Analysis of The Effectiveness of Web Portals used in Academic Institutions of Tribhuvan University

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Abstract
For many academic institutions, the website has been used as a tool for inter- and intra-organizational information exchange. Since universities and colleges have started to use their websites as information centers, effective website design and functionality are very important for higher education institutions to attract students and share information regarding academic activities. The researcher observed various web portals based on the technology used, user perspective, and compatibility of some academic institutions observing that many students spent a lot of time on the Internet than in libraries. A checklist is formed to collect data from the websites and explains it in different tables and figures. Thus, the study is designed to provide insights into ICT colleges' websites' effectiveness.

All the websites are based on PHP, mostly WordPress, The use of Bootstrap is quite good, comparatively websites have slow page loading speeds due to the lack of code and image optimization though valid and standardized codes were used. The use of media queries was very impressive but the lack of proper placing of CSS codes made it visually poor on some of the devices. This research explores the effectiveness of portals and websites in academic institutions and some recommendations are made based on the findings.

Introduction

The World Wide Web (WWW) is a network of online content that is formatted in HTML and accessed via HTTP. The term refers to all the interlinked HTML pages that can be accessed over the Internet. The World Wide Web was originally designed in 1991 by Tim Berners-Lee while he was a contractor at CERN (Techopedia, 2019). Tim Berners-Lee, before coming to CERN, worked on, among other things, document production and text processing. He developed his first hypertext system, "Enquire", in 1980 for his use (although unaware of the existence of the term HyperText). With a background in text processing, real-time software, and communications, Tim decided that high-energy physics needed a networked hypertext system and CERN was an ideal site for the development of wide-area hypertext ideas. Tim started the World Wide Web project at CERN in 1989. He wrote the application on the NeXT along with most of the communications software (Berners-Lee, Cailliau, & Groff, The world-wide web, 1992). In 1990, Tim Berners-Lee of CERN (the European Laboratory for Particle Physics) developed the World Wide Web and several communication protocols that form the backbone of the www. According to the current conjuncture in the world, especially learning is based on learning and life-long learning. The internet is an infrastructure and the web resources are the services on the internet, which has gained more popularity in many countries across the world, and in our country Nepal, is no exception. The websites and web-based resources are the media of communication and sources of information have enabled students, researchers, business information seekers, and information professionals to access information to enhance their work and communicate effectively.

According to SSDP (2009-2013) - Provide ICT teaching-learning materials for effective teaching interactive approaches. Which deals with the interactive materials and classroom environment including video, online/offline modules, or kits for teaching and enhancing teacher's capacities and resources for teachers. Nowadays, there is the need for web resources like websites, e-library, online education systems, and distance learning systems for educational institutions to have a reliable, effective, and attractive web presence is increasing as online technology is becoming an important part of the educational process. Students have adopted and continue to use online and shared information retrieval for their academic and research work at the expense of or without considering the importance and the quality of the traditional information centers as observed by the researcher. However, merely using the web resources was not to guarantee quality and good information. Even though the Internet has a large amount of information, relevance, quality, and authenticity should not be neglected. The question to ask then is why do the students continue or prefer using web-based resources for information? Should the importance, quality, and authentic information derived from the library be relegated in place of the Internet? The researcher observed the availability and usability of the web portals based on the technology used, user perspective, and compatibility of some academic institutions observing that many students spent a lot of time on the Internet than in libraries. Thus, the study is designed to provide insights into ICT colleges' websites' effectiveness. The research objective is to help educational institutions to achieve their goals by designing effective websites.

This study aims to combine the variety of services provided by colleges with the vast resources available via the Internet and digital platforms. The purpose of this research is to considerably improve the effectiveness of service delivery with a focus on college students. Additionally, it makes a significant contribution to the compilation of material that already exists describing the complex web landscape provided by many academic institutions. The findings obtained from this study have the potential to provide significant support to

policymakers, teachers, curriculum creators, researchers, universities, web developers, and students in general, enabling the creation and best use of online portals. Through a detailed examination of the prevalent patterns and practices in the use of web portals among educational institutions, this study aims to clarify the present trends in this field. The discoveries made here have the potential to provide future academics thinking about doing research in related fields with direction. In conclusion, this research is a crucial tool that can promote innovation and advancement in the field of web-based learning services to meet the changing demands of higher education and its stakeholders.

Objectives of the study

Identifying the technologies used, security measures, and accessibility features used in the web portals is the main objective of this study.

Literature Review

The Internet Corporation for Assigned Names and Numbers (ICANN) was created in 1998 to perform technical coordination of the Internet. ICANN also lays the foundations for governance, creating capabilities for promulgating and enforcing global regulations on Internet use. ICANN leverages the capabilities of the Internet domain name system (DNS) to implement four mechanisms of governance: authority, law, sanctions, and jurisdictions. These governance-related features are embodied in seemingly technical features of ICANN's institutional design. Recognition of ICANN's governance mechanisms allows us to better understand the Internet's emerging regulatory regime (Klein, 2002).

Web 2.0, or the "read-write" web as Berners-Lee described it. It's the ability to contribute content and interact with other web users. It has dramatically changed the landscape of the web in a short time. It has much potential. For example, look at YouTube and MySpace, which rely on user submissions. Web 2.0 is a welcome response to web users, who want to participate in the information (Getting, 2007).

Web 3.0 (extending the vague nomenclature). By extrapolating Tim Berners-Lee's explanations, web 3.0 is "read-write-execute." This is difficult to envision in its abstract form. To illustrate, consider semantic markup and web services. Semantic markup refers to the communication gap between humans and computerized applications. One of the biggest challenges of presenting information on the web is that applications cannot provide context to data, and, therefore, can't understand what is relevant. Through the use of some sort of semantic markup (or data interchange formats), data could be put in a form not only accessible to humans via natural language but able to be understood and interpreted by software applications as well (Getting, 2007).

Mobile Technology was introduced during the 1980's. In the beginning, web technologies were used only by a few users to share information related to their academic work with their coworkers. But Today social media have become a part of daily life and billions of common people using web technologies overall the world (Technologies, 2015).

Tare some examples of web technologies include: Mark-up languages including HTML, CSS, XML, CGI and HTTP. HTML is the primary markup language that is used for Web pages. HTML tells the browser what to display on a page. CSS stands for cascading style sheets. Cascading style sheets provide the ability to change the appearance of text on Web pages.

Using CSS, one can also position elements on the page, make certain elements hidden, or change the appearance of the browser, such as changing the color of scroll bars in Microsoft Internet Explorer (Malakar, 2016).

The Internet was first introduced into Nepal in 1993 in a venture of the Royal Nepal Academy of Science and Technology (RONAST) and a private company, Mercantile Office Systems (MOS). The Indian Institute of Technology in Bombay had a UNDP-funded Internet connection through the Education and Research Network (ERNET) project, and RONAST set up a system whereby they could connect on a regular basis to ERNET in Bombay to transfer e-mail messages. The service was only for the use of RONAST's scientific community. The phone connection was of low quality and expensive because of the daily international call charges to Bombay, though, and the project soon ended (Montgomery, 2002).

In 1994, after RONAST ended its ERNET project, MOS acquired the technology and set up the first commercial e-mail service with a link to Australia. The MOS server connected several times a day to transfer messages. Subscribers at this time were mainly international organizations (Montgomery, 2002).

In 1995, a second company, World Link, set up a similar service at a lower price through a cheaper connection to Canada. Their only business was providing e-mail service, whereas MOS's e-mail service was only one of many aspects of its business. MOS focused to a greater extent on larger organizations willing to pay more for higher technical services and support. They were less geared towards individual clients. World Link filled this role. In response, MOS added interactive Internet access with a permanent leased line to Australia. They also acquired the rights to administer the .np domain name. World Link eventually followed suit, offering their own Internet access, again at a lower price. A third company, CAS Trading, entered the ISP market as well. Again, it was mainly international organizations that availed themselves of the Internet service (Montgomery, 2002).

Educational institutions were among the first organizations to develop websites. In their earlier days, the goal was to simply have a presence on the web. Now, many colleges and universities are attempting to include a strong content combined with information about the school and its educational resources (Weinstein, 1997).
Education websites need great attention in terms of their development. The website must appeal to the university's commercial interests, which are primarily the sources of presenting their objectives to the visitors and especially to those visitors who are interested in seeking information. It also aims to facilitate their prospective students and scholars by providing the proper guidelines on the website to help them accordingly. Nevertheless, of equal importance, a university website should serve the non-commercial information that is the need of its current students and faculty. Information like the complexities of curriculum choices and the information about the daily events and procedures that happen within a busy university campus. Therefore, usability is considered the key credentials of effective higher education website design (Mirfa Manzoor, 2012).
The most effective communication resources, computers, and the Internet are part of our daily life and have become one of the important tools in education. The Internet helps transfer information between different points, therefore, this satiation makes the Internet a very powerful information system. People in different age groups and jobs, students and academicians who do scientific research and prepare projects prefer using the Internet

because it is the easiest, fastest, and cheapest ways of accessing necessary information (Cloud, 1989).

Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use (Standardisation, 1998).

Methodology

A mixed-method research method is used in this study, including both quantitative and qualitative approaches. As a general rule in such research, both quantitative and qualitative approaches were taken into consideration when appropriate. Under the quantitative research design, the descriptive research method was selected for this research. There are 15 partial TU constituents and affiliated ICT colleges nationwide, among 15 colleges, 5 colleges (Sanothimi Campus, Hanumanteshwor Campus, Dadeldhura Campus, Siraha Campus, Central College of Tribhuvan University) do not have web-based resources. So the researcher selected 10 colleges (Adikavi Bhanubhakta Campus, Bhalkumari College, Butwal Multiple Campus, Janajyoti Multiple Campus, Janamaitri Multiple Campus, Kabhre Multiple Campus, Mahendra Ratna Campus, Sukuna Multiple Campus, Surkhet Campus, Triyuga Janata Multiple Campus) as the field of research for this topic using nonprobability's purposive sampling method. in this research, the primary and secondary tools were used for data collection for the research, but due to the lack of adequate knowledge of users about the development of the website environment primary data collection tool was useless. So, the researcher prepared a checklist for elements features integrated into websites for this research by using secondary sources of data through visiting colleges to find out the effective use of web portals in their institutions in ICT colleges. Checklists for data collection are extracted from the Web Developer Checklist from webdevchecklist.com to collect various data from the websites.

Result and Discussion

Various tools to validate and check the efficiency of the elements of the website

Code validation is the process of checking that the coding of a web page complies with the standards and recommendations set by the World Wide Web Consortium (W3C) for the web. Code validation helps to produce clean code. Web page HTML (Hyper Text Markup Language), Cascading Style Sheets (CSS), hyperlinks (also known as links), and accessibility can be validated. Code validation is done through the use of HTML validators, Cascading Style Sheet validators, link checkers, and accessibility validators available on the Net or as downloadable software. Each type of validator will be covered in this article and the resulting benefits of clean code explained.

Code validation helps eliminate problems (such as incorrect HTML document structure) so there is a better chance of the website being viewed by all on the internet as intended. The W3C has set standards that the browser programmers are to follow. Some browser is not fully compliant but if we validate the website code, basic coding errors will be eliminated that will cause problems when displaying the web page and result in a web page with clean code.

If we validate our code, it will make it easier for:

- Search engines to index our pages = Search engine optimization
- Text readers to convey our information to the visually impaired = Accessibility
- Those using special devices to surf the web = Accessibility

W3C Markup and CSS Validation Service from W3C

The Markup Validation Service is a validator by the World Wide Web Consortium (W3C) that allows Internet users to check HTML and XHTML documents for well-formed markup. Markup validation is an important step towards ensuring the technical quality of web pages (W3C, About The W3C Markup Validation Service, 2013). The W3C CSS Validation Service can be used to check the correctness (validity) of W3.CSS.

HTML Validator from OnlineDomainTools

It is a tool checks code of web pages against the HTML5 standard using W3C validation engine called The Nu Html Checker. Using this engine guarantees the results are as good as possible and really reflect the HTML5 standard requirements.

Pingdom from SolarWinds

Pingdom offers cost-effective and reliable uptime and performance monitoring for your website. With Pingdom, you can monitor your websites' uptime, performance, and interactions for a better end-user-experience (Pingdom, 2019).

Wappalyzer from wappalyzer.com

Wappalyzer is a cross-platform utility that uncovers the technologies used on websites. It detects content management systems, e-commerce platforms, web frameworks, server software, analytics tools and many more (wappalyzer, 2019).

whatfont tool from Chengyin Website

WhatFont is a tool to get font information about the text easily while hovering over the text content used in websites. We can use browser add-ons or extensions to use this tool.

PageSpeed Insights from Google

PageSpeed Insights is a tool developed by Google Inc. PageSpeed Insights (PSI) reports on the performance of a page on both mobile and desktop devices and provides suggestions on how that page may be improved. PSI provides both lab and field data about a page. Lab data is useful for debugging performance issues, as it is collected in a controlled environment. However, it may not capture real-world bottlenecks. Field data is useful for capturing true, real-world user experience - but has a more limited set of metrics (Google, 2019).

Image & Link Analyzer from imNinjas

It is an SEO tool to check image sizes, alt text, header checks and so on. This tool is mainly used to check the quality of the image, uses of alt tag, and all about the links used in websites.

Check a Site from PowerMapper:
It is a tool developed by PowerMapper that checks the accessibility, broken links, browser compatibility, search engine optimization. It also checks the usability of websites and HTML standards using 700+ standards-based checkpoints.

Online Broken Link Checker from BrokenLinkCheck

This is a free online Checker or Validator. It helps us to find the condition fo hyperlinks and it will also show to that where exactly those broken references are located in our HTML code. The unique feature makes our checking service stand out problem detection tools and makes it very convenient for a webmaster to find bad URLs and clean them in no time. It's never been so easy to locate and fix dead weblinks.

Character encoding detection from Masaryk University

It is a tool for detecting the character encoding of a text in a known language. The language of the text has to be specified as an input parameter so that the correspondent language model can be used. The package contains models for a wide range of languages. In general, it should be more accurate than character encoding detection algorithms with no language constraints (Suchomel & Pomikalek, 2011).

Meta Tags Analyzer from Search Engine Reports

This tool helps us to decide which tag can get our website high ratings and which tags are not very appropriate by analyzing the title, the description, the keywords and media and social tags in relation to the information available in the respective website. It can be used by the browsers to check what information regarding the website needs to be displayed and what keywords should be used. The keywords used in the websites are checked for consistency. It seems if they match the content of the website, how many times they have been used and where they have been used- the title or the description. It will give a detailed analysis of the web pages to the webmasters and allow them to analyze the respective pages and their meta tags in detail.

Alexa Traffic Rank from Alexa

Alexa Traffic Rank from Alexa is a tool to collects data on internet browsing behavior and transmits them to the Alexa website, where they are stored and analyzed. This is the basis for the company's web traffic reporting, including its Alexa Rank. According to its website, Alexa provides web traffic data, global rankings. It provides browser extension to check the traffic rank of the websites.

Google Cache Checker from SmallSEOTools

Google Page Cache Checker by Small SEO Tools instantly checks the Google page cache of your web pages. This is a quick and easy way to check if the pages on your website are included in Google's search index. This tool will tell you if Google knows such web page exists and they have added it to their index, so it will be made visible in Google's search results.

Google Index Checker from Search Engine Reports

Search engine reports offer Google index Checker Tool which allows us to check how many webpages of our website are indexed or not indexed.

Use of SSL (Secure Socket Layer)

Distribution of the use of SSL in websites			
S. N.	**Use of SSL**	**Numbers**	**Percentage(%)**
1	Yes	3	30
2	No	7	70
	Total	**10**	**100**

SSL (Secure Sockets Layer) is the standard security technology for establishing an encrypted link between a web server and a browser. This link ensures that all data passed between the web server and browsers remain private and integral. The following table shows the distribution of using SSL on websites.

We can clearly see that most of the college's websites are under average about performance, registered domain names are somehow satisfactory but some domain names are registered under unofficial, personal names and credentials. There is a lack of using SSL on websites, most colleges are registered under educational websites and organizational website, which is quite impressive.

Testing quality of code

A website is always being an important source of information. It is not possible to get full information without using electronic media, so here come websites. To set up an effective website, one needs content, skill to manage that content in an effective way, flow of content, understating of the various development environment, structure, designing, programming, coding and on-demand maintenance of the web applications. So following topics cover the testing of code used in various colleges websites.

Correct HTML doctype

When authoring document is HTML or XHTML, it is important to add a doctype declaration. This makes sure the document will be parsed the same way by different browsers. The following table shows the distribution of using correct HTML doctype in websites.

Distribution of using correct HTML doctype in website			
S. N.	**Use of correct doctype**	**Numbers**	**Percentage(%)**
1	Yes	10	100
2	No	0	0
	Total	**10**	**100**

We found that web developers are quite aware of using correct doctype in the websites, which makes a website standard and error-free code.

Correct character set

ASCII was the first character encoding standard (also called character set). ASCII defined 128 different alphanumeric characters that could be used on the internet: numbers (0-9), English letters (A-Z), and some special characters like, ! $ + - ( ) @ < > . Distribution of using correct character set can be explaining in pie- chart as given below.
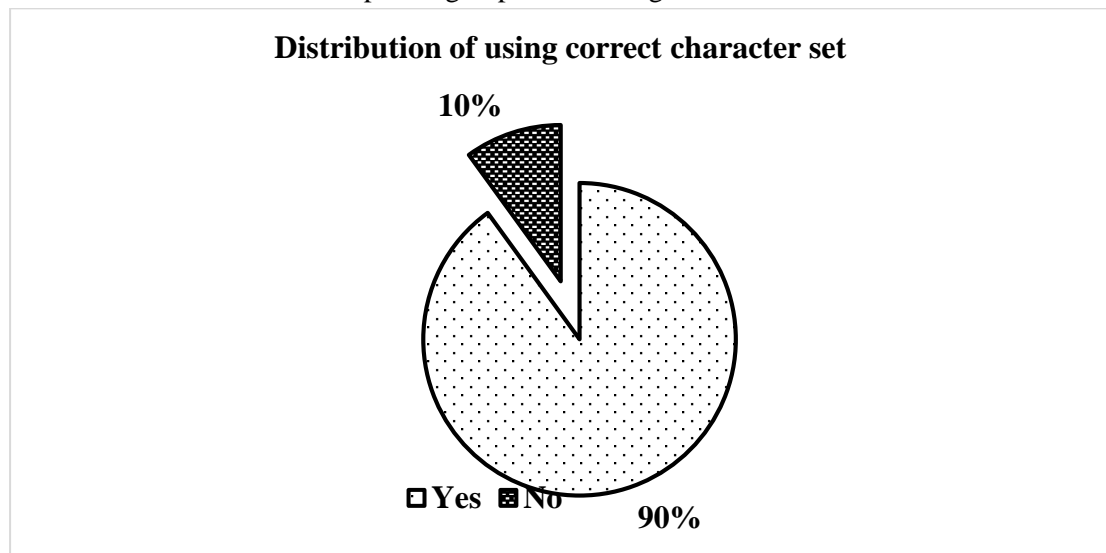

Distribution of using correct character set

Maximum websites use the correct character set to specify the encoding used for HTML. If it is not defined properly, the content was incorrectly interpreted. Likewise, the website which does not use the correct website has the problem of not understanding the Nepali Unicode characters corresponding with the web server.

Viewport configuration

The viewport is the user's visible area of a web page. The viewport varies with the device and will be smaller on a mobile device than a computer screen. Before introducing small devices like cellphones, web pages were designed only for large screens, and it was common for web pages to have a static design and fixed size. The following bar diagram shows the distribution of using proper viewport configuration.

Distribution of using proper viewport configuration
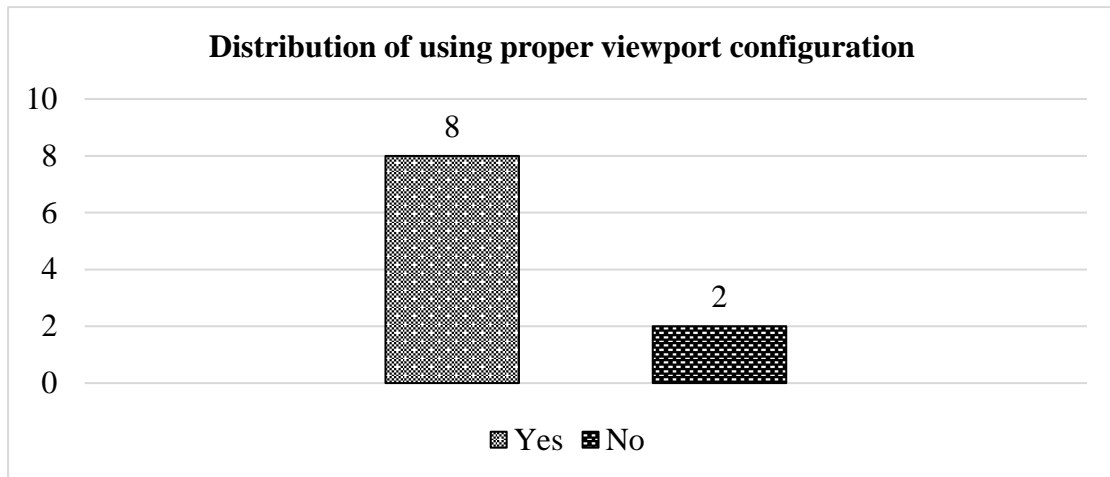
Distribution of using proper viewport configuration

We found that most of the colleges use viewport configuration which is quite good practice while creating websites. Currently, most of the user uses tiny handheld devices like iPad, cellphones to surf the internet for various information. To make compatible for content display, the use of proper viewport is mandatory.

Meta description

The meta description is an HTML attribute that provides a brief summary of a web page. Search engines such as Google often display the meta description typically up to 160 characters long in search results where they can highly influence user click-through rates (MOZ, 2019). The following table shows the distribution of using the proper meta description.

A maximum number of colleges are not using the meta description to summarize their page

Distribution of using proper meta description

S. N.	Use of proper meta description	Numbers	Percentage(%)
1	Great	0	0
2	Good	1	10
3	Average	0	0
4	Fair	0	0
5	Poor	9	90
	Total	**10**	**100**

content and shows it in a search engine in search results with a searching phrase. Only a college is using meta description but it is not perfectly bound with SEO standards. It might be the cause of carelessness and lack of knowledge of search engine optimization techniques.

HTML validation

Validation is the process of checking something against a rule. A validation program compares the HTML code in the web page with the rules of the accompanying doctype and tells we if and where those rules have been broken. The following bar diagram shows the distribution of using valid HTML tags on websites.

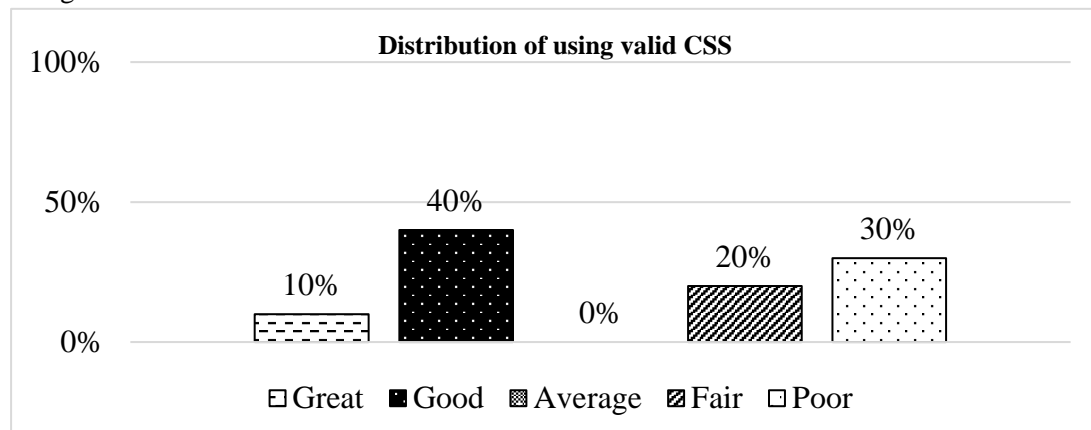**Distribution of using valid HTML tags**
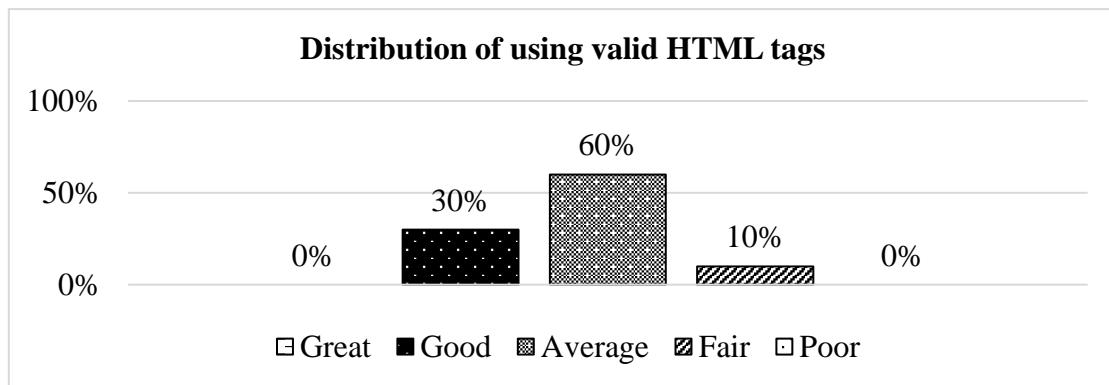
Distribution of using valid HTML tags

Most of the college website has average use of valid HTML code, they have minimum code errors while validating such HTML pages. Some colleges have used valid HTML codes but none of the colleges have used the best valid HTML codes so far. To maintain the quality of our website and webpages, one should be very careful with using valid HTML codes, there is no problem for displaying the content using no valid HTML, but the use of valid HTML made the website more accessible and qualitative.

CSS validation

HTML deals with the content of the websites where CSS maintains the layout of the website and creates websites user-friendly, and visually appealing with the help of various valid CSS properties available for the HTML tags. The following bar diagram shows the distribution of using valid CSS codes on the website.
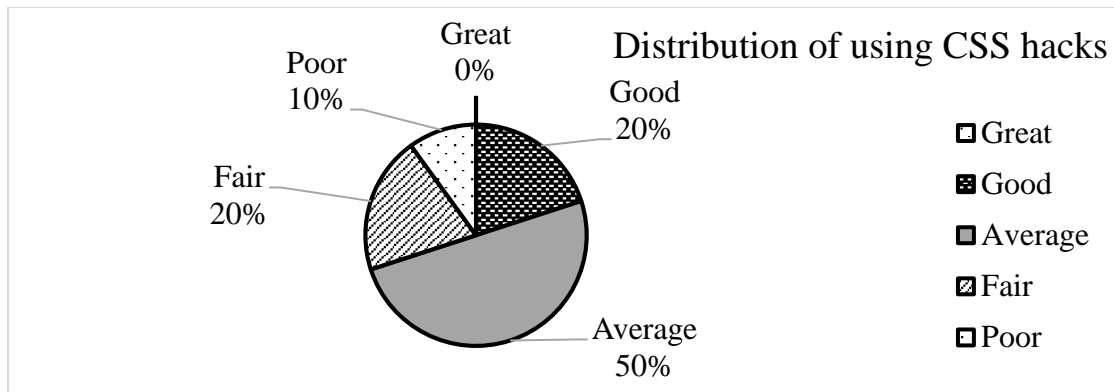

Distribution of using valid CSS

We can see that most college websites have good use of valid CSS codes to maintain the layout design of the websites which is quite good enough. Although comparatively little bit more websites have very poor use of valid CSS. Using invalid CSS in website designing does not affect the normal view of the websites but while integrating with JavaScript, SEO and media queries, one should use valid CSS codes for website designing.

Use of CSS hacks

CSS hacks is a coding technique used to hide to show the CSS based on the browser, version details, features, capabilities, and so on. Different browsers have different interpretations of CSS behavior and different levels of support for W3C standards. The following pie chart shows the distribution of using CSS hacks in the CSS files.
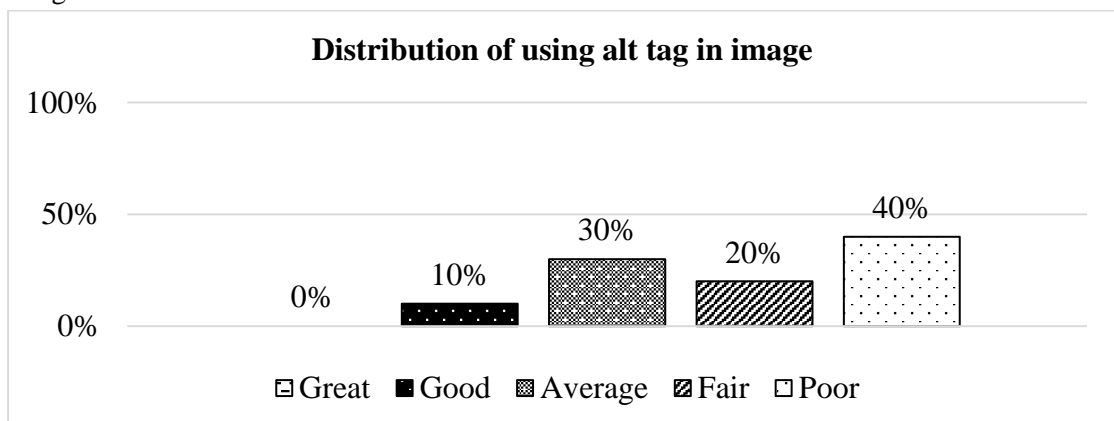
Distribution of using CSS hacks

In the above data, we can say a maximum number of websites have average CSS hacks while coding CSS properties to maintain design consistency over multiple browsers. The researcher found that there is still ample room to improve CSS hacking techniques on the websites. None of the colleges has great use of CSS hack.

Use of alt tag in image

Alt attribute in <img> tag provides alternative information for an image if a user for some reason cannot view it. The following bar diagram shows the distribution of using alt tags in an image used in websites.

Distribution of using alt tag in image

From the above table, we can see that websites have the maximum number of errors due to the carelessness of using all attributes in the image tag and it affects the ranking algorithm of the website for the search engine. A good alt attributes text to enhance the message of a website article or title searched in search engines. There is not a website that has great use of using the alt attribute in websites. It defines that the alt attribute is neglected while developing the websites.

Existence of broken links

Broken links are links that do not work. The reason may occur due to the following reasons:

- Carelessness while developing
- The link is no longer available
- The webpage was moved without a redirect being added

The following table shows the distribution of using broken links on websites.

Distribution of using broken links

S. N.	Existence of broken links	Numbers	Percentage(%)
1	Maximum	0	0
2	Average	0	0
3	Minimum	9	90
4	Null	1	10
	Total	**10**	**100**

We can see clearly that most of the websites have minimum broken links and only one website, it is free from broken links. Broken links can have a negative impact on our website's usability, quality, and ranking when search engines check the available links on the website. It's best practice to either remove or update the broken links.

Use of JavaScript

JavaScript is a lightweight interpreted or just-in-time compiled scripting language. It is the programming language of HTML and the Web where JavaScript controls the dynamic behavior of the web pages. The following bar diagram shows the distribution of using JavaScript on the websites.
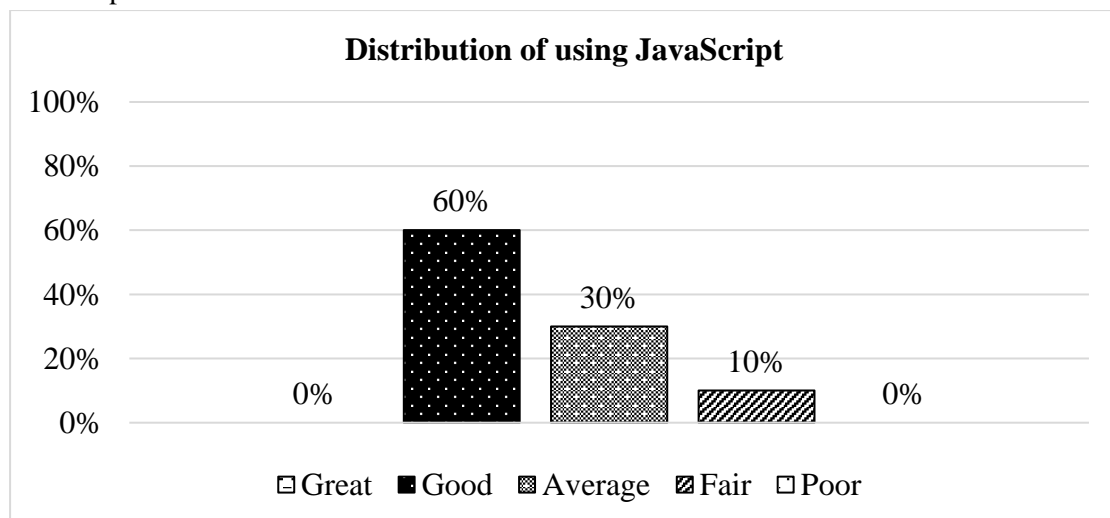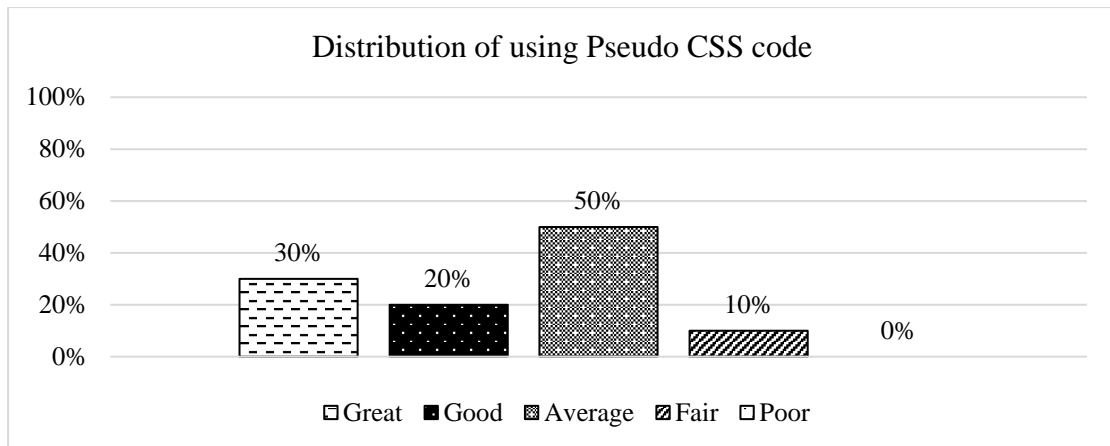

Distribution of using JavaScript

We see the majority of the websites use good use of JavaScript on the website. Most of the websites use JavaScript bundled features available on the Bootstrap framework. Controlling user entries in forms, like contact form and other user-related actions were controlled by JavaScript. There is not a single website that uses great JavaScript. There are very few websites that use a custom JavaScript file for maintaining custom behavior on the website.

Use of pseudo-CSS code

A pseudo-CSS code is a technique used in CSS, it uses a keyword added to a selector that specifies a special state on the selected element(s). The following bar diagram shows the distribution of using pseudo-CSS code in the CSS files.

**Distribution of using Pseudo CSS code**

Distribution of using Pseudo CSS code

The above data exposes that half of the respondent websites are using average pseudo-CSS codes, which means average websites know how and why to use pseudo-CSS codes, there are still lots of classes of selectors where we can use this technique. Thirty percent of respondent websites have great use of pseudocode, which means the developer knows the behavior of user activities so well that users can interact with website contents easily.

Use of semantic language

Semantic elements have meaning with element names like header, form, table, footer, main, section, etc. whereas div and span are some non-semantic elements used in web development. The following pie chart shows the distribution of using semantic language in the HTML file.

Distribution of using semantic language
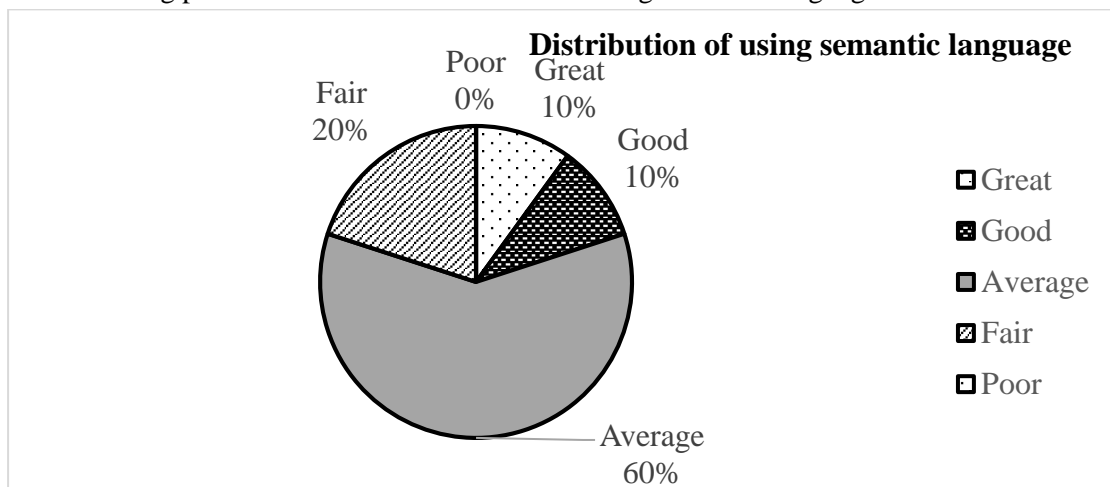
Distribution of using semantic language

In the data above data, we can see that the maximum website uses semantic elements to maintain the markup code and easy access to the content. And it provides various hooking techniques for styling website content. We have found that all the websites have used semantic elements.

Testing of website navigation

Use of main navigation

The main navigation or menu bar is where visitors find links to the important pages on our website. Having the right website navigation design is critical – it affects traffic, conversions,

and user-friendliness. Everything important on our website is connected to the site menu bar. The following bar diagram shows the distribution of using the main navigation on the website.
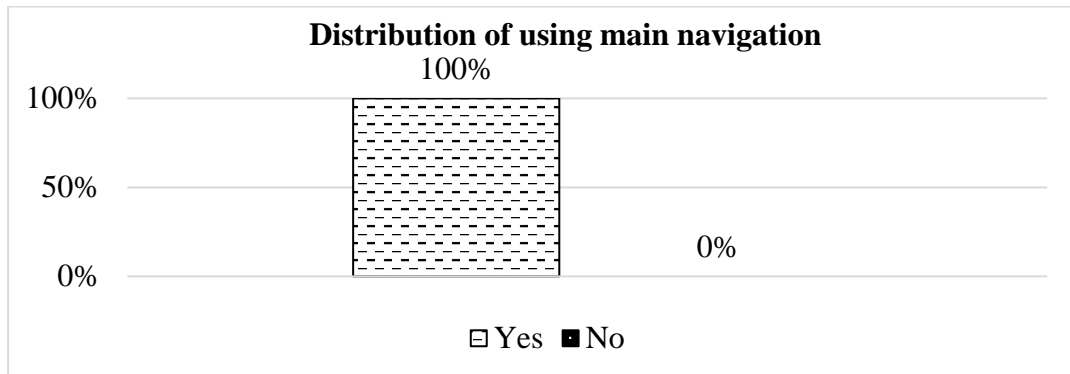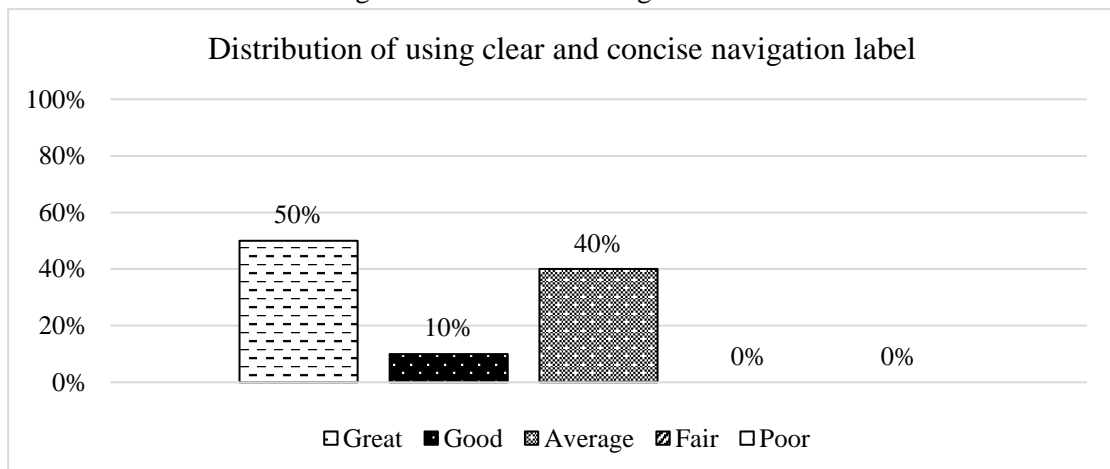

Distribution of using the main navigation

From the data above, all the websites have used main navigation, without main navigation users cannot navigate to all the links available on the website. So we found that all the respondent colleges' website has the main navigation via which all the links are navigated properly.

Use of clear and concise navigation label

The navigation label is the backbone of the website. A navigation label should be concise, a word if possible, and should be clear and meaningful to navigate the desired location. Large chunks of navigation may distract the user in different locations. The following bar diagram shows the distribution of using clear and concise navigation labels on websites.


Distribution of using clear and concise navigation label

In the data above we can see that the majority of the websites have great use of clear and concise navigation labels. Which made users navigate between the links and made the website user-friendly so far. There is not even a single website that has fair and poor navigation which means using a concise and compact menu is the priority for the users now. Responsiveness under main navigation is considered in most of the websites.

Link of logo with main landing page

One of the most common navigation standards is that when we click on the logo of our site we are taken to the Home Page of our website. When a user views a website and wants to go

to the home page there will have to be a link to the home page. The following pie chart shows the distribution of using the linked logo with the main page or home page.

Distribution of using linked logo with main page

No
30%

Yes
70%

☐ Yes
◼ No
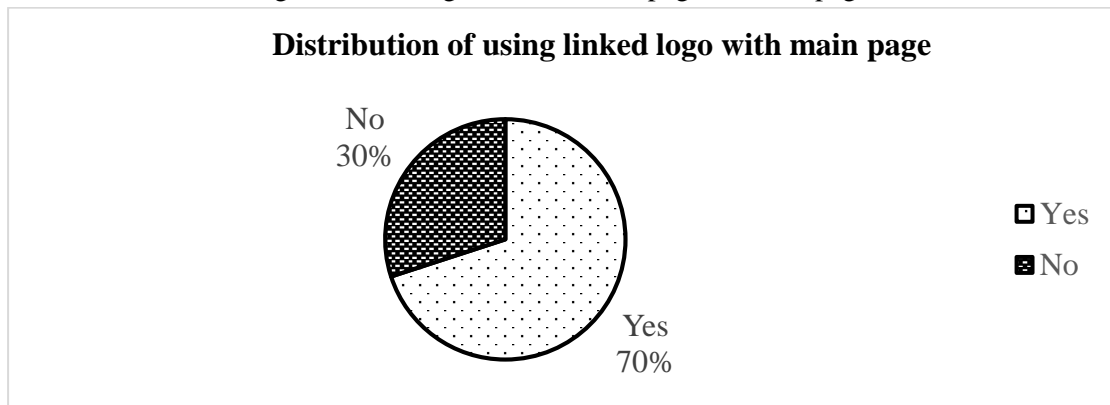
Distribution of using the linked logo with the main page

From the data above, we can clearly explain that the majority of the websites' logos are integrated with the main landing page of the website. There are only three websites that do not have any connectivity of logo with the main home page. The connection between the main organizational logo and the main landing page is more efficient than reducing a home link from the main navigation tab.

Use of site map

A site map is a list of all pages available on a website. It is a model of a website's content designed to help both users and search engines navigate the site. The following bar diagram shows the distribution of using site maps on websites.

Distribution of using site map

100%

100%

50%

0%

0%

☐ Yes ◼ No
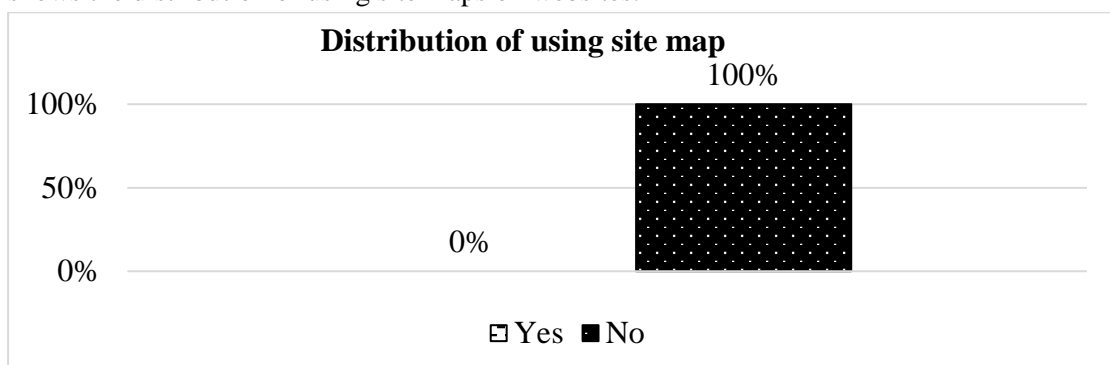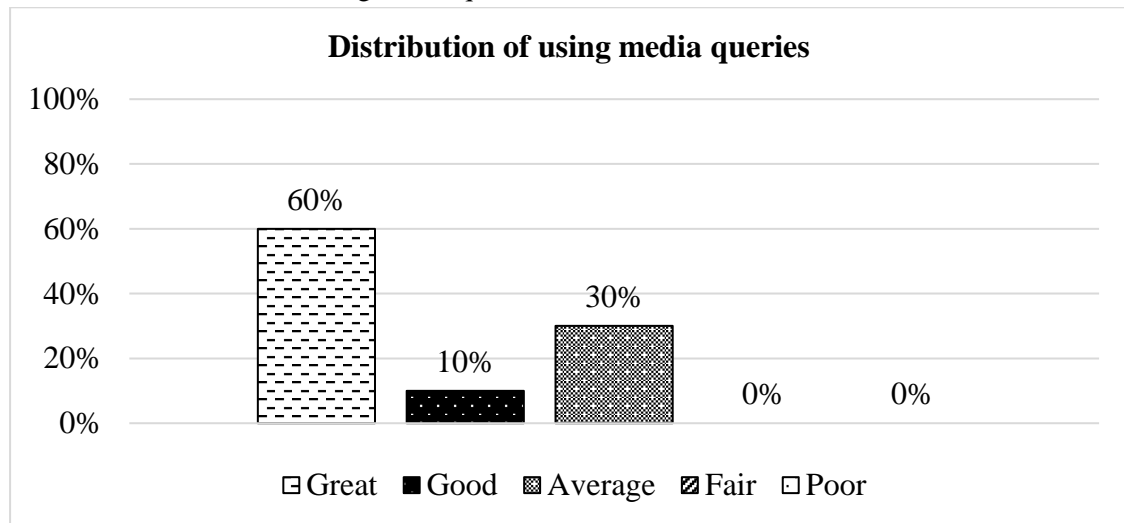
Distribution of using site map

From the above data, we can see that, there is not a website that uses a site map in their website, which means the developer may have some kind of carelessness or not aware of it, whereas it helps search engine crawlers index all pages on the site. In the context of search engines, the site map is also known as a sitemap.xml file. Site maps are especially important for sites that use Adobe Flash or JavaScript menus that do not include HTML links. Google introduced Google Sitemaps to help Web crawlers find dynamic pages, which were typically being missed. Bing and all other search engines also support this protocol.

Website responsiveness

Use of media queries

Media query is a CSS technique introduced in CSS3. It uses the @media rule to include a block of CSS properties only if a certain condition is true. Media queries are a popular

technique for delivering a tailored style sheet to different devices. Media queries check the width and height of the viewport, width, and height of the device, orientation (is the tablet/phone in landscape or portrait mode), resolution, and so on. The following bar diagram shows the distribution of using media queries in CSS files to maintain the screen view.

Distribution of using media queries

Distribution of using media queries

From the data above, we can say that the majority of the college's websites have great use of media query which means the developer has the knowledge and quench to show the website content in all the devices as possible. Three websites have an average use of media queries; it means media queries are integrated but not properly managed efficiently. There is a website that uses good use of media queries. Media queries are useful when we want to modify our site or app depending on a device's general type (such as a print vs. screen) or specific characteristics and parameters (such as screen resolution or browser viewport width).

Use of Bootstrap framework

Bootstrap is a free and open-source CSS framework directed at responsive, mobile-first front-end web development. It contains CSS- and (optionally) JavaScript-based design templates for typography, forms, buttons, navigation, and other interface components. The following pie chart shows the distribution of using the bootstrap framework on the websites.

Distribution of using Bootstrap framework
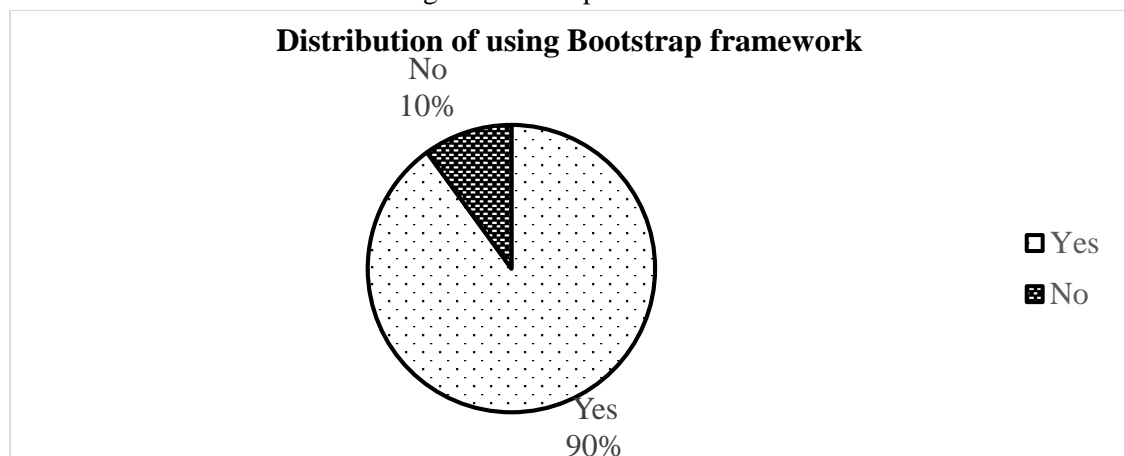

Distribution of using Bootstrap framework

The data above explains that most of the college websites use Bootstrap CSS framework, which means most of the developers use a Bootstrap CSS framework to maintain the content in various screen sizes. Bootstrap is highly customizable, easy to use, based on a grid system, and open

source which makes it a popular CSS framework for responsive design. There is a website that does not use Bootstrap, it uses direct code to execute the content on a different screen.

Use of JavaScript for responsiveness

JavaScript (JS) is a lightweight interpreted or just-in-time compiled programming language with first-class functions. While it is most well-known as the scripting language for Web pages, many non-browser environments also use it, such as Node.js, Apache CouchDB, and Adobe Acrobat. The following bar diagram shows the distribution of using JavaScript for website responsiveness.

**Distribution of using JavaScript for responsiveness**
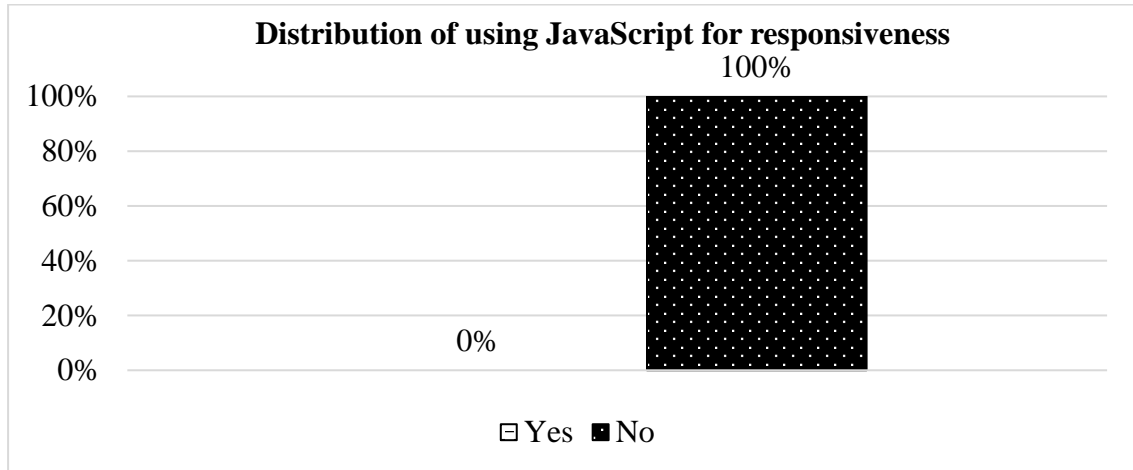
Distribution of using JavaScript for responsiveness

From the data above, all the websites have used JavaScript which means the web developer is quite aware of using JavaScript code to maintain the user behavior and server-side action. JavaScript is used to include a message, scrolling text, animations, menus, pop-up windows, etc. JavaScript is directly embedded in HTML. JavaScript is a platform-independent language. Any JavaScript-enabled browser can understand and interpret JavaScript code. JavaScript can be used to create different buttons with interesting mouse rollover effects. When the user moves the mouse over a button, different effects are generated. It makes browsing more interesting and attractive.

Organization of screen size and easy user accessibility

Web page screen size is a big deal. We should design pages for the lowest common denominator (640x480), the most common resolution (800x600), or the most cutting edge (1280x1024 or 1024x768). But the truth is, we should design our site for the visitors who come to it. The following bar diagram shows the distribution of the user's accessibility over website screen size.

Distribution of user accessibility over screen size
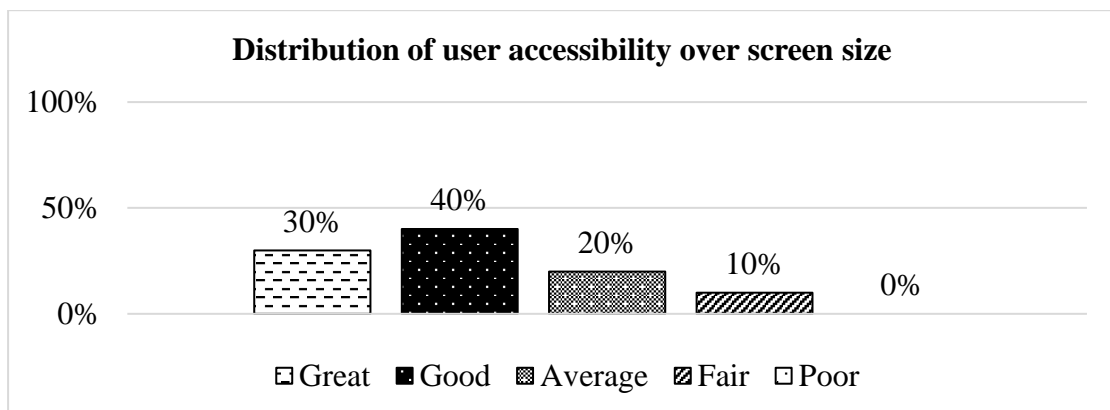
Distribution of user accessibility over screen size

The above data explains that the majority of the websites have good accessibility over the website screen size. It means the majority of the developers know the use of screen sizes. Three of the websites have great accessibility over the screen, which shows that some of the websites have great use of screen size ideas to display the content. There is still a necessity for improvement in the screen sizes of the website although there is not a single website that has poor accessibility of screen size.

Content on smartphones

Devices that are smaller than or equal to 768px fall under this category. These devices are simply known as smartphones or cell phones. The following bar diagram shows the distribution of content design over smartphones.
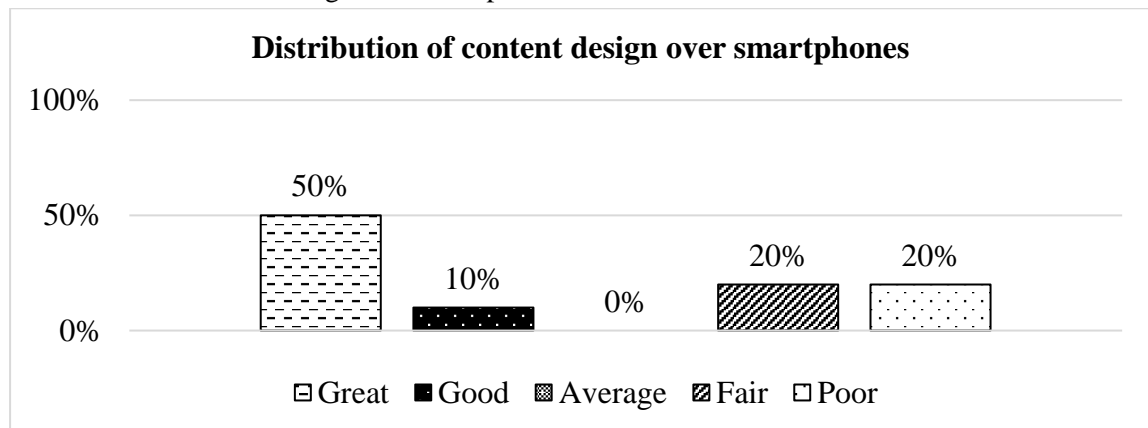
Distribution of content design over smartphones

The data above explains that the majority of websites have great looks and designs over smartphones which means the majority of the web developers know the importance of showing content on smartphones. It is the best practice to design a website on smartphones nowadays. 2/2 websites have fair and poor design over smartphones, which means the design and the arrangement of the content look very poor over smartphones. Half of the website developers seem to be very careless about displaying the content in smartphones.

Developing technology

Web development comes with a huge set of rules and techniques every website developer should know about. Developing a website typically comes down to knowing 3 main languages: JavaScript, CSS, and HTML. Web technologies are the markup languages and multimedia packages computers use to communicate. There was a time when HTML5, CSS3, JavaScript, PHP, and MySQL were used to be the main web development technologies to develop a website or web application. However, with the emergence of several new web development technologies, tools, frameworks, and languages in the last few years, it has now become quite challenging for one to decide what to learn (and what to skip).

Front-end programming used

Front-end web development, also known as client-side development is the practice of producing HTML, CSS, and JavaScript for a website or Web Application so that a user can see and interact with them directly. The distribution of front-end technology used in websites can be tabulated as follows.

Distribution of front-end technology used			
S. N.	**Technology used for front-end (content and styling)**	**Numbers**	**Percentage(%)**
1	HTML	10	100
2	XHTML	0	0
3	HTML5	10	100
4	CSS	10	100
5	CSS3	10	100

From the data above we can say that all the websites are designed under the use of HTML, HTML5, CSS, and CSS3, which is quite impressive cause these are the modern techniques to design a website effectively. Not a college website follows XHTML cause, it uses traditional elements of HTML. The challenge associated with front-end development is that the tools and techniques used to create the front end of a website change constantly and so the developer needs to constantly be aware of how the field is developing. The objective of designing a site is to ensure that when the users open up the site they see the information in a format that is easy to read and relevant.

Back-end programming used

Back-end Development refers to the server side of development where we are primarily focused on how the site works. Making updates and changes in addition to monitoring the functionality of the site will be our primary responsibility. This type of web development usually consists of three parts: a server, an application, and a database. Code written by back end developers is what communicates the database information to the browser. Distribution of using back-end technology for web development can be tabulated as follows.

Table no. 11 shows that 90 percent of the websites are built under PHP and 10 percent

Distribution of back -end technology used			
S. N.	**Technology used for back-end**	**Numbers**	**Percentage(%)**
1	PHP	9	90
2	JSP	0	0
3	ASP	0	0
4	Others	1	10
	Total	**10**	**100**

The data above explains that most of the college websites are built under PHP, it is an open-source language, easy to use and due to its efficiency in web development, PHP has gained popularity. Only a website used another type of back-end language for web development.

Developmental framework

A web development framework is a set of resources and tools for software developers to build and manage web applications, web services, and websites.

Such a framework includes template-building capabilities for presenting information within a browser, the programming environment for scripting the flow of information, and the application programming interfaces (APIs) for accessing underlying data resources. Distribution using the development framework can be tabulated as follows.

Distribution of development framework used

S. N.	Development framework used	Numbers	Percentage(%)
1	WordPress	6	60
2	Joomla	0	0
3	Drupal	0	0
4	CI	1	10
5	Yii	0	0
6	Laravel	1	10
7	RoR	0	0
8	Other	2	20
	Total	**10**	**100**

The data above shows that the majority of the websites are built under WordPress, a popular CMS (Content Management Site) framework to build websites. WordPress provides a very easy environment to create an elegant website, which is why the majority of websites use WordPress as a development framework for website building. 1/1 websites use Laravel and Codeigniter framework which is quite impressive. Laravel is quite a popular framework to this day although CI provides easy and rapid web development ideas to build a dynamic website.

Importantly, a rapid web application development framework is not limited to coding alone. Features such as APIs, templates, models, and more are also available in these frameworks. To enhance the visual look and feel of a web application, a rapid web application development framework comes in handy. It has 'drag and drop' features that allow adding stunning visual features. The process of incorporating the features is easy.

Scripting languages

A scripting language is a programming language designed for integrating and communicating with other programming languages. Some of the most widely used scripting languages are JavaScript, VBScript, and so on. The following bar diagram shows the distribution of using scripting languages on the websites.

Distribution of using scripting language

Distribution of using scripting language
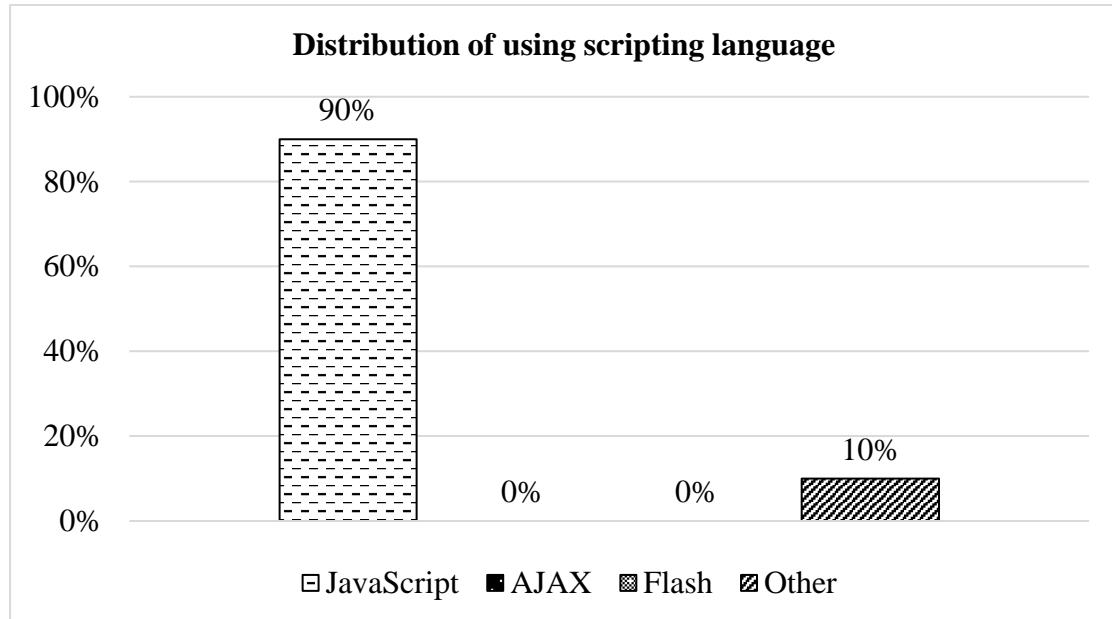
The data above shows that most of the websites use JavaScript as the scripting language. JavaScript is very easy to maintain and easy to integrate with HTML files. It provides amazing behavior on user action. Only a website that uses some other scripting language other than JavaScript. Scripting languages are becoming more popular due to the emergence of web-based applications. The market for producing dynamic web content is now expanding extremely rapidly such that new scripting languages have been developed to allow users with little or no programming expertise to develop interactive web pages with minimum effort.

Database used

A database (DB), in the most general sense, is an organized collection of data. More specifically, a database is an electronic system that allows data to be easily accessed, manipulated, and updated. In other words, a database is used by an organization as a method of storing, managing, and retrieving information. Modern databases are managed using a database management system (DBMS). The following bar diagram shows the distribution of using the database on the website.

Distribution of using database
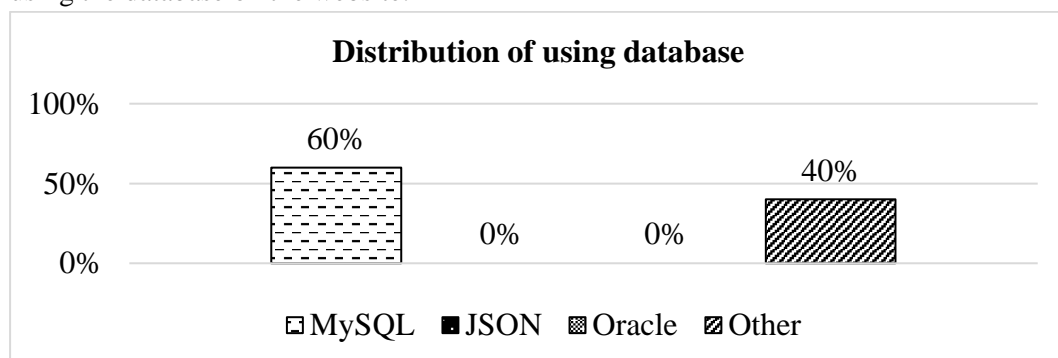
Distribution of using a database

From the above data, the majority of the websites use the MySQL database integrated with the WordPress CMS framework. MySQL provides easy queries to manipulate the content efficiently. Four of the websites use another database type. Database records and files must be organized to allow retrieval of the information. Queries are the main way users retrieve database information.

Use of plugins

A plugin is a software add-on that is installed on a program, enhancing its capabilities. Plug-ins are commonly used in Internet browsers but also can be utilized in numerous other types of applications. The following bar diagram shows the distribution of using plug-ins in websites to maintain various features.

Distribution of use of plugins
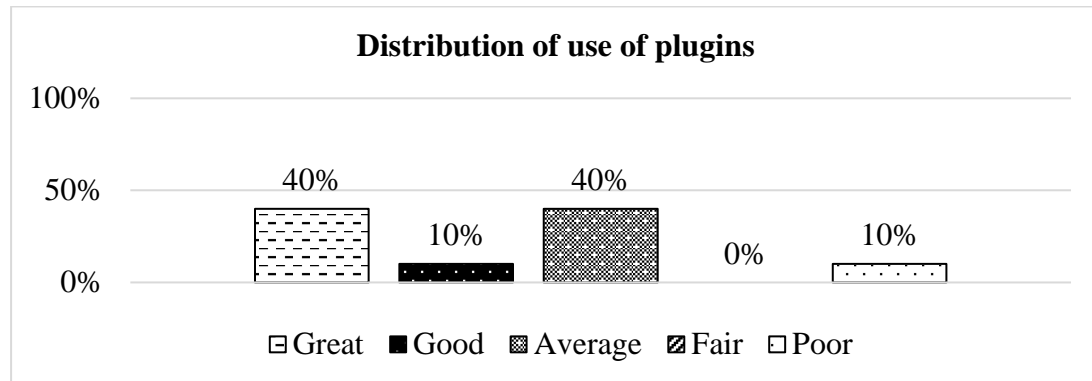
Distribution of use of plugins

The data above explains that four websites have great use of plug-ins in their websites, and the developer is aware of using it with its functionality. There is only one website that is not using such features. Sometimes using plug-ins in websites may create lots of problems and interrupt the normal execution of the website over the web browser but using the right plug-ins for adding extra features to our website made it more efficient.

The content type of the page

Content type refers to the content of a page that is transferred via HTTP and classified according to a two-part structure.
A static site is usually written in plain HTML and what is in the code of the page is what is displayed to the user.
A dynamic site is written using a server-side scripting language such as PHP, ASP, JSP, etc. The distribution of content type on the page can be tabulated as follows.

Distribution of Content type of the page

S. N.	Content type of the page	Numbers	Percentage(%)
1	Static	0	0
2	Dynamic	10	100
	Total	**10**	**100**

The data above explains that all the website content is dynamic easy to update from time to time and easy to manage the content as per requirement. Dynamic websites are very much needed by academic institutions for updated information and updated content sharing.

Use of web fonts

A web font is a specially tuned font for use on websites using the CSS @font-face declaration. A web font comes in four flavors. A TrueType file, a WOFF file, an EOT file, and an SVG file. Each one is designed to target different browsers. The following bar diagram shows the distribution of using web fonts on websites.
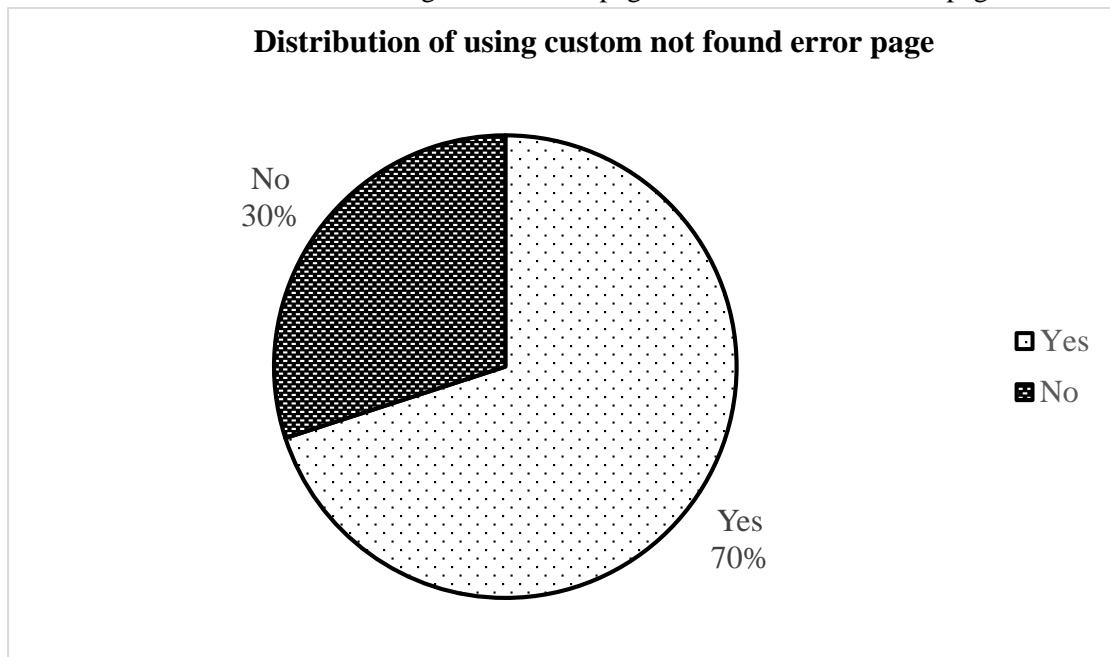
Distribution of using web fonts
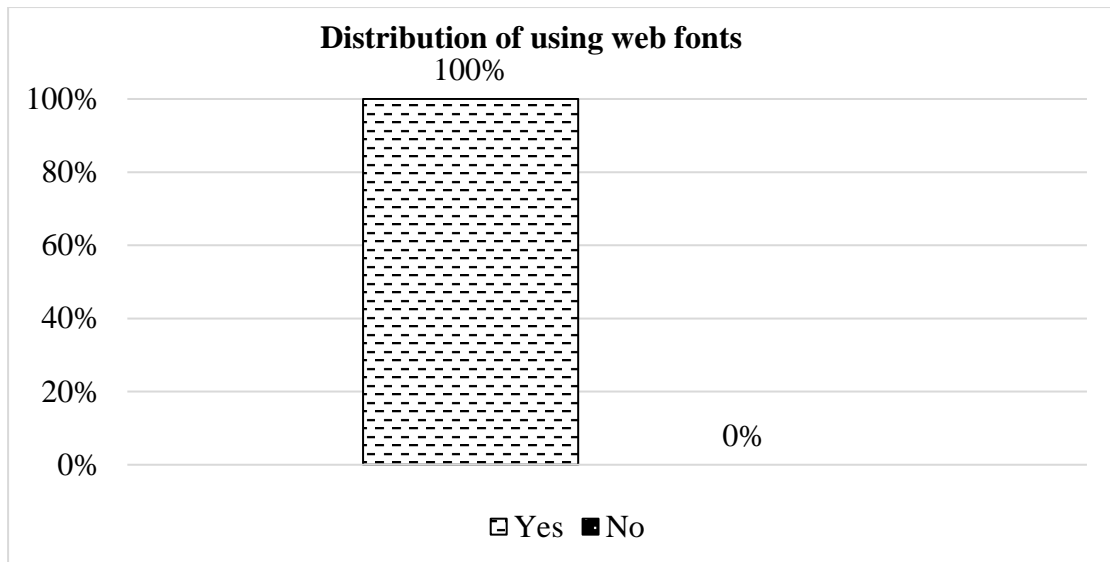
Distribution of using web fonts

From the data explained above, we can say that all the websites use web fonts, which look very elegant compared to local fonts and activate only when there is internet connectivity. It is a best practice to use web fonts on the website.

Custom not found / 404 – error page

A 404 error message is a Hypertext Transfer Protocol (HTTP) status code indicating the server could not find the requested website. In other words, our web browser can connect with the server, but the specific page we're trying to access can't be reached. The following pie chart shows the distribution of using custom error page to maintain error on the page.

Distribution of using custom not found error page

The data explained above, clearly explained that the majority of the websites do not have distinct error pages to maintain the errors from the page. Normally it consists of page not found or not found resources from the website. Three websites are using separate error pages to maintain it very effectively.

Auto language translation

Language translation is the process of converting the written word from one language into another in a way that is culturally and linguistically appropriate so it can be understood by its intended audience. The following table shows the distribution of using auto language translation features on websites.

Distribution of using auto language translation			
S. N.	**Use of auto language translation**	**Numbers**	**Percentage(%)**
1	Great	0	0
2	Good	1	10
3	Average	0	0
4	Fair	0	0
5	Poor	9	90
	Total	**10**	**100**

The data explained above shows that most of the college websites do not use auto language translation features although it is free to use using API. There is only one college named Mahendra Ratna Campus that uses this feature to convert the content into a different language. It is a best practice to use an auto language translator on our website.

Website page loading speed

Website page speed can be described in either "page load time" (the time it takes to fully display the content on a specific page) or "time to first byte" (how long it takes for your browser to receive the first byte of information from the web server). The following bar diagram shows the distribution of the loading speed of the websites.

*Distribution of website loading speed*
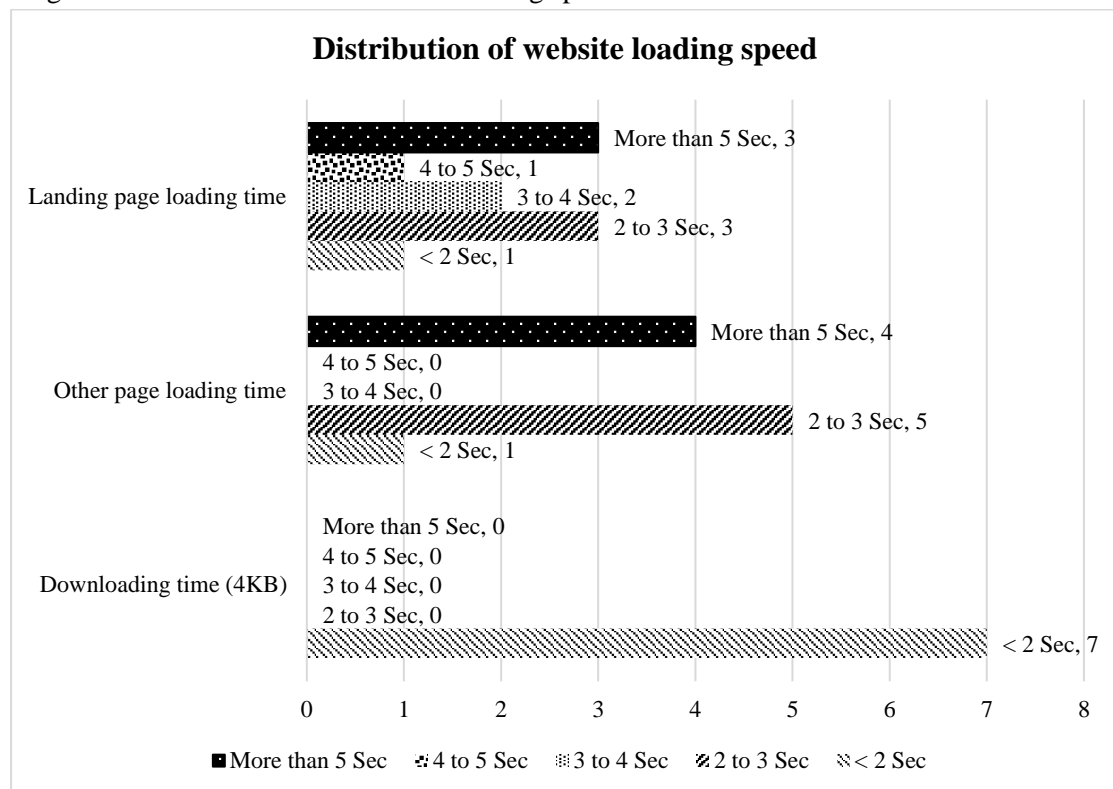
From the data explained above most of the websites are taking more time to load the landing page, which means the code is not very much optimized, to solve this problem the developer should optimize the code first and optimized images should be used in the landing page. Broken links must be avoided. Similarly, most of the websites are taking more than 2 seconds to load a normal page other than the home page, 5 websites have taken 2 to 3 seconds to load the normal page which means these websites have average loading speed on loading the normal page. Not all the websites have a download feature, only 7 websites have download features, all the websites with download features download the file of 4KB within a couple of seconds, which means there is no problem in downloading the file from the website but time may increase based on the internet speed externally.

Distribution of traffic user on website

S. N.	Traffic user on website	Numbers	Percentage(%)
1	Less than 50	10	100
2	Between 50 to 100	0	0
3	Between 100 to 500	0	0
4	Between 500 to 1000	0	0
5	More than 1000	0	0
	Total	**10**	**100**

Use of website cache

Website cache is a hardware device or software application program used to temporarily store frequently accessed static content of a website. The following pie chart shows the distribution of using website cache on the website.

Distribution of using website cache
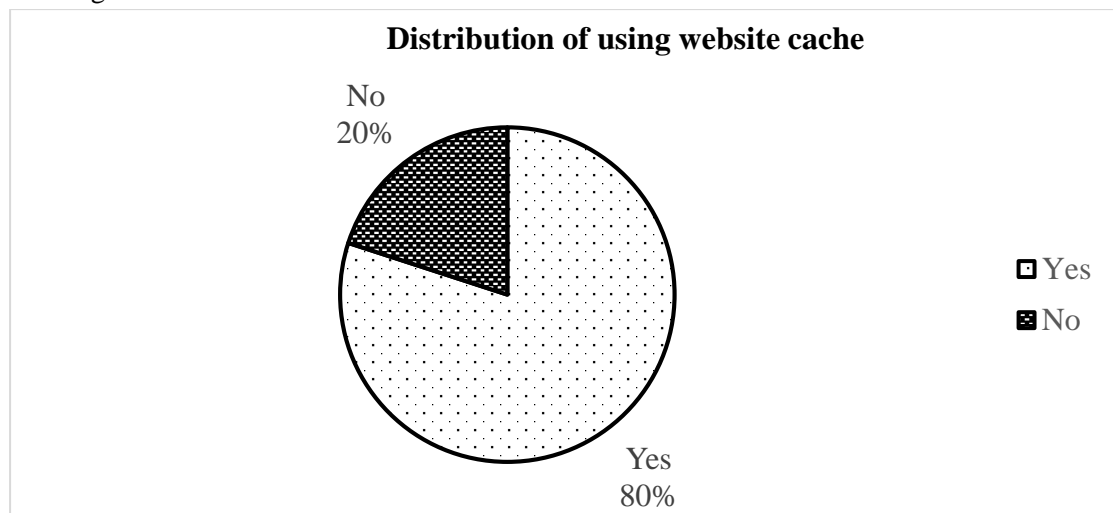
Distribution of using website cache

The above figure no. 62 shows that 80 percent of websites have website cache and 20 percent of websites have not used website cache.

From the data above we can see that most of the websites have used website cache for frequently used static data. Only two of the websites have not used a website cache.

Website security

Website security is any action or application taken to ensure website data is not exposed to cybercriminals or to prevent exploitation of websites in any way. The following table shows the distribution of measuring website security.

S. N.	Website security measures	Yes	No
	Distribution of measuring website security		
1	Enabling of user login session	0	10
2	Cookies popup and integration	0	10
3	Use of CAPTCHA and reCAPTCHA	0	10
4	Custom user than admin	0	10

From the above data, we can clearly say that there is not a single website that has features that belong to website security. Generally, academic websites do not have confidential data or documents, although website security is very much mandatory for the website's efficiency. An example, the contact form used on the Contact Us page of the Janamaitri Multiple Campus website does not have a captcha or reCaptcha, which means code generating using scripting language can send multiple inquiries from that page and bandwidth was compromised. So, the proper security should be managed.

Website Accessibility

People with disabilities face many accessibility barriers when they try to access websites. One common barrier is a lack of meaningful text descriptions for graphical elements on a website, which affects individuals with visual impairments who use screen readers. Another common issue is related to the use of keyboard versus mouse controls. Distribution of accessing the website can be tabulated as follows.

S. N.	Website accessibility	Yes	No
	Distribution of accessing website		
1	Feature for hearing disabilities users	0	10
2	Feature for visual impairment users	0	10
3	Feature for color blind users	0	10
4	Custom text and background color	0	10
5	Custom font size by user	0	10
6	Audio and video subtitle	0	10
7	Accessing website using keyboard	10	0

From the data explained above, we can clearly say that there is not any feature or facility for hearing and visually-disabled a user on the college's websites. Website text, backgrounds, and color combinations are not custom builds, they cannot be changed, adding such features to websites enables all types of users to use the website. It is best practice that all the links and web components are controlled by the keyboard.

Conclusion

The Internet has shown a popular tool in the academic area, it seems to be widespread use of various forms of technological tools such as the Internet, websites, and emails, and students,

and lecturers were generally favorable to these new paradigms. A university, college, or academic institution should maintain the high level and qualitative use of websites for the continuous promotion attached to the organization's objectives. This study focused on the tools and technology used in evaluating the quality of different academic websites.

From the research work, most of the college's websites are registered under educational domain names and it seems that some of the colleges still have no domain name correspondence to the college name. Most of the colleges revealed their domain name registered details regarding contact information. It is found that the page loading time of all college websites is taking more than 2 seconds which is below the standard. The majority of the colleges' websites do not use SSL for encryption integration on content transmission over servers.

HTML, CSS, and JS are the backbones for website development, from the research, it is found that all the colleges' websites have correct and valid use of HTML and CSS, correct doctype and character set. The use of the correct viewport made websites display the contents on different-sized devices. Most of the college's websites do not use meta keys and descriptions which is very much important for the SEO. The use of JS and semantic elements are good. The alt tag value is not given for the images. Overall, standard and valid codes are used while developing the websites.

Talking about website navigation and links, it is found that most of the links including navigation links are concise, meaningful, user-friendly, and easy to access. The main navigation is structured in ul, standard on global practice, and free from broken links, but there are minimum broken links found on the websites. Few college websites use automatic navigation tabs. The use of site maps, and separate feedback links are some limitations on websites. The majority of the website's logos are interlinked with the main landing page of the website. Use of social media is average below. The majority of the websites have poor use of footer links. In some cases, links are created but are disabled.

The majority of the websites used media queries to display the content on different devices, but it seems that the effectiveness of media queries for responsiveness is below average. Most of the queries used in CSS are targeted only for a device, medium-sized devices. The majority of the websites use Bootstrap framework, an open-source and most popular CSS and JS framework available. The use of JS and Skeleton is nil.

As we know HTML, CSS, and JS are the backbone of the website, in this research work, it is found that all the websites use HTML, HTML5, CSS, CSS3, and JS for front-end development. All the websites are using PHP as the back-end programming language, a popular open-source scripting language. Most of the colleges are built in WordPress, a popular PHP framework for developing CMS websites. Some colleges are using the Laravel framework to develop their websites. The majority of the websites are using MySQL as a database as they are built in WordPress. It is found that the very good use of plug-ins in the websites.

The majority of the websites are visually appealing, but the choice of theme color is poor. It is a global practice that using more than three theme colors in websites may distract the user, The use of a title and scroll bar is good, and there is no use of pop-up messages on the user's actions. A very poor use of tooltips is found in all websites. Text alignments and object structure are good according to the design principle. Page design consistency is very satisfactory.

Website contents are the primary elements for the website development. Websites are designed and developed to show the content effectively in such a way that all the users can access updated content easily. So, the updated content is the main target of the website user.

In this research, it is found that most of the colleges' websites have updated content regarding college information, academic documents, notices, etc. Most of the websites have great content availability. Most of the websites do not have blog pages. The majority of the websites have a download feature to download content like syllabus from the websites. It is found that the majority of the colleges' websites use date and time features.

It is found that very few users are visiting the websites each day. The user traffic rate is very low in all the websites. Comparatively, Google page ranking using the Alexa tool is very poor for all the websites. Most of the websites do have not enough website backlinks. There is not a single feature that is enabled for the security of the websites. The use of CAPTCHA in forms, cookies setup, and use of sessions are very much compromised during the development of the websites. It is found that all the links and components of the websites are controlled by the keyboard.

There is no feature or facility for disabled users especially hearing and visually disabled users. Text backgrounds and color schemes are not custom-built; these features cannot be modified as the user's requirement.

From the data explained above, we can clearly say that there is not any feature or facility for hearing and visually-disabled a user on the college's websites. Website text, backgrounds, and color combinations are not custom builds, they cannot be changed, adding such features to websites enables all types of users to use the website. It is best practice that all the links and web components are controlled by the keyboard.

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