Usability Evaluation of Facebook and Instagram by Visually Impaired People

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Introduction/Importance of Study:

Social networking websites have become the main medium for communication, information sharing, entertainment, buying/selling, and various other purposes. People of every age use social networking websites, and their usage is increasing daily, especially in current circumstances. People with different abilities also used social networking websites, but each set of users had their requirements for using these websites. Visually impaired people use computers and the web with the help of screen reading tools e. g.; jaws, and NVDA. Screen reading tools read a web page sequentially, which was a time-consuming process. The major problem with screen reading tools came while reading visual content. Screen reading tools only read the alternate texts of non-visual content behind their tag. This research focuses on the usability of social networking websites for visually impaired people. Two of the most commonly used social networking websites, Facebook and Instagram, were selected for the usability evaluation. Accessibility, efficiency, and effectiveness were the metrics of usability, which were evaluated in this study.

Novelty statement:

A consolidated set of guidelines specific to social networking websites were presented in which some new guidelines were also proposed for Facebook. A mock interface was developed based on the proposed guidelines for Facebook.

Material and Method:

`For the evaluation of usability, a controlled experiment was conducted with 28 visually impaired people in which 16 participants evaluated Facebook and 12 evaluated Instagram to find the usability problems faced by visually impaired people.

Result and Discussion:

Results show that Instagram was as easy to use as compared to Facebook when used by visually impaired people with the help of screen reading tools.

Concluding Remarks:

Results showed that Facebook was difficult to use in comparison to Instagram. Thus, new guidelines were proposed for Facebook, and based on the guidelines, a prototype was proposed.

Keywords: Usability evaluation; Facebook; Instagram; Visually impaired and WCAG.

Introduction

Web application usage is growing day by day. People with various disabilities also use the website and access them with the help of screen reading tools. Web accessibility for visually impaired users is a difficult task. Various authors have proposed guidelines to ensure web accessibility for visually impaired people. However, the same general guideline cannot be applied to all kinds of websites; for example, browsing an e-commerce website is different than browsing an entertainment website, or browsing a social networking website is entirely different from accessing an educational website. To address this issue, generic-specific guidelines have been proposed, for example, for social networking websites [1], [2]. Does this research investigate whether existing guidelines are sufficient or not?

Other websites other than social networking websites, such as e-commerce, library websites, homestay websites, institutions websites, and online food ordering, have been evaluated according to WCAG and by visually impaired people [3]–[6]. Social Networking Sites (SNS) are selected as demand by the community for communication. SNS are used by sighted people as well as by visually impaired people. SNS is selected as they are dynamic and rich with non-visual contents [7]–[9]. SNS is rich with visual content, making it difficult for visually impaired people to use them. This study will evaluate the selected SNS, which are Facebook and Instagram, by visually impaired people and finds the usability problems with the help of a controlled experiment.

Social networking websites are more dynamic than any other kind of website [6] [7]. Facebook and Instagram are social networking websites with more graphical content than any other website. Visually impaired people have faced many difficulties in accessing social networking websites. These issues may vary from the interface type as they used the same websites from smartphones and a desktop. Both of the interfaces have their difficulties in accessibility [8]. Visually impaired people find two interfaces of the same website different as they lack some features and some regions or sections are not accessible by the mobile interface and desktop interface. From the literature, it is found that visually impaired people have faced common problems like navigation, searching, image description, and many others [8]–[10].

There is a difference in the accessibility of sighted and visually impaired people. Sighted people access the web non-sequentially, while the visually impaired use a screen reader for accessing the web, so it is sequentially. In this era, social media applications and websites are commonly used by sighted and visually impaired people. Standard guidelines are proposed for easy access to websites for visually impaired people. Still, they are generic and cannot be applied to all kinds of websites. Web Content Accessibility Guidelines (WCAG) are anticipated for the accessibility of websites to people with various disabilities [3]. All websites should follow these guidelines to make them accessible to people with visual impairment. There are still requisite for improvement in these guidelines for more accessible websites. Different kinds of websites are evaluated, and it is found that most problems did not conform to WCAG, so these guidelines are not enough [4]-[5]. The problems which are gathered after the evaluation of websites of them do not conform to WCAG [5]. This paper will focus on evaluating the two most popular social interacting websites of interactions social websites that are Facebook and Instagram.

Social media nowadays is most commonly used among people. Its users involve all types of users and users with disabilities. These disabilities include hearing impairment, visual impairment, learning disabilities, and others. Among all the websites in the world, Facebook is the most used website by its users [11]. It involves users of all ages and is used daily. In the literature, various evaluations have been done for Facebook. In the previous evaluation of Facebook, a limited number of tasks have been performed for their evaluation with some blind and sighted users. The highest number of tasks performed for the evaluation of Facebook is six, and in other papers, two or three tasks have been performed [8],[12]–[14]. Some photo-

centric mobile applications were also evaluated with visually impaired users. They only focus on how they upload or engage photos on social media through Snapchat and Instagram[15].

One of the major issues which were addressed in the literature is the lack of navigational content accessibility and lack of understanding of visual objects (graphics) on various websites [4],[13], [3]. In the evaluation of university websites, 19 new guidelines have been proposed to solve search and navigation issues. Based on these guidelines, a text interface is developed, but it was unable to solve the issue of navigation [3]. Websites lack of providing alternate text with visual objects on websites due to which visually impaired users cannot understand the object, which is mostly an image. This issue was solved when people developed prototypes and interfaces that provide an alternate text with images, making them understand the image's context visually impaired people. Because screen reading tools read the alternate text of the graphical content for visually impaired people for their understanding.

The literature review conducted for this work is divided into many subsections. The categorization is based on the type of website, being evaluated and proposing new guidelines. Literature for this work has two broader categories: one is the evaluation of the websites, and the other category is proposing guidelines after the evaluation of the websites. In the literature, a lot of work is done on evaluating different websites concerning visually impaired people.

The literature review can be classified into various subcategories. The major two categories are the paper that only evaluates websites through visually impaired people [2], [4], [6], [10], [15], [12]. And the paper evaluates websites and proposes guidelines for improvement in WCAG [1]. These two major categories can be divided into other categories as well. Evaluation of websites has two subcategories: evaluation of websites based on their features by visually impaired people [1]-[8], [10] [15] and the other one is the assessment of interface of the websites. The evaluation of the interface design of websites is further divided into two subsections: the evaluation of web interface and mobile interface of social networking websites e.g., Facebook [4], [6], and the evaluation of responsive and non-responsive web design [8] In the literature, the evaluation of interfaces is performed in two categories one on the web and mobile interface, and the other is on responsive and non-responsive design interfaces. As a result, visually impaired people found mobile interfaces more accessible and usable than social networking websites' web interfaces [4], [6]. But there is a problem with the mobile interface of Facebook that it is lack features [4]. In the evaluation of responsive and non-responsive interfaces [8], non-responsive design interfaces are much more accessible compared to the responsive design interface. In the responsive design interface of many websites, navigation problems are found prominently.

Social networking, photo-centric and educational websites are evaluated on the basis of their features and accessibility to visually impaired people. In social networking and photo-centric application, it is prominently found that the graphics and images lack description, which made screen readers difficult to read and difficult to understand visually people [13], [10]. In some of the website's navigation problems found variously, the content present on the navigation is not accessible, which makes website accessibility difficult for visually impaired people [9],[8],[6],[1]. Some of the work is performed to present new guidelines for improving WCAG (2.0). Firstly, this work [1] evaluates university websites and maps their problems to WCAG. Then they proposed some new guidelines as an improvement in WCAG. The research methodology adopted for this study was derived from [11]. The methodology took several steps to get accomplished. The first step was about the selection of metrics that were being evaluated. In this research, the criteria that were measured were the perspectives of usability: efficiency, effectiveness, and accessibility, which measured the time and the number of completed tasks, respectively. The second step was about the descriptive study of the research, which was about the literature to understand the state of the art. This worked literature review was held to find out the existing standard and guidelines that were already

there for visually impaired people for web accessibility. From the literature review, the existing problems that were faced by visually impaired people while accessing different kinds of websites were also identified. And, also the problems extracted from controlled experiments were identified. The third step was about the prescriptive study, after having a descriptive study, it was identified that to find the problems faced by visually impaired people while using social networking websites Facebook and Instagram, an experiment should be conducted to find out additional problems faced by visually impaired people. The last step was to have another descriptive study to evaluate the method that was the experiment in this scenario, which was developed after the prescriptive study. The visually impaired people held the evaluation of the experiment which was undertaken for Facebook and Instagram by performing the selected top most used tasks on Facebook and Instagram, and their results were evaluated in terms of "time" as the efficiency and "number of tasks completed" as the effectiveness of the experiment. So, this methodology was formed according to this studied and applied successfully.
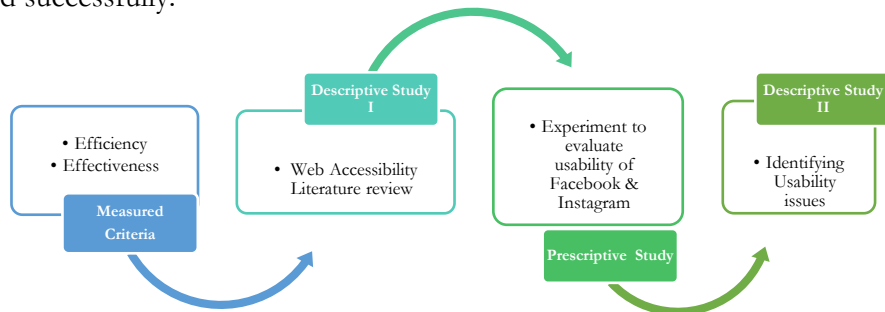

Figure 1 Research Methodology

This paper's arrangement was as follows: section 1 briefly describes the introduction, objectives, and goals of this work. Section 2 explains the literature review that was conducted for this work, a comparative analysis of the literature, and key findings from the literature. Section 3 discusses the preliminary experiment conducted to find out the usability issues visually impaired people faced while using Facebook and Instagram. Section 4 explains the result analysis of the data obtained after the execution of the preliminary experiment, the problems identified from the experiment, and the statistical testing of the experiment. Section 5 compares the problems with existing guidelines and literature and the solution as the guidelines for social networking websites. A mocked interface was also developed based on the proposed guidelines. Section 6 describes the study's conclusion limitations and future work.

This paper's arrangement was as follows: section 1 briefly describes the introduction, objectives, and goals of this work. Section 2 explains the literature review that was conducted for this work, a comparative analysis of the literature, and key findings from the literature. Section 3 discusses the preliminary experiment conducted to find out the usability issues visually impaired people faced while using Facebook and Instagram. Section 4 explains the result analysis of the data obtained after the execution of the preliminary experiment and the problems.

The foremost purpose of this work was to detect the difficulties faced by people with visual impairments while using social networking websites e. g. Facebook and Instagram. The main objective of this research was the usability evaluation of, Facebook, and Instagram by visually impaired people. This study also identifies the problems given in the literature by different authors. This work aimed to identify the problems of people with visual impairments and map these problems to wcag and the existing literature. Also, the goal was to improve and add additional guidelines specifically for social networking websites, such as wcag.
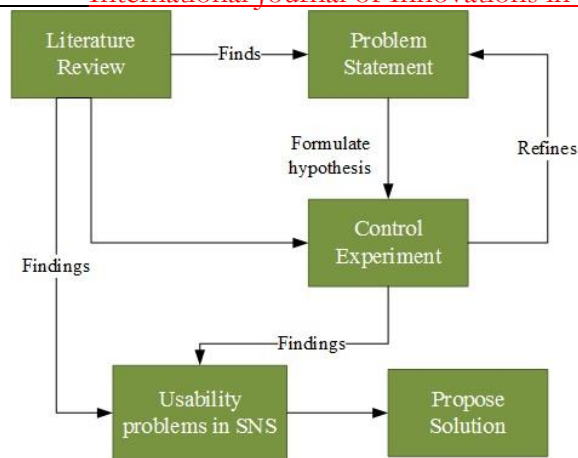
Figure 1: Research Steps

Material and Methods

In this section, a survey was performed to determine the usability and accessibility issues of visually impaired people using Facebook and Instagram. The survey was conducted in two steps:

- Firstly, an experiment was conducted to find out how much Facebook and Instagram are accessible and usable by visually impaired people.
- Secondly, after evaluating the efficiency and effectiveness Usability of Facebook and Instagram, the results and issues are mapped to WCAG, and then new specific guidelines for social networking websites are proposed, which were in addition to WCAG guidelines.

The experiment was executed to find usability issues in the websites of Facebook and Instagram. Facebook and Instagram websites are evaluated on Laptops/PC. Further details and results of this experiment are discussed below. This experiment uses a between-subject design. As in this experiment, the subjects (participants) are distributed into two groups. One group of participants evaluates Facebook, and the other evaluates Instagram by performing the same tasks for both social networking websites.

For the execution of this experiment, two of the top social networking websites were selected based on their MAUs (monthly active unique users). The two selected social networking websites are 1) Facebook and 2) Instagram which have 2.23 billion MAUs and 1 billion MAUs, respectively.

More than five special institutes were visited to find out an appropriate number of participants. Visited institutes include:

- Government Qandeel Secondary School for Blinds, Rawalpindi
- Government Special School for blind girls, Rawalpindi
- Al-Ghazali School for blinds, Rawalpindi
- Pakistan Foundation for Fighting Blindness, Islamabad
- National Special Education Centre for Visually Impaired Children, G-7/2, Islamabad

The objects that are studied in this experiment are Facebook and Instagram websites. The purpose was to estimate the Usability of social networks Facebook and Instagram by performing certain tasks on social networks with respect to their performance time. The quality focus was the efficiency and time usage of social networks Facebook and Instagram. The perspective was from the visually impaired people. The experiment was conducted using the students and instructors of Government Qandeel Secondary School for blinds, Rawalpindi, Pakistan, and Pakistan Foundation for Fighting Blindness, Islamabad, Pakistan.

The study was conducted as a blocked subject-object study. In this experiment, participants were distributed in two groups (blocks). The first group of participants evaluated Facebook by performing five tasks, and the second group evaluated Instagram by performing the same four tasks for evaluating Facebook. The participants in this experiment include males, females, low vision, those totally blind, teachers, and students.

The hypothesis for this experiment was formulated as:

H_1 There is a difference in the Usability of Facebook and Instagram for visually impaired people.

For this experiment, independent variables were the visually impaired participants, Facebook and Instagram.

For this experiment, the dependent variable is the timely completion of each task, the total time to perform all tasks by each participant, the number of completed tasks, and the total number of tasks. These metrics are achieved after the evaluation of Facebook and Instagram.

For the execution of this experiment, a permission letter from Fast-NUCES University, Islamabad, is issued for the execution of this experiment in the Government Qandeel Secondary School for blinds and Pakistan Foundation for Fighting Blindness. After the submission of the permission letter to the institutions, the school's principal is informed about the experiment and what to do in the experiment. JAWS screen reader tool installed on the machine (laptop) on which the visually impaired participants can evaluate this experiment. A screen recording tool is also installed on the machine for determining the time taken by each participant for performing the tasks. For the execution of this experiment, 3-4 Facebook and Instagram accounts were created and filled with real data to take care of participants' privacy. Each of the participants performed these four tasks for the evaluation of the Facebook and Instagram websites:

1. Search a user
2. Sent friend request to a user / Followed a user
3. Open timeline of a user
4. Block a user

This experiment uses a between-subject design. As in this experiment, the subjects (participants) were distributed into two groups. One group of participants evaluates Facebook, and the other evaluates Instagram by performing the same tasks for both social networking websites. Note that the number of participants is not the same in both groups.

Threats to validity with its types related to this experiment and how they are controlled. First, internal validity is discussed below:

1. Multi-group threats are addressed in a way that both the group of participants are treated the same way. For both groups, the participants who are unfamiliar with the interface have given time to make them familiar with it.
2. Selection bias is handled in a way that the selection of participants is random and done based on the availability of participants in the institutes. Participants involve both genders, male and female. Teachers and students are part of this experiment, and people with low vision and total Blindness are involved.
3. Selection threat is not countered in this experiment because the subjects in both groups were not homogeneous. Their experience level, education level, and type of Blindness are different.

Now, come to construct validity threats and how they are controlled and applied in this experiment:

1. Inadequate pre-operation of construct threat is addressed. This work is to make sure that the metric used to measure the evaluation of Facebook and Instagram is correct for it. The metric which is being used in this experiment is "time". Time measures the

participant's performance time for each task on Facebook and Instagram. Time will indicate the efficient usage of Facebook and Instagram. Results will conclude which social networking websites from these two selected social networks are easy and efficiently used by visually impaired people. And the number of complete tasks by each participant indicates the effectiveness of Facebook and Instagram.

2. Restricted generalizability across constructs threat is countered in a way that, in this experiment, two treatments were tackled Facebook and Instagram. After the complete execution of the experiment, the effective one is identified.

Some of the external validity threats are also tackled, which include:

1. Situational factors are considered in which the participants are free, and there are no encumbrances of their work and classes.

2. The participants provided a peaceful environment so they could perform the tasks easily.

3. Inclusion and exclusion criteria were clearly defined for the population, so only the participants who use social networking websites were part of this experiment.

Selection biases also occur during the experiment as some of the student participants are not willing to perform this experiment. Participants were not forced to perform this experiment. Only the participants who are willing and want to experiment are selected.

Result and discussion

Although there are numerous meanings of Usability, we embraced the definition that ease of use comprises three autonomous developments: effectiveness, efficiency, and satisfaction. Beneath, we examine what each of these developments implies in our unique circumstance and how we estimate it.

Table 1 indicates the results obtained after the evaluation of the Facebook website, and table 3 shows the results after evaluating the Instagram website by visually impaired people. Note that the time is measured in minutes, for example, here, 0.26 means 0 minutes and 26 seconds. The time taken to perform each task on Facebook is calculated in minutes. Time is a metric that calculates the efficiency of usage of Facebook and Instagram websites. For the comparison of how much Facebook and Instagram websites are efficient in use by visually impaired people, a standard time is set by a sighted participant who uses a JAWS screen reader to complete all the tasks, and then the total time will be used as a standard, and compare to the time of each visually impaired participant. The effectiveness of Facebook and Instagram websites is calculated by determining the number of tasks completed by each participant, which can be seen in table 1 and table 2.

Table 1 Facebook Results

#	Task 1	Task 2	Task 3	Task 4	Total Time	Gender	Blindness Type	Completed Task	Profession
Participant 1	10.45	15.15	0	0	26	male	full	2/4	student
Participant 2	4.42	3.2	5.13	2.15	15.52	male	full	4/4	student
Participant 3	0.44	0.51	1	2	4.35	male	full	4/4	teacher
Participant 4	5.25	1.13	0.29	1.48	8.15	male	full	4/4	teacher
Participant 5	3.37	1.09	0.35	1.09	5.9	male	full	4/4	teacher
Participant 6	0.43	1.11	0.49	2	4.03	male	low vision	4/4	teacher

#	Task 1	Task 2	Task 3	Task 4	Total Time	Gender	Blindness Type	Completed Task	Profession
Participant 7	2.01	0.43	1.26	1.14	4.84	male	full	4/4	teacher
Participant 11	0.41	2.1	1.6	4.11	8.22	male	full	4/4	teacher
Participant 13	0.55	0.4	0.12	0.55	1.62	male	full	4/4	teacher
Participant 15	1.5	0.21	0.36	1.1	3.17	Female	full	4/4	teacher
Participant 17	0.55	0.39	0.4	1.16	2.5	Female	low vision	4/4	teacher
Participant 19	0.15	0.12	1.21	1.2	2.68	male	full	4/4	teacher
Participant 21	0.33	1.31	0.31	0.55	2.5	male	full	4/4	teacher
Participant 23	1.02	0.29	3.05	0.3	4.66	male	low vision	4/4	student

Table 2 Instagram Results

#	Task 1	Task 2	Task 3	Task 4	Total Time	Gender	Blindness Type	Completed Task	Profession
Participant 8	0.52	2.37	0.18	0	3.07	male	full	3/4	teacher
Participant 9	0.13	1.12	0.16	0	1.41	male	full	3/4	teacher
Participant 10	0.47	0.37	0.23	1.1	2.17	male	full	4/4	teacher
Participant 12	2	0.28	1	1.25	4.53	male	full	4/4	teacher
Participant 14	0.2	0.15	0.9	0.19	1.44	male	full	4/4	teacher
Participant 16	0.19	0.15	0.18	1	1.52	Female	full	4/4	teacher
Participant 18	0.29	0.23	1.48	0.56	2.56	Female	low vision	4/4	teacher
Participant 20	0.18	0.8	0.12	0.22	1.32	male	full	4/4	teacher
Participant 22	0.28	0.17	1.1	2.1	3.65	male	full	4/4	teacher
Participant 24	1.5	0.48	0.54	1.04	3.56	male	low vision	4/4	student
Participant 26	0.44	0.26	1.02	0.58	2.3	male	full	4/4	student
Participant 28	0.23	0.13	0.15	0	0.51	male	full	3/4	student

For the statistical analysis of the results that are obtained from the experiment, null and alternate hypotheses were made.

Alternate hypothesis H_1: There is a difference in the Usability of Facebook and Instagram websites.

Null hypothesis H_0: There is no difference in the Usability of Facebook and Instagram websites.

For significance testing of data sets, normality is being measured firstly by using the shapiro-wilk test for normality on the data sets of Facebook and Instagram. According to this normality test, the p-value obtained from this test on Facebook results is $1.259e^{-12}$ and for Instagram p-value is $2.512e^{-07}$. Data present in both the data sets have a p-value < 0.05, which means that the data is not normal. The proving of the developed hypothesis t-test is being applied to both data sets. These test results by giving a p-value of $1.864e^{-06}$ and $4.463e^{-08}$ for Facebook and Instagram, respectively. After looking at the p-values, which are less than 0.05, the null hypothesis H_0 is accepted, There is no difference in the usage of Facebook and Instagram websites by visually impaired people.

Efficiency is a measurement metric for how much time each participant takes to complete each task on the websites of Facebook and Instagram. For comparing the efficiency metric as a standard, one sighted participant performs all the tasks of Facebook and Instagram websites using the JAWS screen reader tool, and its efficiency is compared to all the participants. Details of standard efficiency are as follows:

Table 3 Standard Efficient Time

	Task 1 Search	Task 2 Follow Request	Task 3 Timeline	Task 4 Block	Total time
Facebook	0.26 mints	0.25 mints	0.10 mints	0.36 mints	1.38 mints
Instagram	0.23 mints	0.25 mints	0.25 mints	0.25 mints	1.36 mints

By comparing the time of every participant with the standard time, it is found that participant 13, who evaluates the Facebook website, is the only one closest to the standard time. While in the evaluation of the Instagram website, participants 8, 12, 18, 22, and 24 are far from the standard.
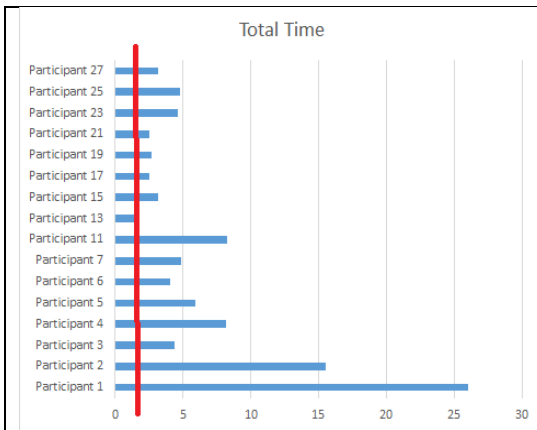

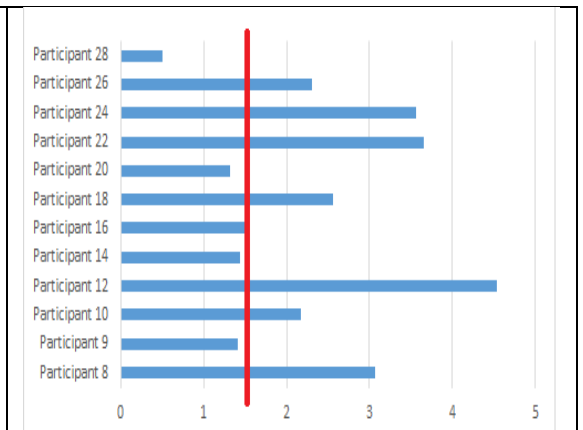Figure 3 Comparison with Standard time of Facebook

Figure 4 Comparison of Standard Time of Instagram

Effectiveness is a point at which a user can efficiently complete a task. In this experiment, effectiveness can be measured by looking up the number of completed tasks in table 1 for the Facebook website and table 2 for the Instagram website. After the analysis of the results, it is found that participant 1 cannot complete all the tasks and completed only 2 tasks out of 4. Participant 1 cannot complete the timeline and blocking task while using the Facebook website.

Participants 8, 9, and 28 cannot complete all the tasks while using the Instagram website. These participants cannot perform the blocking task on the Instagram website as they say that the popup that appears to block a user is not accessible.

In this section, the problems which are identified after the execution of the experiment with visually impaired people are described. The usage problems of Facebook and Instagram are discussed in this section, and some additional issues are also identified during the tasks performed by the participants.

One common problem while executing this experiment is that the detection of the image is a major challenge for people with visual impairments. The alternative text is not feasible for detecting the image using screen reading tools like JAWS. Most of the participants use an external keyboard while using Facebook on the laptop. Most participants say that the desktop interface is not much effective in terms of usage compared to the mobile interface of Facebook. The mobile interface of Facebook is not much compatible with the JAWS screen reading tool as the mobile interface of Facebook, so visually impaired people use the URL https://www.m.facebook.com. Following are the problems that are faced by visually impaired people that are identified after the complete execution of the experiment:

i. Participants attached an external keyboard to the laptop to perform the task of evaluating Facebook using the JAWS screen reader.
ii. Some participants face difficulty searching for a friend on Facebook through its search bar.
iii. While some of the participants who can successfully perform searching cannot get out of the search section.
iv. Participants cannot detect images due to their insufficient alternative text, which may define their description of the image.
v. Cannot go back to previous sections.
vi. When the GUI of websites changes, it is difficult to use the new interface.

Other than these specific problems, some of the general problems are also identified, including the sequential movement through JAWS, which consumes more time. Visually impaired people find difficulty when the interface of the website is updated and the navigation changes.

Instagram is a new-age thing. During the experiment, people with visual impairment also used Instagram as another social sites. Very few of them did not use Instagram ever. Instagram is a different kind of site as we compared it to Facebook. Its interface is entirely different and is more of a pictures-oriented site. Problems that are identified after the execution of the experiment are as follows:

i. Most participants attached an external keyboard to the laptop for their ease of use.
ii. Some participants did not know how to access the popup that appears on Instagram while blocking a user.
iii. Another problem regarding the popup is that after accessing the popup, the participant did not get out of that popup and got stuck in a loop.
iv. On Instagram, some of the elements are not labeled, due to which visually impaired people cannot understand the purpose of that element and its usage.

During the experiment, it is found that most of the visually impaired people have interacted, with Instagram, but few have not used it before. Instagram is more of a photo-centric application which means that it consists of media more than text which makes it a screen reader difficult to access it.

Web accessibility means that all kinds of websites in the world should be accessible by people having different abilities and easy to use without facing any difficulty. Social networking websites are the most widely used by people with different abilities due to various standards and guidelines. These standards and guidelines include W3C standards [16], and AFB's Social Media Accessibility Standards, founded by the American Foundation for blinds. They work

to educate visually impaired people and do research as well [17]. Another de facto standard includes web content accessibility guidelines WCAG [3] which are explained below.

Web content accessibility guidelines (WCAG) are known as the de facto standard, which must be applied to every type of website. WCAG guidelines allow the website to make them accessible to people with various disabilities. These disabilities include visual impairments, hearing impairments, and moving disabilities. WCAG is divided into four principles: operable, robust, perceivable, and understandable. Perceivable in WCAG says that the material and components of the interface must be presentable to its users. The alternative text must be provided to any type of non-text material, for example, images and graphical objects. Operable in WCAG says that the modules present in the interface and the navigational components must be operable by their users. This principle further describes that all the content present on the interface must be accessible through the keyboard. Websites or applications make it easier to find the content and to navigate its users. Headings and labels must be described that show their purpose on a webpage. The page of the website must be titled that describes their purpose. Understandable in WCAG says that the information on an interface and the action of the interface should be understandable by its users. This principle is further divided into many guidelines, which say that a web page must appear and operate predictably. Perceivable in WCAG describes the interpretation of the contents present on an interface by each user. This principle further explains that the content on the interface should be compatible with the current use such as web browsers, API's and future users. WCAG has three stages of conformance: Level A, Level AA, and Level AAA. Level AAA is the top level of conformance, thus means that to reach this level all principles and all requirements must be fulfilled [1].

Through the literature, it is found that the WCAG is not enough. Following are the limitations of WCAG that are found in the literature.

- WCAG ensures that the websites are readable by screen readers, not ensure their accessibility to visually impaired people [18].
- Visually impaired people face many problems in navigation and search. These issues are not conforming to WCAG [3] [9].
- WCAG depends on AJAX, which produces many accessibility problems for visually impaired people [19].
- [2] Shows that the problems in 13 websites, 50% of problems did not conform to WCAG.

As can be seen in the literature, WCAG is not enough. Many issues occur while using a website. It is found that on Facebook, navigational problems and searching problems have been occurring, and these problems or criteria do not conform to WCAG. In another survey of multiple websites, it is found that the problems after the evaluation of websites only 40% of them conform to WCAG, and the rest have no link to the criteria of WCAG [20], [21]. The problems identified during and after the experiment, few of these problems are also found in the literature and also in the de facto standard WCAG. In this section, the identified problems are compared with the existing guidelines and also with the literature.

Table 4 Comparison of Problems

Problems	WCAG (2.0)	Literature
FACEBOOK		
Attaching an external keyboard	2.1.3 all the elements should be operable through the keyboard / 2.1.2 no keyboard trap /	-

	Assistive technology (use the alternative keyboard)	
Searching difficulty	-	-
Cannot get out of the search section	-	-
Cannot go back to previous sections	-	-
Changing the GUI makes it difficult to use	-	-
Cannot detect image	1.1 provide text alternatives for all the non-text content	-
INSTAGRAM		
Attaching an external keyboard	2.1.3 all the elements should be operable through the keyboard / 2.1.2 no keyboard trap / Assistive technology (use the alternative keyboard)	-
Searching difficulty	-	-
Cannot get out of the search section	-	-
Cannot go back to previous sections	-	-

The experiment was conducted to find out the problems that are faced by visually impaired users while using Facebook and Instagram are identified. Then the identified problems are mapped with the existing literature and guidelines. Of a total of 10 problems, 6, are mapped with the existing literature and guidelines, and for the left, 4 new guidelines are proposed.

Table 5 Proposed Guidelines

Problems	Proposed Guidelines
Changing of GUI makes it difficult to use	Make sure while changing the interface, the primary navigation should not change.
Searching Difficulty	Control keys should be mentioned for ease of use by visually impaired people.
Cannot get out of the search section	The keyboard arrows button should work for the entry and exit of every section of the page
Cannot go back to previous sections	The keyboard arrows button should work for the entry and exit of every section

Now, let's explain the proposed guidelines in detail:
1. In social networking websites that are visually rich, when the GUI of these websites is updated, some changes are made concerning color scheme, navigation design, and button style. When visually impaired people use the updated interface of the website, they faced many difficulties in accessing and using it.
2. Searching should be easy as the users can easily go to the search bar as the control keys should be mentioned for ease of use by visually impaired people.
3. Screen reading tools like JAWS are used with the help of a keyboard. It is necessary for a website that every content present on the website should be accessible and used through the keyboard. The problem faced is not getting out of some sections of Facebook due to which a user gets trapped.

Table 5 explains the problems identified after the evaluation of Facebook and Instagram are the problems found in Facebook Usability that are not mapped to the existing guidelines and literature. So, it is clear that Facebook has low efficiency compared to Instagram because the problems found from Instagram are mapped to existing literature. Still, the problems from Facebook are new, so there is a need to propose new guidelines for them.

From the proposed solution, it is once again clear that Facebook has more Usability problems than Instagram, and the developed hypothesis H_1 again proved that there is a difference in the Usability of Facebook and Instagram for visually impaired people. The goal of this research is to provide a consolidated set of guidelines that are generic-specific for social networking websites. So, in the end, a set of guidelines for social networking websites is presented, for people with visual impairments.

The following are the specific guidelines for social networking websites that can improve the Usability of social networking websites for visually impaired people.
i.   All the elements should be operable through a keyboard.
ii.   All the elements should be labeled.
iii.   Alternative text should provide for all non-text elements.
iv.   Make the content as simple as possible.
v.   The primary navigation of the website should not change while updating the GUI.
vi.   The arrow buttons of the keyboard should be able to enter and exit any page section.

After proposing a set of guidelines for social networking websites, an exemplary mock interface was designed specifically for people with visual impairments. This interface has more text as well as its primary navigation. Visually impaired people found more difficulty in search other than any other task. This interface is suggested in a way that is connected to a keyboard. Specific key controls are applied on this interface, so the user press the controls key going to that section. This interface also describes text for an image as well.

Figure 5 Mock Interface of Facebook Screen 1	Figure 6 Mock Interface of Facebook Screen 2
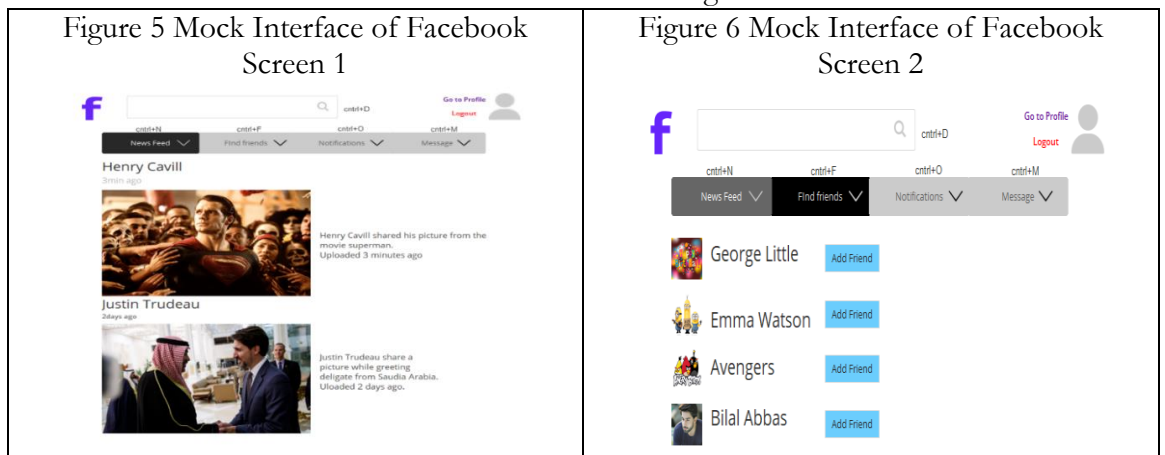
This mock interface is designed especially for people with visual impairments. This interface allows a user to add text to elaborate the image so the screen reader tool can read the text, and visually impaired people can understand the image. The interface is connected to the keyboard, and control keys should be mentioned on the screen, so it is easier for the visually impaired user to go to each section of the page. This interface is a replica example of Facebook because the problems occur more on Facebook than on Instagram.

Conclusion.

In the end, a set of guidelines is presented, specifically for social networking websites for the better Usability of visually impaired people. For developing these genre-specific guidelines, an experiment is executed to find out the Usability problems faced by visually impaired people while accessing Facebook and Instagram. After the Usability valuation of Facebook and Instagram, problems are identified faced by visually impaired people while using

Facebook and Instagram. Then these problems are mapped with the existing literature and guidelines. Some of those problems are mapped with the existing ones, but some new guidelines are proposed.

The new guidelines are proposed against the problems identified by Facebook. This study concludes that Facebook's Usability in terms of efficiency and effectiveness is low compared to Instagram. It is much different in the Usability of Facebook and Instagram; more issue is found on Facebook than on Instagram. In the following subsections, we discuss key contributions, limitations, and future work.

The limitations of this work in the lack of participants and fewer tasks that are used to evaluate Facebook and Instagram. In this study, only 2 social networking websites, Facebook and Instagram are evaluated with 28 participants and tasks for both Facebook and Instagram. This study was limited due to the unavailability of visually impaired participants.

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