

# The Challenge of Web Accessibility

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## Introduction

This initial purpose of this project was to create a portfolio of my past and present design work in the form of a website. When I sat down to think of who would be accessing the site, I realized that many of the people I knew or worked with had challenges that would affect how they interacted with the website. Some were simply apprehensive when using a computer or accessing the internet, while others lacked the skills to follow a complex navigation system. Some had cognitive issues and would be discouraged if confronted with too much text or information in one area. Others would be frustrated with a multimedia presentation that ran without their input or control.

I realized that to include everyone in my potential audience, I needed to design for the person with the fewest computer skills and the most potential barriers to accessing my site. I had recently attended a conference on assistive technology and realized that the challenge I faced was to design a website that was accessible to both able and disabled users. The purpose of this project therefore expanded to incorporate accessibility and accessibility options into the framework of the portfolio. The process of learning and practicing accessible

design taught me how challenging a task it is for a designer to accomplish.

Despite the difficulties, I learned that accessible design is more than the right thing to do. I found that is also a better way to design a more flexible and scalable website.

## Defining Web Accessibility and Disability

Web accessibility means that all users—regardless of ability or disability—can view, access, and interact with the Internet and with individual websites.

What does it mean to be disabled? Disabilities occur in a variety of areas and for a variety of people. Some are temporary, and some are permanent; however they all need to be considered when designing a web site. Studying disabilities and how they impact web design means incorporating not only the different needs of disabled users, but also the different methods through which they access and interact with a website.

There are many conditions that result in a person being considered disabled: briefly, they involve having difficulty with or being unable to perform necessary daily tasks without assistance; having one or more developmental, mental, or emotional conditions; and having a condition that limits the ability to work around the house or makes it difficult to remain employed. Based on these

criteria, fully 18.1% of Americans are considered disabled.<sup>1</sup> For the purposes of studying web accessibility, I am expanding the definition to include age-related issues that strongly correlate with physical or mental difficulties. These include—but are not limited to—diabetes, poor eyesight, a decrease in motor skills because of a stroke or arthritic condition, and decreasing cognitive skills as a result of age or dementia.

Disabilities tend to fall into several categories that facilitate the discussion of their impact on accessibility: visual, auditory, mobility, cognitive disorders, and seizure disorders. The significance of each type of disability is discussed further in the following sections.

## Visual Impairments

Visual disabilities may include poor eyesight, color-blindness, macular degeneration, cataracts, and blindness. Any of these conditions may mean a user will have difficulty in seeing small text, areas of decreased contrast, or they may not be able to see the screen at all, and rely instead on keyboard or other non-visual input systems. Many users with visual impairments use screen magnifiers, grid systems, screen readers, Braille outputs, and text-to-speech utilities.

## Auditory Impairments

Auditory disabilities mean that a user may not be able to hear or understand audio portions of a website. This type of situation can be extremely frustrating for a student who must access interviews or recorded lectures in place of classroom instruction. For a website that features a narrated video, the user with an auditory impairment may not even realize they are missing an important portion of the information that is being presented.

## Mobility Impairments

Mobility impairments can range from mild arthritis that makes clicking a mouse difficult to conditions like Cerebral Palsy or Parkinson's disease, or Quadriplegia. These types of disabilities often make using a mouse or typing on a keyboard impossible. Some users may only be able to interact with a computer in limited ways, for example by using a mouth stick or by eye movement. Many different types of hardware and software may be involved for a user with mobility issues: adaptive keyboards, single switches, joysticks, screen magnifiers, grid overlays, and adaptive mice or mouse programs.

## Cognitive Impairments

Cognitive Impairments can be a result of a clinical condition, a disease, or a brain injury. Types of conditions include Attention Deficit Disorder, Autism,

Traumatic Brain Injuries, and Dementia. The various clinical disabilities can be looked at from the point of view of the functional challenges they create, rather than the specific type of condition. The main functional issues include deficits in or difficulties with:

1. Memory
2. Problem-solving
3. Attention
4. Reading, linguistic, and verbal comprehension
5. Math comprehension
6. Visual comprehension<sup>2</sup>

### Seizure Disorders

Seizure disorders, while not classified as visual disorders, occur when individuals are susceptible to seizures as a result of looking at flickering or strobe lights. The main consideration for this type of disorder is not to use these types of lights or effects on a webpage.

### Implications for Design

The variety of disabilities and impairments discussed above create a myriad of challenges for the web designer. Not only do different individuals have

different needs and challenges when accessing a website, they have many different methods for coping with these needs and challenges. Each type of coping method—whether it is an assistive technology solution, a hardware adaptation, a custom program, or a software adaptation—has different ramifications for the designer. Because there is a certain amount of overlap to discussing all of these factors, Table 1 is used to illustrate the relationship between the user's needs and adaptations, and the resulting designer's considerations.

Type of Disability	Challenges for the User	User Adaptations	Design Solutions
Visual	<ul style="list-style-type: none"> <li>-text size is too small</li> <li>-contrast is insufficient</li> <li>-image maps for links</li> <li>-complex images for explanation</li> <li>-non-linear content</li> <li>-non-descriptive links</li> <li>-links such as "Click Here" or "More..."</li> <li>-tables</li> <li>-colors used for contrast or structure</li> </ul>	<ul style="list-style-type: none"> <li>-screen magnifier</li> <li>-magnifying software</li> <li>-adaptive keyboard</li> <li>-screen reader</li> <li>-text-to-speech/speech-to-text program</li> <li>-Braille display</li> </ul>	<ul style="list-style-type: none"> <li>-increase size of text</li> <li>-effective color and contrast schemes</li> <li>-images need alternative text</li> <li>-multimedia captions and alternative presentation</li> <li>-linearization of content</li> <li>-tab order</li> <li>-access keys</li> <li>-CSS instead of tables</li> <li>-separation of content from presentation</li> </ul>
Auditory	-cannot access audible portions of a website	-textual clues	<ul style="list-style-type: none"> <li>-captioning</li> <li>-alternative presentation</li> </ul>
Mobility	<ul style="list-style-type: none"> <li>-users cannot use mouse</li> <li>-users cannot use keyboard</li> <li>-users cannot speak in intelligible voice</li> </ul>	<ul style="list-style-type: none"> <li>-mouth stick</li> <li>-head wand</li> <li>-sip and puff</li> <li>-on-screen keyboard</li> <li>-adaptive keyboard</li> <li>-eye tracking device</li> <li>-speech synthesizer</li> </ul>	<ul style="list-style-type: none"> <li>-tab order</li> <li>-access keys</li> <li>-linearization of content</li> <li>-clear hierarchy of information</li> </ul>
Cognitive	<ul style="list-style-type: none"> <li>-memory</li> <li>-problem-solving</li> <li>-attention</li> <li>-reading, linguistic, and verbal comprehension</li> <li>-math comprehension</li> <li>-visual comprehension<sup>3</sup></li> </ul>		<ul style="list-style-type: none"> <li>-reminders of site structure and navigation</li> <li>-simple, clear, thorough instructions</li> <li>-use of multimedia and/or images in addition to text</li> <li>-avoid calculations or make automatic</li> <li>-use multimedia, moving images, combinations of media</li> </ul>
Seizure	blinking lights cause seizure	avoid these types of web pages	do not use flickering or blinking lights

Table 1: Disabilities, Challenges, and Solutions<sup>4</sup>

## Planning for Accessibility

Creating an all-inclusive design that accommodates a full range of disabled users necessitates following numerous sets of guidelines and rules. Some guidelines are common-sensed based, some are expressed through design and layout, but many of the important considerations involve the intricate details of a site's code and structure. Based on a variety of sources and organizational guidelines, I developed a generalized plan for compliance with Accessibility standards and guidelines.

### 1. Define the User

All-inclusive design should accommodate the broadest possible range of users, which means an equally broad range of special needs and adaptations. The designer should identify all potential challenges his or her users face, and then create a checklist of solutions to meet each challenge. Table 1 is an example of this type of analysis.

### 2. Incorporate Different Methods of Interaction

The two primary methods of interacting with a website—of interacting with the computer in general—are the mouse and the keyboard. However, interactions are not as simple as this either/or choice. The designer cannot automatically assume that keyboard-based entry is as simple as a user typing on a keyboard. Depending on the user's level of mobility, keyboard entry may be accomplished by using a mouth stick, head stick, or sip-and-puff device. If this is the case, every extra "click" or "tab" required to navigate a site

may require a significant effort, and a designer must be aware of this concern and adjust the site design as necessary.

### 3. Identify Issues of Structure and Issues of Content

Mapping out the entire site—how many pages, how much content per page—is an important step, as it helps the designer separate the content from the structure of the website. Because many users rely on a keyboard-based means of navigation, the designer must structure the site to accommodate this method. Assigning a tab-index order (the order in which a user tabs through links and objects on a page) and providing access keys (example: ALT + F to access the File menu) are helpful shortcuts that enable a user to avoid the potentially difficult or impossible method of using a mouse. A link that enables the user to skip past the navigation section to the main content is also a helpful option.

Another reason to plan the entire site as completely as possible before performing the actual coding is that Cascading Style Sheets (CSS) are usually processed in the order they are written. If a designer decides to add a layout object—such as a column or an image—between two existing page elements, the page may not display as the designer intends.

Creating and grouping all content ahead of time helps to ensure that the content is clear, well-organized, and can be processed in a linear fashion. The designer should use descriptive headings and links, and should structure text with appropriate tags: headings, lists, paragraph text, etc. This process ensures that a user with a text-only browser has

access to the complete content of the site, and that this content is optimized for tools like screen readers and alternative browsers. When all content is organized ahead of time, it is easier for the designer to incorporate alternative text, captions, or even alternative presentations of information, particularly if multimedia is used within the site.

#### **4. Incorporate Technology Variables**

Users have many choices when it comes to accessing the internet, and these choices are increasing every day. Not only are there a variety of browsers available (Internet Explorer, Mozilla, and Opera, to name a few), there are increasing numbers of devices that can be used to access the internet. The range of choices has expanded from choosing between a PC and a Mac to choosing from a variety of sizes of computers: desktops, laptops, personal information devices, and now, smart phones that offer built-in internet browsers. The designer should do his or her best to ensure that the website displays correctly across a variety of browsers, and that the website's content scales to fit the device used.

#### **5. Test with a Range of Tools**

Throughout the design process, the designer should incorporate a variety of testing tools to evaluate whether the site is meeting accessibility standards and whether all the appropriate tags, tab indices, access keys, and alternative text are included. This process is similar to the “rapid prototyping” process for product development. Testing the site with a variety of tools and options—particularly screen readers—effectively incorporates basic usability testing into the design process. Many of the available testing tools simulate the

experience of having certain types of disabilities. These tools can be valuable aids for usability testing when the designer is not able to work with users who are actually disabled. Testing with an older population can be every effective, as screening for particular disabilities may not be necessary because the occurrence of disabilities increases with age.<sup>5</sup>

## **Incorporating Accessibility: Case Study: Gadwire**

### **Challenges and Problems**

The process of designing this site was arduous, at best, as the designer had very little experience with CSS and the coding side of Accessibility. Another challenge resulted from trying to design a site while still collecting data. Revisions to content and layout were often necessary, which in turn, complicated the process of structuring the site. Since one of the first tenets of Accessible design is the use of CSS, as opposed to tables, the designer's first task was to learn more about CSS and its application.

### **The Case for CSS**

Cascading Style Sheets (CSS) function as a layer between the content of the designer's content and the user's interface. Although the user accesses the site through a browser, the browser itself might be an adaptation of a conventional type and therefore present the webpage differently than the designer intended. The user may also incorporate a variety of filters or adaptations (see Table 1), which in turn affect how he or she accesses and interacts with the webpage. When a designer uses CSS to define the style of a webpage, he or she

effectively simplifies the content to a format—a series of text, images, and objects—that the user can easily access, even through the filters of adaptive technology or the user's custom browser settings. It should be noted that the user has the “final say” when it comes to displaying the webpage, since he or she has the option to disable CSS, choose not to display images, and change the text size, font, and colors used in a website.

The benefit of using CSS, as opposed to tables and layers, is that it very effectively separates the content of a web page from its structure. Many of the tools that disabled users employ—such as screen readers and alternative browsers—reduce a page to its textual elements and do not process images or multimedia objects unless an alternative textual description is provided for the image or object. Because of this tendency, the designer must be especially aware of how the content of a webpage is structured and ordered, and whether it can be “linearized,” or expressed simply as plain text with headings, paragraphs, and lists. Using tables instead of CSS may result in confusion for the user, since a table’s contents will be read in a linear fashion, while the designer may have intended for the table to impose a structure or hierarchy upon the content.

Using CSS enables the designer to experiment with different text sizes, colors, margins, borders, and positions—all without changing the content in the process. Using CSS also makes it easy for the designer to test a website at various screen resolutions and with a variety of built-in user options, such as the Accessibility options available through Internet Explorer or

Mozilla. However, CSS is not always easy to learn or to use, and as such, requires a significant investment of time to become proficient.

## Testing for Accessibility

In addition to proficiency with CSS, the designer must also follow special guidelines for coding, using XHTML 1.0 strict in order to comply with the highest of Accessibility standards. The [World Wide Web Consortium](#) hosts the [Web Accessibility Initiative](#) (WAI), which produces three helpful and well-organized documents: “Core Techniques for Web Content Accessibility Guidelines,” “HTML Techniques for Web Content Accessibility Guidelines,” and “CSS Techniques for Web Content Accessibility Guidelines.”<sup>6</sup> The Core Techniques document the helpful for creating the site, but I found that using many different accessibility testing tools was the most effective method for refining the site to ensure compliance with the various guidelines. The most useful document I discovered was the “[WebAIM Quick Reference: Testing Web Content for Accessibility](#).” It provided detailed explanations of the various types of testing, as well as links to most of the available tools designed specifically for accessibility testing. The tests recommended by WebAIM were used to test the Gadwire website. The types of tests<sup>7</sup> and the results for Gadwire are as follows:

## **Valid/Modern Coding Practices**

The standard for Accessibility is XHTML 1.0 strict. [www.cynthiasays.com](http://www.cynthiasays.com) is an effective tool for testing site code as various levels of compliance. The Gadwire site passes the Section 508 test, and the WCAG 1.0 Priority 1 tests.

## **Content Scaling**

The site is easily readable at a variety of screen resolutions and with various text sizes.

## **Disable Styles, Images, and Tables**

There are several tools for testing these features: The RNIB toolbar, the Firefox web developer toolbar, and the AIS Accessibility toolbar. The Gadwire site is organized and reads logically when CSS is disabled and when images are not displayed.

## **Device Independence**

The site should be navigable without a mouse, using only keyboard commands. The Gadwire site incorporates a logical tab and navigational order, facilitating keyboard access.

## **Browser Compatibility**

The Gadwire site looks reasonably good across Internet Explorer, Mozilla, and Safari (Mac). It is functional in all of these browsers.

## Automated Tools

The Gadwire site passes a variety of automated tests, including CynthiaSays, WAVE, and several other style and color tests found in the AIS toolbar.

## Human Checks

Links, forms, and images are all appropriately labeled or described with alternative text. The color and contrast schemes pass the Fujitsu Color Doctor simulation and the Juicy Color and Contrast Analyzer.

### Test across disability types

Visual: Colors and contrast are used effectively. Fonts are clear, and type size is sufficiently large. Site is easily navigable via keyboard and/or with screen reader for blind users.

Auditory: There is no audible content.

Mobility: Keyboard (and facilitated keyboard) access is clear and simple. Tab indices and access keys are straightforward and logical.

Cognitive: Layout and navigation are consistent across the site. Instructions are simple and clear and incorporate both images and brief text. Future improvements include the use of symbols to enhance comprehension for the user who has challenges with reading or the language.

Seizure Disorders: No blinking, flashing, or strobe-type effects are used in the site.

## Follow Accessibility Principles

“POUR Principles:

Perceivable: available through sight, hearing, touch

Operable: compatible with keyboard or mouse

Understandable: user-friendly, easy to comprehend

Robust: works in several browsers, assistive technologies, mobile devices, old browsers”<sup>8</sup>

The Gadwire site follows the POUR principles.

## Raising Awareness: The Gadwire Survey

Early in my research, I found a study conducted by Microsoft exploring the potential market for accessible technology and the level of awareness among disabled users of available accessible technology.<sup>9</sup> The Microsoft study examined assistive technologies (including a computer’s built-in accessibility options) from the point of view of whom they might benefit, rather than how many disabled users might use them. Because the guidelines for classifying a user as disabled can be expanded to include those who are temporarily disabled, or suffer from mild impairments due to age-related conditions, the Microsoft study included these types of users in their study of the awareness of assistive technology options. Some of the key findings demonstrated that 57% of users could potentially benefit from using accessible technology, but only about 44% used any form of accessible technology.<sup>10</sup> An abbreviated summary of the findings on use and awareness is as follows:

*More than half of computer users with difficulties/impairments report learning about accessibility options and utilities by discovering them on their own.*

*Given how influential an individual's computer experience and confidence are on the use of accessible technology, it is not surprising that a prevalent way individuals learn about accessible technology is through discovering it on their own.*

*Although the discoverability of accessibility options/utilities seems relatively high being that 58% of users of accessibility options discover it on their own, a significant gap exists between awareness and use of accessibility options/utilities among computer users with difficulties/impairments who most need this technology. For example, 79% of computer users with visual difficulties/impairments are aware of display options that would make their computer screen easier to see and read, but only 57% use display options. Even though computer users with mild and/or severe difficulties/impairments are likely to benefit from the use of these options, usage remains lower than awareness because computer users do not recognize that accessibility options/utilities will benefit them or they do not know how to find and/or use them.<sup>11</sup>*

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These findings prompted me to survey awareness levels for accessibility options and try to raise them in some small measure through the Gadwire website.

The Gadwire survey was designed to gather general data on user age, computer confidence and experience, and awareness of accessibility options. A sample of the survey is reproduced in Appendix 1.

## Analysis of Results

I expected the survey results to approach those of the Microsoft study, showing a correlation between a lack of confidence and experience with a lack of awareness of accessibility options. However, my results did not reflect this idea. Of the 14 people who were *unaware* that the accessibility options existed: 4 were male; 10 were female; 10 (71.4%) stated they had “some amount” or “a great deal” of confidence; and 10 (71.4%) stated they had an “average” or “expert” level of experience. All 14 would “possibly” or “definitely” recommend the accessibility options.

## Some General Findings

Of all 47 respondents, 46 (97.9 %) would “possibly” or “definitely” recommend the accessibility options. Of all 47 respondents, 40 (85.1 %) found the instructions to be “clear and easy to follow.” Of all four options for adjusting a website’s view (Change text size, Change page colors, Manage Toolbars, and Download Options Toolbar) the most likely to be used in the future were “Change text size” (24 out of 47) and “Manage Toolbars” (27 out of 47).

## Comparing Studies

From the Microsoft study:

"The majority of computer users (54%) are aware of some form of accessible technology but fewer are using it. Some form of accessible technology is used by 44% (or approximately 57 million) of computer users."<sup>12</sup>

Survey results:

30 of the 47 (70.2%) of the respondents were aware of the accessibility options listed on the website. Only 16 of the 47 respondents (34%) have used accessibility options. An interesting difference between my survey and the Microsoft study was that a higher percentage of the survey respondents were aware of accessibility options, but a lower percentage actually used the options than used accessible technology. Given the fact that I have personal knowledge of most of the respondents, I am unaware of any significant disabilities within the group, which means that statistically, the group of respondents does not reflect the fact that 18.1 percent of the population is considered disabled. Logically, when surveying respondents who are *not* disabled, one would expect a *lower* level of awareness of accessibility options, but this was not the case. The discrepancy might be attributed to the respondents' age or education level, however there is not enough data to test or support these theories.

Additionally, the Microsoft study explored the use of accessible *technology*, while the survey asked only about a few accessibility *options*. So a straightforward comparison of the awareness level is not possible.

Except for the seemingly inverse relation between computer confidence and awareness of accessibility options, I could not draw any significant conclusions from the survey results. In order to garner more useful or accurate results, a new survey should be conducted with a larger, more representative population.

Did the survey raise the level of awareness of accessibility options? For the 14 people who were previously unaware, yes. Additionally, all 14 of these respondents would “possibly” or “definitely” recommend these options to someone else.

## Conclusion

Designing a website should begin with the process of defining the audience for the site. What is a typical user like? What are his or her expectations for the website? How will he or she interact with the website? When the designer makes the choice to create an accessible site, he or she takes on additional challenges that add to the already considerable work of creating a site, gathering the content, and structuring the layout and interface. Defining a typical user is particularly difficult when the user may be disabled. Because there are so many different types of disabilities, there are many different needs to accommodate. Additionally, the adaptations used for accommodating disabilities add another layer of difficulty to the design process. Assistive technology such as screen readers and magnifiers, specialized keyboards, mouth sticks, single switches, and many others all work to filter the content of the designer’s site. The designer must be aware of and design for these filters, which generally

entail breaking complicated blocks of content into the simplest forms of text, image, and object.

To accomplish this in a way that best benefits the user, the designer should forgo the uses of tables and complicated layers in favor of Cascading Style Sheets, as they are more easily processed by browsers and bypassed by filters. However, learning the intricacies of CSS is time-consuming and difficult, and often discourages designers from striving to meet accessibility guidelines. Because CSS separates content from structure, it enables the designer to adhere to one of the main principles of accessible design. Using CSS also creates a site that is more flexible and scalable and easy to edit. In the long run, however, designing for web accessibility makes good business sense, because the same guidelines that govern accessibility tend to facilitate search engine optimization.<sup>13</sup> Clear simple text, logical order and structure, simple navigation, and appropriate use of tags and headings will accomplish both goals. Designing for accessibility is not easy, but it benefits both users and designers. When designers become more aware of the advantages of accessibility, everyone will benefit.

## Appendix A – Gadwire Survey

This survey consists of questions regarding the "Change Your View of This Website" section of the Gadwire site. Please note that we do not use your name or any contact information.

**1. Please give your age:**

- 16-20
- 21-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46-50
- 51-55
- 56-60
- 61-65
- 66-70
- 70+

**2. Please give your gender:**

- Male
- Female

**3. Please rate your level of confidence when using a computer:**

- Very little confidence
- Some lack of confidence
- Some amount of confidence
- A great deal of confidence

**4. Please rate your level of experience with using a computer:**

- Very little experience
- Some experience
- An average amount of experience
- An expert level of experience

**5. If you are working, how often do you use a computer for your job?**

- Never
- Not working or retired
- Rarely
- Occasionally
- Often
- Daily

**6. Approximately how much time did you spend on the "Change Your View of This Website" section?**

- Less than 5 minutes
- 5 - 10 minutes
- More than 10 minutes

**7. Before you looked at the "Change Your View" section, were you aware of any of the options listed in this section of the website?**

- Yes--have used them
- Aware that they exist, but have not used them
- Unaware of these options

**8. Were the instructions on each page clear and easy to follow?**

- Yes
- No
- A little confusing

**9. Do you think you will use any of these options in the future? (Choose all that apply)**

- None
- Change text size
- Change page colors
- Manage Toolbars
- Download Options Toolbar

**10. Would you recommend any of these options to someone else?**

- Possibly

- Yes, definitely
- No

**11. Please add any additional thoughts or comments:**

End of Survey

## Appendix B – Survey Results

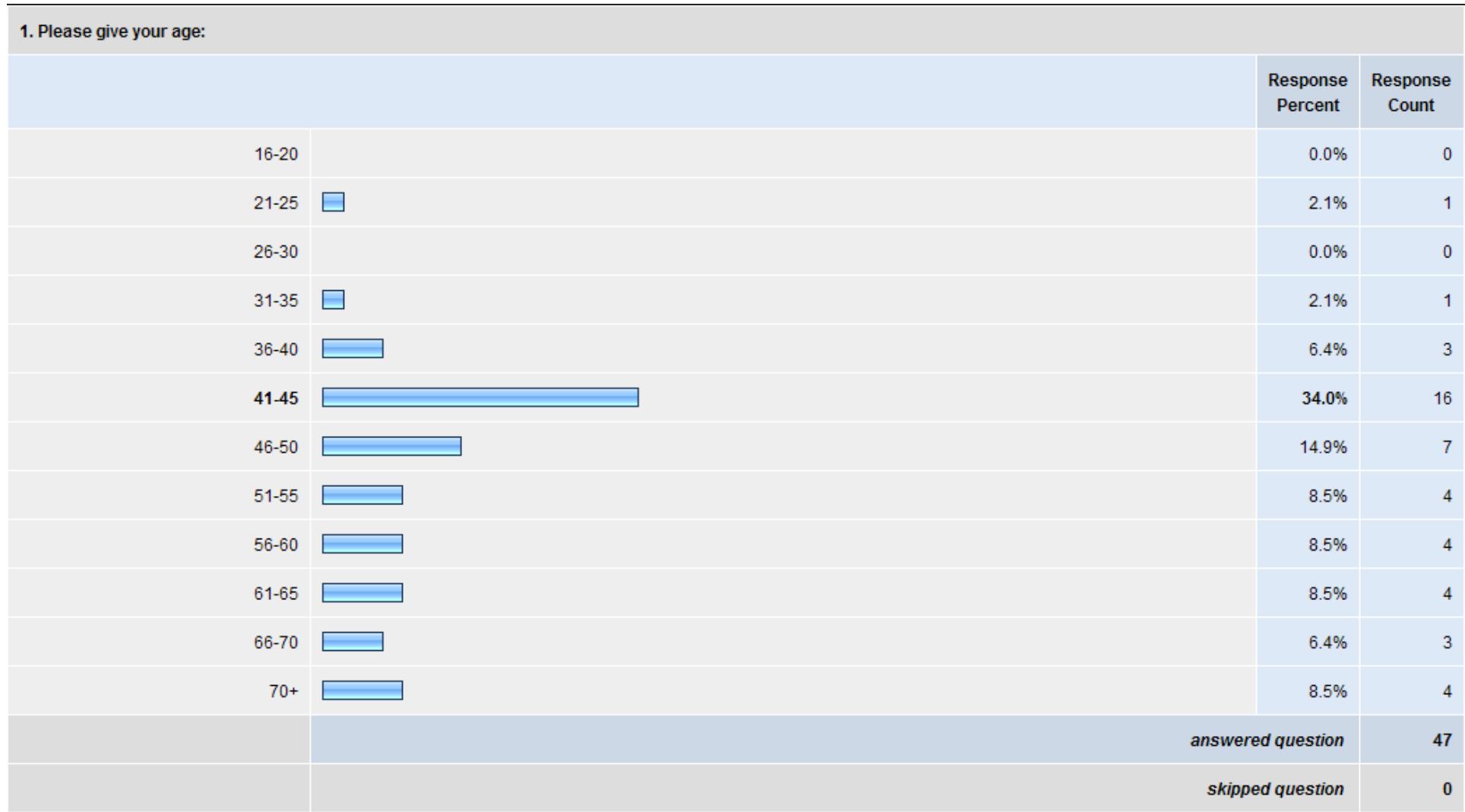


Figure 1 - Survey Q1

## 2. Please give your gender:

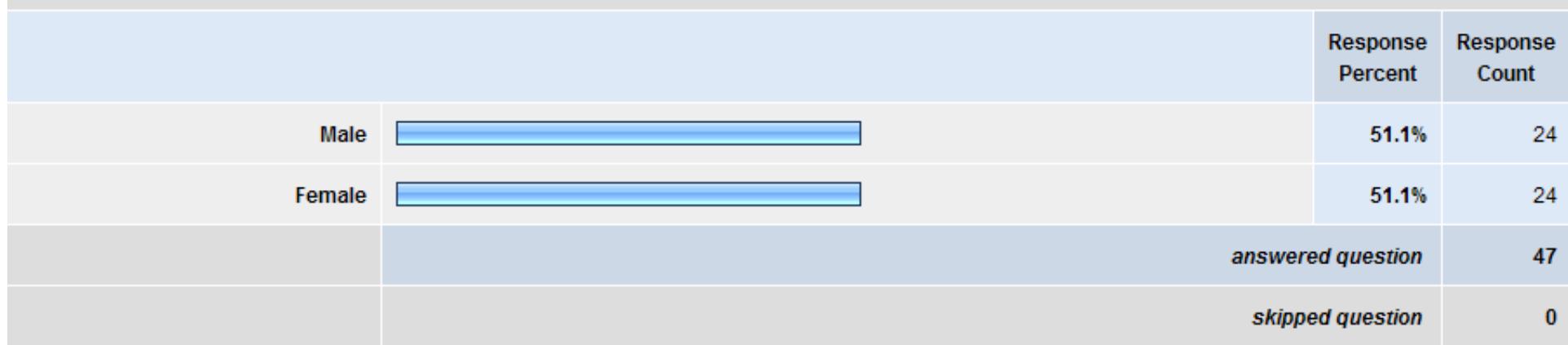


Figure 2 - Survey Q2

## 3. Please rate your level of confidence when using a computer:

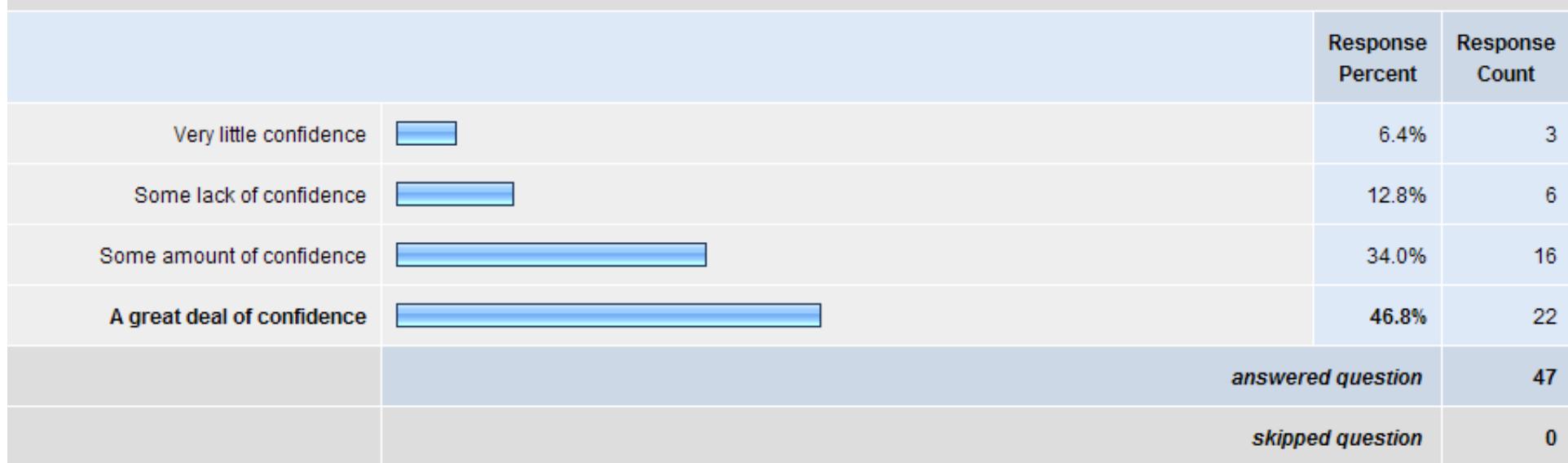


Figure 3 - Survey Q3

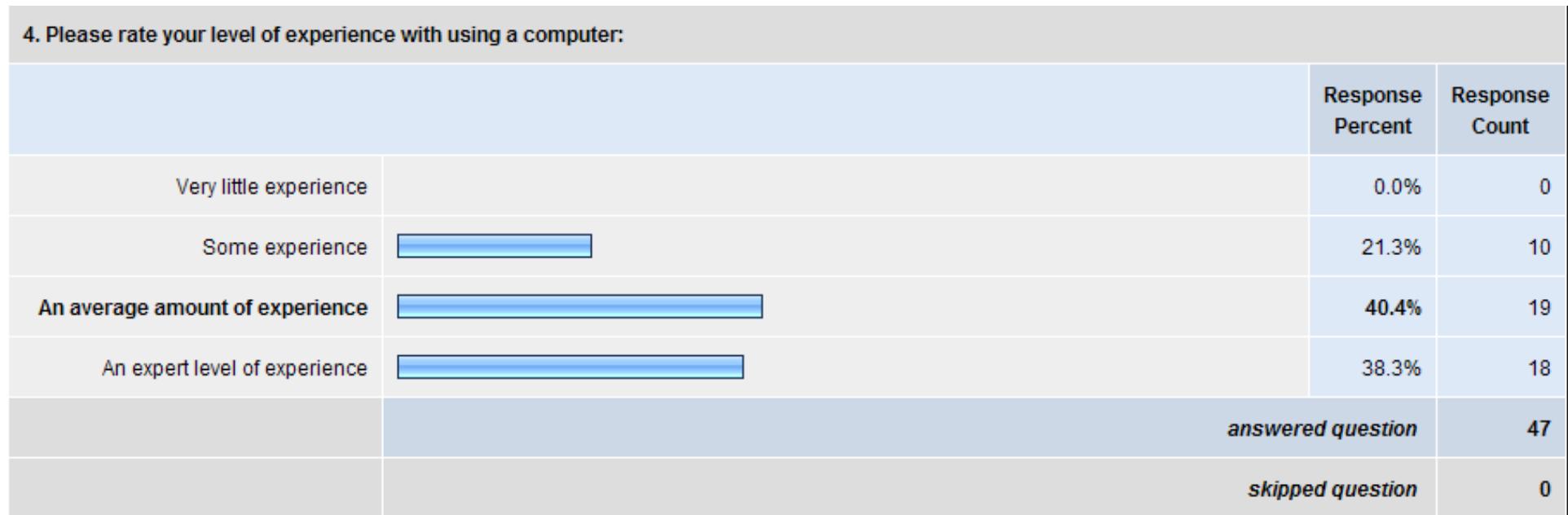


Figure 4 - Survey Q4

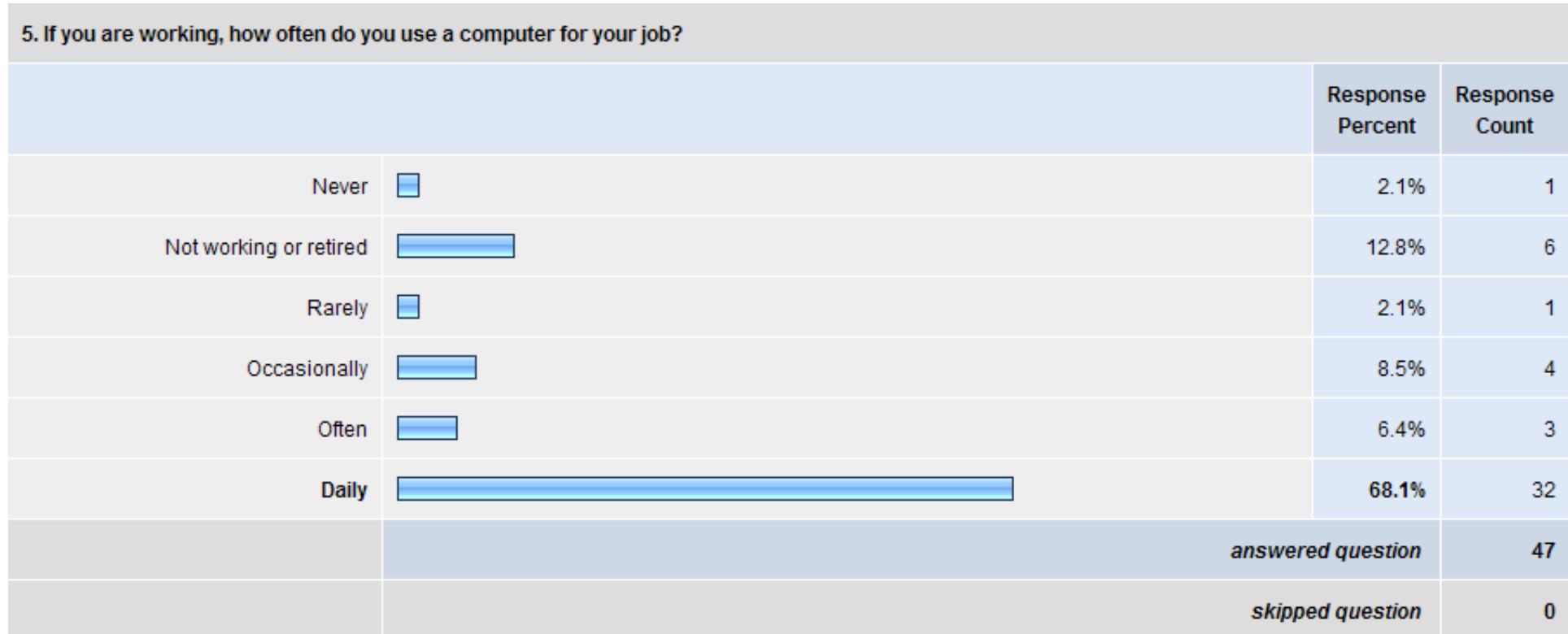


Figure 5 -Survey Q5

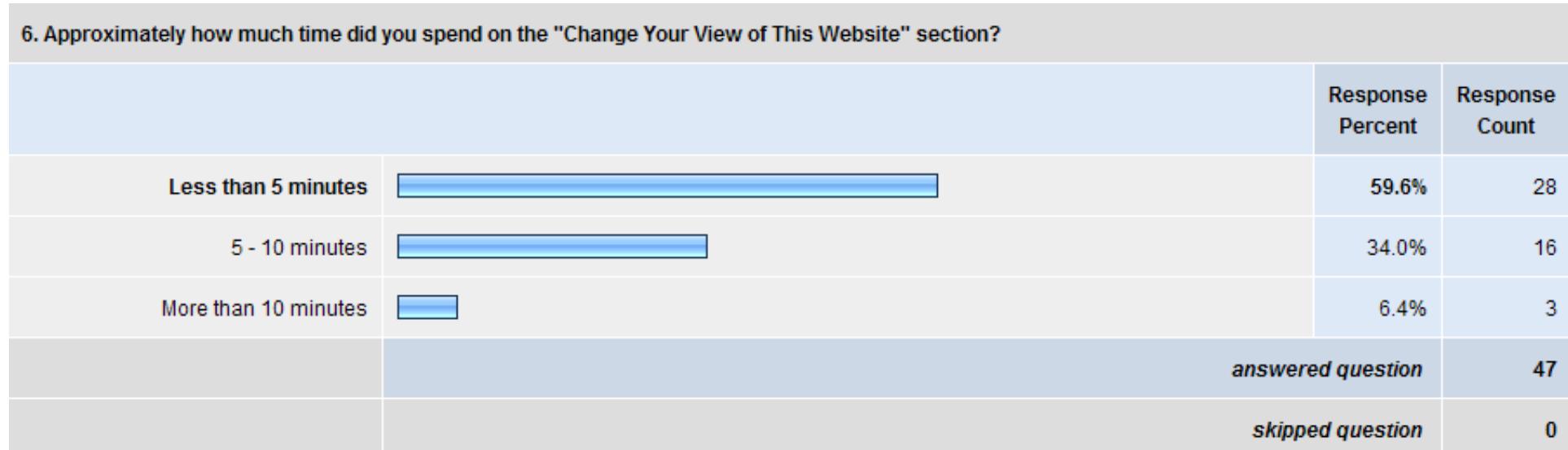


Figure 6 - Survey Q6

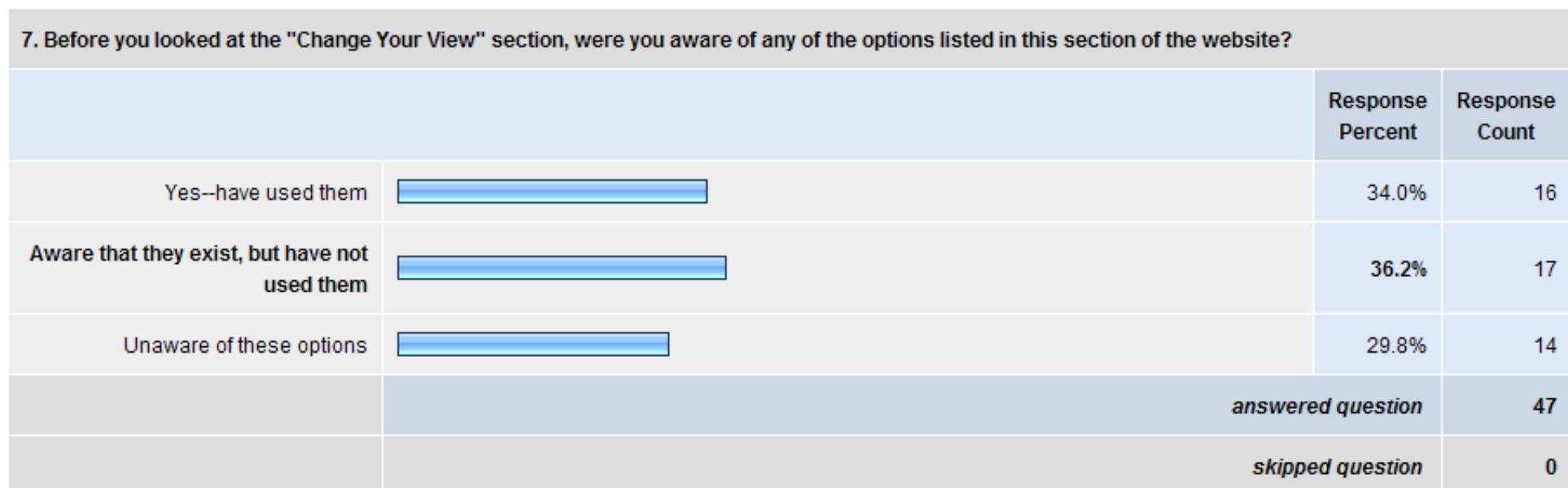


Figure 7 - Survey Q7



Figure 8 - Survey Q8

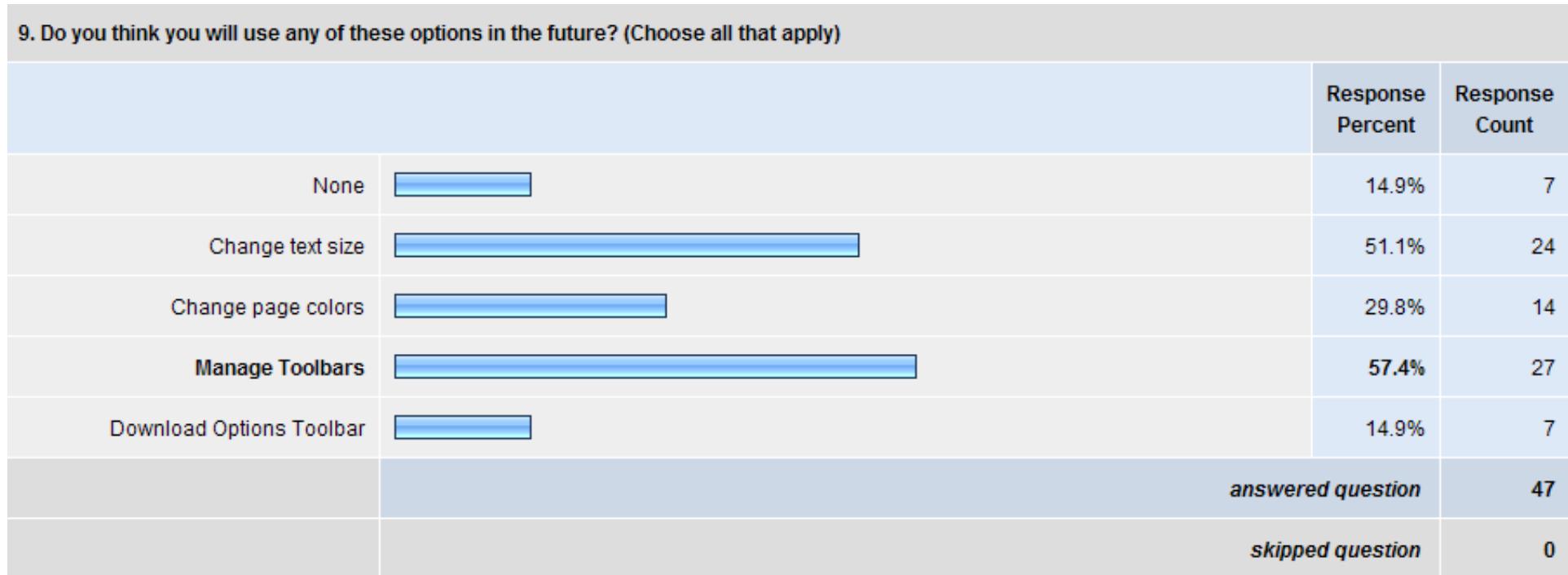


Figure 9 - Survey Q9



Figure 10 - Survey Q10

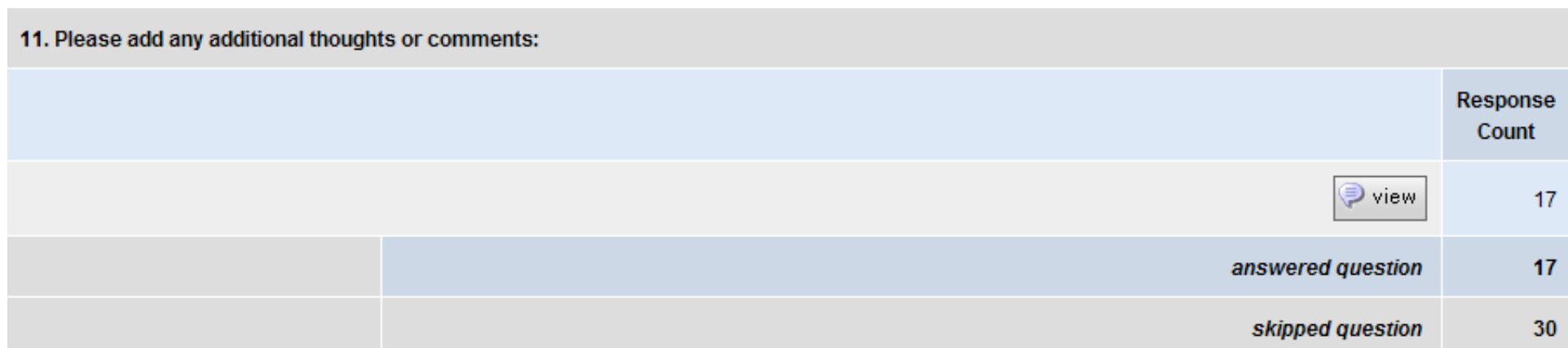


Figure 11 - Survey Q11

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