trevino, & Ryan, 1993; Huang, 2003). Using HCI, an analysis of newly developed media, such as a website, should focus on user behaviors while using the media. One such method in HCI is to perform a hierarchical task analysis, which focuses on the decomposition of higher-level tasks, such as general website navigation tasks, into lower-level tasks, such as finding specific pieces of information within the child pages of a website (Dix et al., 1998). Various observational techniques can be used early in the design cycle to evaluate how new media is being used with the intent to improve an existing design to better meet the users’ needs and preferences (Dix et al., 1998). A “high-quality” website should be designed to meet the user’s needs (Mich et al., 2003), because regardless of the business or the mission of the website, alternative web sources are only a mouse-click away. So, meeting the needs of the target audience is of paramount importance in order to attract and retain your user-base. Design methods in HCI utilize a variety of processes, including a user-centered design that “puts the user first in thinking about the design of an application or product” (Dix et al., 1998); and participatory design, which pulls in the users of the product to serve as co-designers of the end product. These user-interface design processes are iterative in nature, which inform the re-design process to better meet the users’ needs and preferences (Dix et al., 1998).

Agriculture and Technology

The average age of farmers in the United States is 58, and though new and beginning farmers tend to be younger than established farmers, “35 percent of beginning farmers are over age 55 and nearly 13 percent are 65 or older” (USDA ERS, 2012). Recognizing the average demographics of our nations’ farmers, steps should be taken to create websites with their preferences and needs in mind. Webster and Ahuja (2006) suggested older adults experience more disorientation when compared with younger adults due to more difficulty in creating mental maps while using a website, with navigation issues becoming increasingly problematic as search tasks become more complex. These feelings of disorientation can be mitigated through paying special attention to designing efficient navigation tools that foster better mental mapping as users progress through a website’s content. Morrell (2005) suggested the best way to determine usability problems for older adults on a website was by conducting simulations that

allow older adults time to navigate through a website and provide feedback on their experience. Likewise, as public service agents, both Extension and NRCS personnel serve as resources to farmers in the information gathering stages, and are often called upon to help farmers make important decisions (USDA NIFA, 2019; USDA NRCS, 2019), so equal importance should be placed on incorporating public service agents' needs into the creation of online educational resources that can be used as tools for supporting their clientele.

Purpose and Objectives

In 2017, a group of faculty members from various land-grant universities formed a cover crops council in an effort to create a working group of experts in various agricultural production systems. The council was formed to address building soil health through the promotion and education of incorporating cover crops into cash crop systems in specific geographic regions throughout the southern United States. Through funding resources from a national research program, the council was able to build a website to be used as an educational resource for helping disseminate the most current, research-based information on cover crops. The website was intended to be a tool for farmers, agents, and other agricultural professionals to be able to access not only from a fixed location, such as a desktop computer, but from mobile devices as well, as much of the working hours in these professions are spent in the field. As such, it was important to verify the usability of the website to ensure the efficiency of the tool when making decisions regarding cover crops. By looking at the relevant research in the area of website usability, the researchers aimed to better understand the components of the website found to be favorable to their target audience.

Understanding the potential for online resources for extending research-based information to practitioners and producers, the purpose of this research was to identify key elements effective in creating a positive user experience, and identify potential barriers for the target audience in using this website as a resource.

Two research objectives guided this evaluation:

- 1) Identify specific website elements that aid the user in gathering information, and
- 2) Identify specific barriers to gathering information from the website.

Methods/Procedures

A cover crops website was created to improve access to practical knowledge on using cover crops in order to increase the likelihood of their adoption by agricultural professionals and growers. Often adoption of an agricultural innovation depends on the awareness of the innovation, perception that the innovation is feasible and worthwhile to trial, and perception that the innovation promotes farmers' objectives (Pannell, 1999). The design and release of a mobile-friendly website was a critical part of the larger strategy by the council to increase cover crop adoption, in addition to implementing field days, workshops, and farmer networks to help disseminate information regarding proper use of cover crops across the region. In the case of the present study, the targeted groups for the website resource were Extension agents, Natural Resource Conservation Service (NRCS) agents, and university faculty members of various crop and soil science departments.

Two moderated focus groups were conducted to solicit feedback from ANR and NRCS agents as well as several faculty members from various crop and soil science departments on the content, design, and function of one production system in one physiographic region. The feedback would help website designers re-configure the existing site, as well as guide the construction of the remaining production systems and physiographic regions on the website. Ten participants, all of whom were given pseudonyms for anonymity, were asked to provide their thoughts about the website. Each focus group had five participants that met via Zoom, an online meeting platform which allows people to connect using audio/visual technology to create a sense of community from a distance. Each moderated focus group lasted an hour and a half and was recorded and transcribed for accuracy. Three participants were female, and seven were male. All participants had familiarity with cover crops in row crop production in the southern region prior to the focus group studies. The developed moderator's guide for the focus groups was reviewed by experts in evaluation and cover crop sciences for relevance and accuracy of measuring the research objectives and was approved through the International Review Board. Following previous research recommendations (Lamberz et al., 2018; Mich et al., 2003), the moderator's guide was developed to evaluate the usability of the website and the users' personal experiences with the website. Participants were asked to complete specific tasks within the website, that included navigating the site to find specific information and recording the number of clicks it took them to find the requested content. Additionally, participants were asked to discuss specific pages and the way in which content was presented within the website. Additionally, a second component of the focus group required participants to complete a task of searching for information using a mobile device. Again, participants were asked to record the number of pages they navigated through before finding the answer to the question posed to them by the researchers. Both focus groups included the activity of navigating the website and discussion of the website content; however, the second portion of the focus groups called upon unique perspectives of each of the groups' participants to solicit feedback regarding their feelings and experiences. The first focus group was conducted with five Extension and NRCS agents, and focused on the content and usability of the website as a potential tool for meeting their own needs as public service agents who are often called upon to assist farmers in making important decisions regarding cover crops. The second focus group was conducted with five various faculty members and focused on how the current content and overall structure of the website could be adapted as the other production systems and physiographic regions continue to be developed. In this form of participatory research (Cornwall and Jewkes, 1995), agricultural professionals were consulted for their opinions and suggestions to inform and contribute to the process of building the cover crop website. Utilizing consultative participatory research as a means of informing the website construction process helps draw upon local knowledge within the subject area to serve as a critique of the website, which will ultimately improve communication and information delivery to other agricultural professionals and farmers. While the website was also intended to be a useful tool to farmers, the current study did not incorporate farmer feedback, as the website is still in the early stages of content-building. A thematic analysis was employed to identify recurring themes throughout the two focus groups (Fereday & Muir-Cochrane, 2006). Within each theme, quotes were cited with the participants' researcher-assigned pseudonym. To differentiate between the first and second focus group discussion, the citation was either designated with a "1" or "2". For example, Mary-2 designated a citation from the second focus group discussion. From the transcripts of the focus groups, the themes that emerged, with specific regard to the content and functionality of the website were: simple, clean appearance;

efficient browsing; process-thinking design; and mobile-friendly. Both focus groups were given a summary of the moderator's notes for review and were asked to provide any edits or additions.

Results/Findings

Following data analysis of both focus group discussions, four themes emerged that helped identify specific website elements that aided the website users in gathering information, as well as design elements that created barriers for participants to efficiently use the website. These themes were (a) simple, clean appearance, (b) efficient browsing, (c) process-thinking design, and (d) mobile-friendly. While the two focus groups were different, both in their composition of participants and the purpose for which feedback was sought, the same four themes emerged in both discussions. Therefore, results were not differentiated between the two groups considering the same four themes arose from both discussions. The following provides the contextual basis of the four themes.

Simple, Clean Appearance

When asked to provide feedback regarding the cover crop website's layout and design, participants often commented on their appreciation for looking at a simple webpage, free of distracting images or colors. They liked how the use of colors on the page were contrasting against the white background, which helped them quickly identify the key features and information on each page. The term *clean* often surfaced as participants of both focus groups described their experiences with the website. For example, when asked what participants found pleasing on the website, Susan-1 shared "The website is clean, it's not overcrowded with too much information." Derek-1 immediately agreed with her, saying "it's clean and easy". Carol-2 was the first participant in the second focus group to also comment on the simple website layout, saying, "I think it's clean. I like that it's clean. It's not too distracting, it's not too busy." This comment prompted others to further reflect on the simplicity of the layout. John-2 provided his observation of the clean layout being helpful for quickly finding the information he was looking for. He said:

I agree. I guess I wasn't thinking this until Carol said it out loud, but it is clean. It's very, very well laid out. The golden ratio, does anybody know what that is? Okay. I don't know if this is on purpose or someone just has a really good eye, but the top almost third is much more dense than the bottom third. It's very pleasing. There's a menu bar across the top, there's a couple of things in the middle, you can just do quick clicks, and then there's these main meaty things at the bottom. That's all you need. Once you get inside, you can start having more fun. I don't have any constructive criticism, just compliments. Andrea-2 also agreed with this sentiment, adding, "I like the white space, I like the rhythm of the layout".

Some of the sections of the website contained more information than others, and similar comments were made regarding desires for more simple, clean layouts. For example, Tom-1 commented on one of the more dense pages, "It's a little bit crowded. It throws you off a little bit. That's actually a lot of reading really." Other participants also voiced concern with sections that contained too many words as being distracting, as Mike-1 also stated, "The only thing I had about that was it's [the specific page] very wordy, and it gives me a lot of considerations, but it

really doesn't point me to an answer.”

Efficient Browsing

A recurring theme surfaced in both focus groups regarding the efficiency of web-browsing. Participants talked about two important elements that would increase efficiency of browsing and learning. They suggested that increased accessibility of navigation tools and clear labels for key features or information would reduce the amount of mouse clicks needed to find desired information and would limit confusion and time spent browsing. Preferences for how navigation tools were ordered varied slightly; however, a consensus was met in both focus group discussions with wanting to have access to navigation tools on every page of the website, and that the tools should be clearly labeled and visible at all times while scrolling. For example, while talking about how some participants navigated to specific pages faster than others, Mike-1 shared his thoughts about how to navigate faster:

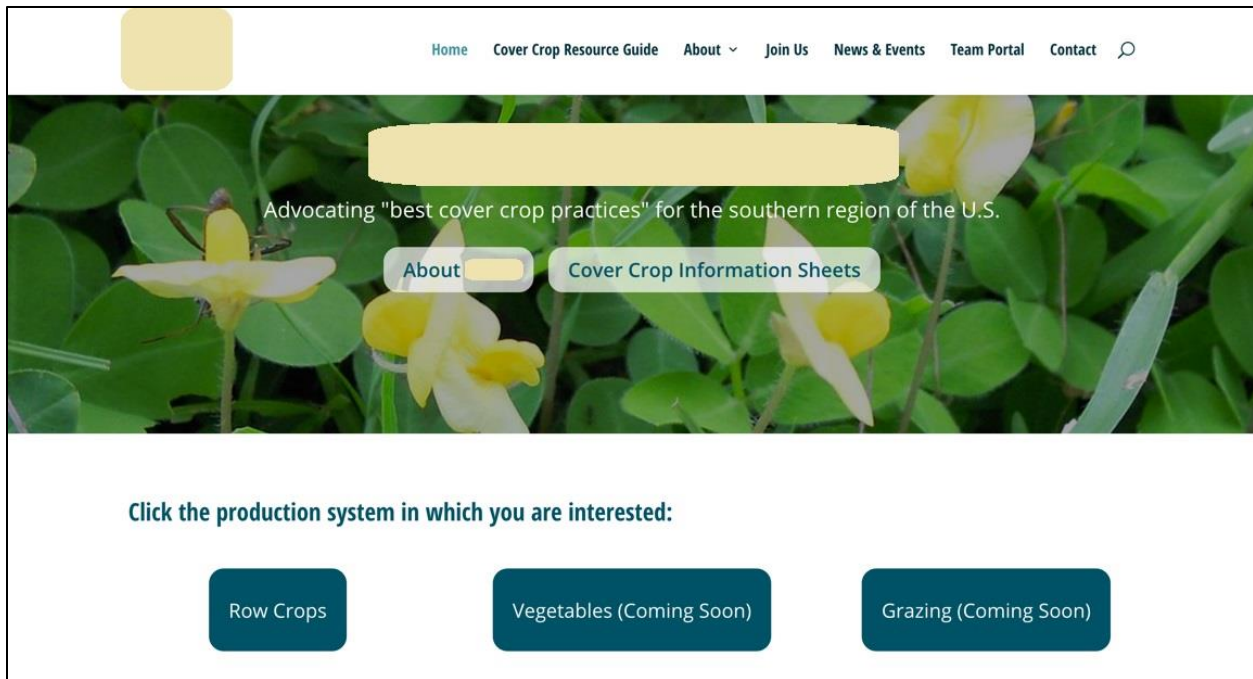
It's got all the content that's more or less on the website in a list. I really like that just because like it's got “How Do I Plant a Cover Crop”, “Cover Crop Information Sheets”, everything that is within the website is right on the front page...Anyway, I could get there a lot faster if I had that page when it first loaded up so to speak, the table of contents maybe, or something.

In the second focus group, participants discussed their experiences with the navigation features of the website on various pages of the website. Carol-2 expressed confusion in trying to find information on several of the webpages, and could not figure out how to navigate back and forth between information she had been reading. John-2 suggested “There's different ways to get here and so now listening to Carol's experience, I think that if you put a title above that navigation bar, it makes it very clear to people that that is a tool, then it can be used on any of these pages to get around.”

The issue with navigation contributed to the amount of mouse clicks participants had to make in order to navigate to specific information they were asked to find. Mouse clicks were an indicator of how well the participants could navigate through the website. Tom-1 expressed a bit of frustration, indicating his trouble finding information quickly compared to some of the other participants, as was heard in his comment “I had two questions with five clicks, but it just accidentally happened. I don't know how these people are doing it with three clicks!” Mike-1 offered his advice in response to Tom's frustration:

I think the difference between the clicks may be, and this goes back to finding the information easier, I always went to the cover crop information sheets from the home page. That saved me a lot of clicks to kind of get straight to the facts as opposed to if I click on row crops down there at the bottom I have to go through several clicks before I can even get to any information that makes sense (See Figure 1).

Figure 1. Screenshot of Home Page



Process-thinking Design

The third theme that arose from the focus groups was the idea of organizing information in terms of process-thinking, especially when considering farmers and agents will be using this information to guide their production decisions in terms of seasonal changes. When asked to provide feedback on how content was arranged on the webpages, Mike-1 detailed his preference for how information should be organized:

The planting and managing, when I see managing cover, I'm thinking about how do I manage it and how do I plant into it, as opposed to how do I grow it. Then, I moved down on planting cash crops and cover crop residue. In my mind, I think about selecting the species, which you've got their selection tool. Then, I think about how do I plant it, when do I plant it, how much do I plant, all that stuff. That's one season so-to-speak.

Others agreed with Mike in terms of how information, especially in the navigation menu, should be categorized and ordered. Participants felt that information should be recategorized to help consolidate information more logically. Those categories should then be placed in order following the natural steps one would take throughout the season in terms of planting, managing, and terminating cover crops. Mike-1 summarized the conversation by refining his earlier remarks, saying "I guess what I think about is that it's a process...I'm thinking about the table of contents being in the process of moving through all of this." The suggestion for organizing information in terms of process-thinking was repeated from a slightly different perspective in the second focus group, when John-2 said:

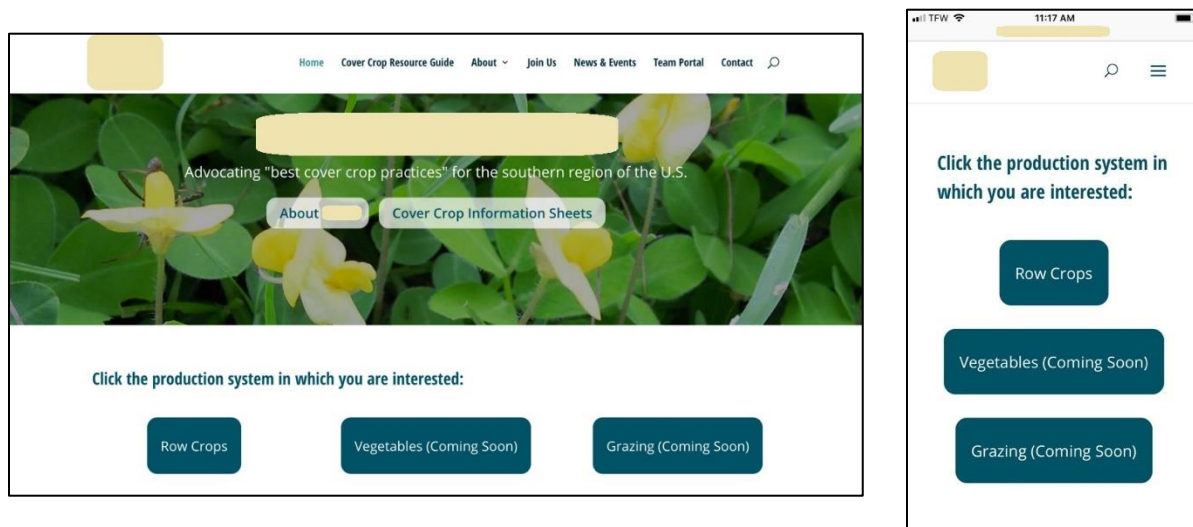
I'll say that everybody approaches these kinds of organizational tasks differently, but for me, starting on the home screen with a specific question, I did not know whether I wanted to choose the production system and a cover crop information sheet, or use the navigation

bar at the top. I just tried something just to get in there. I chose row crop system, that seemed right, and then I chose a state, and then a county.

Mobile-Friendly

The final theme that arose in both discussions was the importance of the website being mobile-friendly in order for it to be considered a credible and reliable resource. When asked to use the website from a handheld device, participants immediately provided feedback on how the mobile version should be reformatted to be more user-friendly. Susan-1 commented “I think I like the desktop version better. It just seems more user-friendly. When you type in the website address on the phone it doesn’t give you the same options (See Figure 2), which if it did that might be a little bit faster for folks.” Tom-1 agreed with Susan, saying “So, I found the answer, but it was actually harder on my phone...it’s hard to navigate on a phone.”

Figure 2. Comparison Screenshots of Home Page on Desktop and Mobile Phone



Mike-1 concluded the conversation with a suggestion for making the mobile format more efficient by providing specific answers as opposed to lots of general information, arguing:

In the field, I’m normally looking at what chemicals to use or if I’m getting ready to go to a farm, maybe some considerations for the farmer about their planter, you know? More specific things like that as opposed to general information. I read a lot of considerations, but it never really got me to any conclusion. It was good information, but maybe more specific on the mobile device.

Susan-1 suggested one way of increasing mobile-friendliness would be to transfer some of the important information into table format, “All of this might be better as a table. Just trying to help navigate all the amount of information on here, so if you’re trying to find the answer real fast so you don’t have to read through everything if you don’t need to.” Several participants agreed with having graphs and tables accessible from the website, especially when users need to access information quickly while they are in the field making decisions with producers.

Discussion/Conclusions/Recommendations

Online resources play an important part in helping farmers make better decisions in their farming operations (Franz et al., 2009). The present study sought feedback from agricultural professionals and faculty members of soil science departments but did not solicit feedback from farmers. This is because the website is still in the early stages of construction and design; therefore, it is critical that the content of the webpages is scientifically-sound, providing research-based information, as the ultimate purpose of the cover crops website is to be a resource for farmers, agricultural professionals and educators. The Human-Computer Interaction (HCI) theory suggests that given the focus on the end users (Dix et al., 1998; Mich et al., 2003), data collection should employ observational techniques of users interacting with the new media to document their personal experiences (Dix et al., 1998; Sindhuja & Dastidar, 2009). Observations in the present study were made through the use of two moderated and recorded focus groups, where participants were assigned tasks and asked to provide feedback of their use of the newly created cover crops website. Tasks were performed on their desktop computers as well as their handheld smart phones and tablets. The purpose of the focus groups were to gather information from the participants on their overall experience and solicit feedback for ways of improving website usability. In HCI, this method of representation and analysis is preferable because it puts the user first in thinking about the design and application of new media (Dix et al., 1998). The focus group discussions revealed several key factors for how the new cover crops website could be tweaked for optimal effectiveness, efficiency and satisfaction.

The two research objectives of this study were 1) to identify specific website elements that aid the user in gathering information, and 2) to identify specific barriers to gathering information from the website. Participant feedback provided insight regarding user experience and general usability of the newly created website. The four themes that arose from the data were 1) Simple, Clean Appearance; 2) Efficient Browsing; 3) Process-thinking Design; and 4) Mobile Friendly.

In reference to the Simple, Clean Appearance theme, the conversations, both in the affirmative and negative regarding the websites' clean appearance, suggested that when designing a website intended to be used as an informational source, it is important not to overwhelm readers with too much information or distracting elements. Keeping the layout simple, clean, and straight to the point is key for a satisfying experience. Focus group participants even talked about the pleasant design, with a clean white background and bold contrasting colors for the tabs. While participants enjoyed the photographs, they mentioned their preference for minimal use of photos that are carefully and strategically selected. The photos they enjoyed were high-resolution and helped reinforce the literature on each of the webpages. Participants also indicated that pages with a lot of text made things look "busy" and were a distraction. When participants had to scroll down the page, it became evident they lost track of where they were and even what page they were on, so limiting text to each page is important to not confuse users. As presented in the results, a clean, but process-oriented design was recommended by the participants. To accommodate this finding, websites should break up larger sections of information and move that information to a different page that is easily accessible from a navigation bar, or menu, with a specific process in mind.

With regard to navigation, it became evident this website function plays a huge role in helping people create mental maps (Webster & Ahuja, 2006) of getting to and from specific pages on a dense, informational website. Participants found the information useful; however, many expressed frustrations in trying to find the information they were tasked with finding during the focus group activities. Some participants suggested better labeling for a navigation

menu that would be present on each webpage, so that at any given point, a website user can easily click on a menu item in the navigation pane and get to the specific page they are looking for. Again, the website was designed with the agricultural professional in mind, so it is critical that agents and farmers are able to use the cover crop website as a resource whether they are in the office or in the field. Providing clearly labeled navigation menus on each page of the website will help website users navigate more efficiently when looking for information.

While the perspective for how information should be categorized and organized was slightly different, with some participants suggesting a seasonal approach and others suggesting a geographic (from larger geographic range to smaller), it was apparent that participants wanted to see content in terms of process-thinking. From the conversations in both focus groups, participants felt at times that information was miscategorized or disorganized in the hierarchy of the website. This led to confusion and feelings of disorientation. It is crucial to minimize disorientation on websites if the goal is to serve as a useful resource and retain users.

Mobile-friendly functionality was also regarded as an important factor in overall usability of the cover crop resource. Participants had difficulty with navigation on the mobile version of the website, stating the options on the mobile drop-down menus were different to the options on the desktop versions. The most agreed-upon suggestion was that both versions maintain consistency for improving navigation and easing frustration. One focus group conversation brought attention to the need for quick, reliable tables and graphs that contain good information in a readily-available format, especially for times that information is needed on-farm. In many cases, information on the website requires a lot of reading, which participants responded to negatively, suggesting that information on the mobile version should be tailored to get straight to the most important information without lengthy, detailed explanations.

The feedback from this study has helped the website and content managers strengthen the website design to improve the target audience's experience while using the website. Future studies will focus on farmers' feedback regarding experience while using the website, general usability, and will also evaluate farmers' perceptions of the credibility of the website as an educational resource to support decision-making. Eye-tracking studies would also be an effective means for understanding what specific elements of a website users find interesting and pleasing. Other research questions that should be addressed in future studies may also address from where or whom do farmers, agricultural professionals and educators receive cover crop information, and their reasons for choosing particular sources of information over others. The Human-Computer Interaction (HCI) framework for evaluation and website design is an effective approach in early stages of developing new media, such as the website in the current study. As social beings, people will actively seek out information through various available media sources to affirm their decisions, so the efficiency of a website in delivering the information users are looking for in a direct, simple way will ensure retention of those website users. Extension and NRCS can use this information to better understand the role online support tools play in helping their clients make more informed decisions when implementing changes to their current farming practices.

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