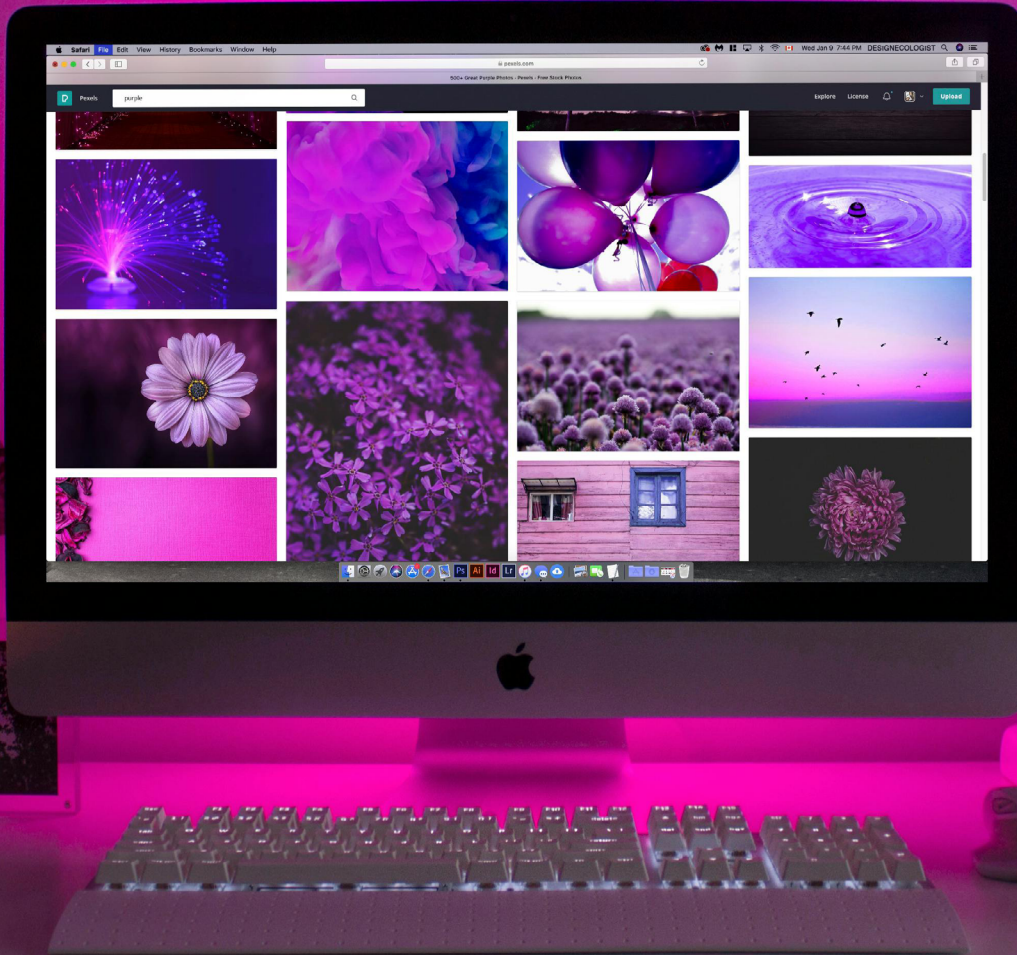# SECTION

5

COMPUTATIONAL THINKING AND WEB DEVELOPMENT

Computational Thinking (Programming Logic)

Web Technologies and Databases

INTRODUCTION

Take a moment to explore the beauty of this website here or https://t-tel.org/. Are you curious about how it was expertly created? In this section, you will learn the basics of building a website. Through hands-on activities and problem-solving tasks, you will develop your coding skills and understand how websites are made using tools such as HTML, CSS, and JavaScript.

We will focus on web outline plans, which include essential elements like sitemaps, wireframes, and prototypes. These tools will help you see the different parts of a web page and may even inspire you to try web development yourself!

There are many excellent websites, such as w3schools.com and codecademy.com, where you can learn more and practise your skills.

We are excited for you to gain these valuable skills – let us get started then!

At the end of this section, you will be able to:

1. Identify and describe the key components of a Web page, including headings, menus, links, text, images, and other relevant elements.
2. Draw and explain 2 web outline plans showing the wireframes.

Key Ideas

1. **Web design** - Web design involves planning and creating the visual layout and structure of a website. It ensures the site is attractive, user-friendly, and works well on different devices.
2. **Web development –** Is the process of building and maintaining websites
3. **Front-end –** Refers to the part of a website that users interact with directly
4. **Back-end –** Ensures that the front-end operates smoothly by handling data processing, storage, and security
5. **Sitemap** - A sitemap is a visual or structured map that outlines the organisation and hierarchy of a website's pages
6. **User experience (UX)** - Refers to how users interact with and feel about a website
7. **User interface (UI)** - Refers to the visual elements of software or a website that users

interact with

8. **Website blueprint** - A detailed plan that outlines the structure, content, and navigation of a website

9. **Content structure** - Refers to the organised arrangement of information on a website, ensuring that content is presented in a logical and easy-to-navigate manner.

10. **Wireframe** – Like a house plan, a wireframe is a simple sketch that shows the structure of a website.

11. **Prototype** – Like a small model of the house, a prototype allows you to see how the structure works in real life.

Let's begin this section with an interesting activity!

Activity 5.1

Do this activity individually.

1. Click on these two links and explore the similarities and differences on the landing page (the first page that opens when you click the link).
   Link 1
   Link 2

2. List 5 things they have in common.

3. What are the key differences between them?

4. Share your finding with the class and discuss.

From the activity you just completed, you will notice that link 1 is just a design, without any functionality, while link 2 has functionality which makes the website respond to what you clicked on.

In this learning, we will look at the difference between web design and web development, which you may have already understood from Activity 5.1.
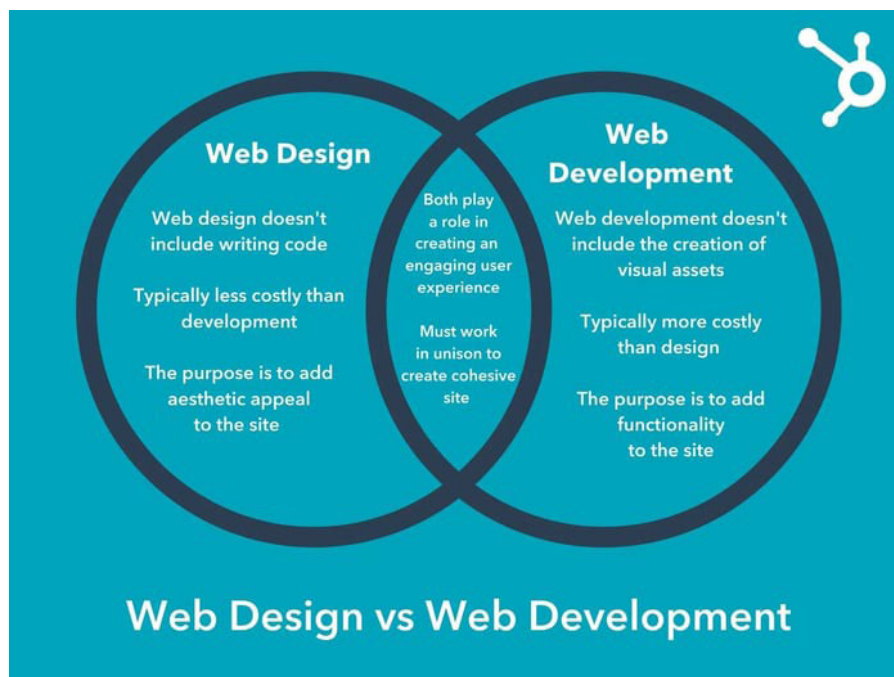
THE DIFFERENCE BETWEEN WEB DESIGN AND WEB DEVELOPMENT

Web Design

Web design is about making a website look good. It deals with the colours, layout, and overall appearance of the website. However, w**eb development** is about making the website work (function). This means, it involves creating the parts of the website that users interact with, using coding languages like HTML and JavaScript.

Before a website is developed, web developers take the ideas that web designers come up with and make them work by writing codes. In SHS Years 2 and 3, you will learn more about how this coding works, especially HTML. For now, you will learn the basic idea(s) of how websites are built. See the simple one-page website example from Activity 5.1 link 2. This helps you understand how web design and development come together to create websites.

Figure 5.1 highlights some of the key differences between web design and web development.

Figure 5.1: Differences between web design and web development

Now that you understand the difference between web design and web development, let us look at web development in more detail.

Activity 5.2

1. Imagine you are to create a human being using these three images. Arrange them in the best possible order.

1	2	3
JS	CSS	HTML
Figure 5.2: JH	Figure 5.3: CSS	Figure 5.4: HTML
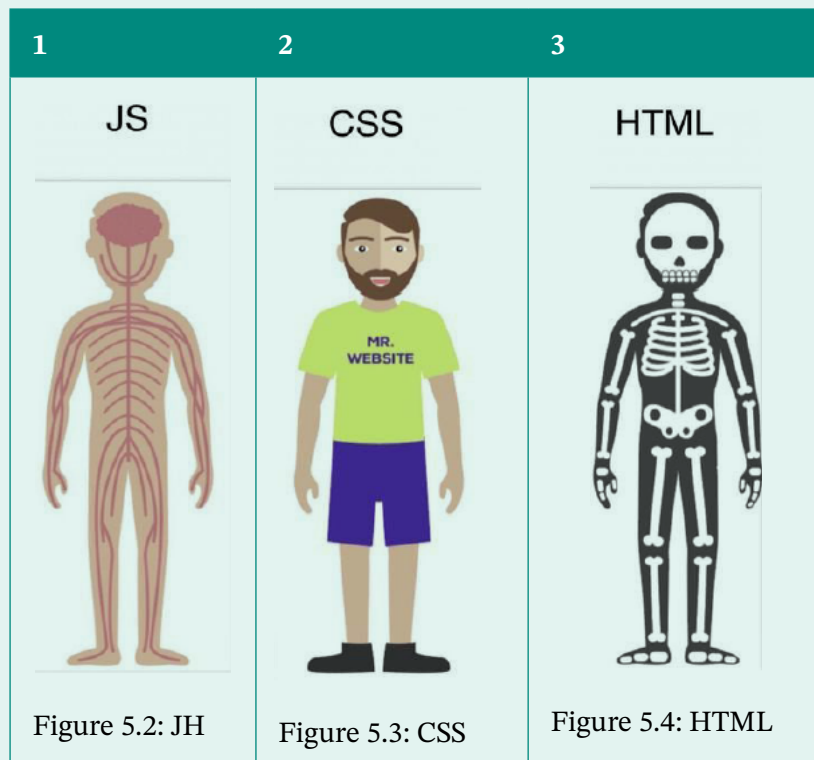
2. Justify your reasons for the arrangement.
3. Share your arrangement and reasons with your peers.

Good work, the activity you just completed is a process of how web development works.

Web Development

Web development is the process of creating and maintaining websites and web applications. It involves using different tools and technologies (such as JavaScript, CSS, HTML, etc.) to build these sites. The main goal of web development is to meet the needs of the client, who is the person or organisation paying for the project. This means creating online experiences that are accurate, informative, reliable, interactive, and easy for users to navigate.

There are two aspects – front-end development and back-end development:

1. **Front-end development** is all about designing the parts of a website that users see and interact with. It focuses on the user interface (how the website looks) and the user experience (how easy and enjoyable the website is to use). Here are the main technologies used in front-end development:

a. **HTML** (**H**ypertext **M**arkup **L**anguage):

HTML is the standard language used to create web pages. It provides the basic structure and content of a webpage. HTML uses special bracketed codes called **tags** (like <body>, <p>, <img>) to tell the web browser how to display different parts of the page.

b. **CSS (Cascading Style Sheets)**:

CSS is the language used to style the visual appearance of a website. It allows developers to customise colours, layouts, fonts, and other design elements. CSS can be written directly in the HTML file or in a separate file that is linked to the HTML document. Keeping the content (HTML) separate from the design (CSS) makes it easier to apply the same styles across multiple pages.

c. **JS (JavaScript):**

JavaScript is a type of programming language called a scripting language which adds interactivity and dynamic features to websites. It allows developers to create things like animations, interactive maps, real-time updates, and form validations. JavaScript makes websites more engaging and responsive to user actions, enhancing the user experience.

Think of it this way, just like the completed Activity 59.

- HTML is like the skeleton of a website, providing its basic structure.
- JavaScript is like the muscles and nerves, adding movement and interactive functions to make the website come alive.
- CSS is like the skin and clothes, giving the website its style and appearance (beauty).

By combining HTML, CSS, and JavaScript, front-end developers create websites that are not only visually appealing but also easy and enjoyable to use.

Mastering the skills of these tools and technologies will help you become a good front-end developer – would you like to be one?

Activity 5.3

Let us have some fun playing with this front-end code. Follow these instructions carefully to enjoy this simple website.

1. Click here to download the zip file.
2. Unzip or extract the file to a specific location where you can easily get access to it.
3. Double click on "simple website" to Run the website.
4. What do you notice about the website? Write down some observations.
5. Share your observation with peers in the classroom.

Congrats, you are on your way to be one of the best website developers.

2. **Back-end Development** involves the parts of a website that you do not see but makes everything work smoothly. It includes managing servers, databases, and the logic that powers the website. Here is a simple breakdown of what back-end development is all about:

    a. Server-Side Processes:

        Think of the server as the brain of the website. It handles requests from users (like when you click a button) and sends back the right information.

    b. Database Management:

        A database is like a digital storage room where all the website's data is kept. This includes things like user information, products in an online store, and articles on a blog. Without a database, the website cannot save or find any information.

    c. Application Logic:

        This is the set of instructions that tells the website how to behave. It processes the data from the database and ensures that everything runs correctly. For example, when you log in to a website, say Facebook, the application logic checks your username and password against the database before it allows you to login to your account.

    Common Back-End Programming Languages include:
    - Python
    - Ruby
    - Java
    - PHP

    These languages help developers create the functionality that makes websites interactive and responsive to users' actions.

Web Hosting and Deployment

This is the process that is followed after development has finished (which includes testing and adding security measures). Websites need to be hosted on a web server so that a user can access the content from their browser over the internet. Web hosting services provide the server space for the website content and resources to be stored on, allowing the website to run.

Deployment involves uploading the files and resources for the website to the hosting servers, then configuring them so that they run successfully in a browser on the internet.

Activity 5.4

1. List at least four (4) browsers you know.

2. State what you used the browser for.

3. Explain why the browser was able to function based on your understanding of front-end and back-end development.

4. Share your response with your peers using a PowerPoint presentation.

You may have noticed that anytime you type a website address like (www.ges.gov.gh) into a browser, the browser leads you to the website.

Web browsers are like cars that take you to a specific location (like the school park).

The URL (Uniform Resource Locator) is the address of that specific location. Every website has its own unique URL (meaning no two or more websites can use the same address/URL).

Accessing the Website

Each website has a unique URL (short for Uniform Resource Locator), commonly called its web address. The URL tells your browser where to go on the internet. When you type a URL into the browser's address bar and press Enter on your keyboard, the browser will load the page associated with that URL. A browser is software which is used to show web pages. See Figure 5:5 for examples of popular browsers.

Safari   Mozilla   Chrome   Edge   Opera

Figure 5.5: Some popular browsers

Components Of Web Pages

Understanding the different parts of a web page helps you create websites that are easy to navigate and enjoyable to use. These parts are called **web elements**. Let us explore three important web elements: **Headings**, **Menus** and **Links**. We will use Ghana Education Service (GES) website: www.ges.gov.gh as an example for our activities.

1. **Headings** are the titles or subtitles you see on a web page. They help organise the information shown on the page, making it easier for users to understand the structure of the content.

    a. **Different Sizes**: Headings come in various sizes. The main heading is larger, while subheadings are smaller.

    b. **Visual Clarity**: Larger headings stand out, making it easier for users to scan the page and find what they are looking for.

Importance of Headings

Headings guide users through the content. They break up the text into sections, so users can quickly locate the information they need without getting lost.

Activity 5.5

1. Open your web browser and go to www.ges.gov.gh
2. Look at the homepage and identify at least three headings.
3. Note the size and placement of each identified heading.
4. Share with your peers how the headings help organise the information on the page.

2. **Menus,** also known as navigation bars, are lists of links that help users move around the website. They are usually found at the top or down the side of the page.

Importance of Menus

Menus provide a consistent way for users to explore the website. They make it easy to find the information you need without getting lost.

Activity 5.6

1. Visit the website www.ges.gov.gh
2. Find the main menu or navigation bar on the homepage.
3. Click on different menu items.
4. Observe how the menu helps you find various sections of the website.
5. If the menu has dropdown options, hover over the main links to see additional links.
6. Explore these dropdown menus to see what extra information they provide.
7. Share your finding on how the menu helped you navigate the website with your peer and discuss.

3. **Links**, also known as hyperlinks, are clickable elements on the web page that connect to other parts of the website. They allow the user to navigate between the different pages of the website or between different sections within the same page (internal hyperlinks). Links can also direct the user to a different website (external

hyperlinks). Hyperlinks within a website can be either text-based or represented by images.

We will learn more about internal and external hyperlinks as we move through this course.

Other Relevant Elements

1. Headers/Footers

The header and footer are typically at the top and bottom of the web page. They tend to be the same across all web pages and provide a consistent style throughout. The header typically contains the websites logo, title and navigation/menu, and the footer typically contains the websites contact information, copyright details and links to important pages such as the privacy policy.

2. Forms

These enable the user to interact with the website by entering information, making selections or uploading files. The data can be submitted for processing by the back-end.

3. Buttons

These provide interactive elements to the user; they trigger actions or events when clicked. Examples include navigating to a different page and pressing the submit button at the end of a form. Buttons typically trigger a function in the back-end code that completes a specific processing action.

4. Audio/Video

Audio and video elements can be included in a web page and can be used to present engaging content to enhance the overall user experience.

5. Web Widgets

These are small standalone elements that can be included in a web page to provide specific functionality for example:

a. Calendar widgets: displaying a calendar view of events of appointments.

b. Social media widgets: displaying updates, feeds or recent posts from social media accounts.

c. Website search widgets: providing search functionality across the whole website, making it easier for users to find what they are looking for. These are particularly useful for content-heavy websites such as news sites.

d. Digital clock widget: display a digital clock.

e. Weather widget: displays weather updates and forecasts for a given location.

Widgets can save developers having to code features and functionality from scratch, providing reusable elements that can be easily included into any web page. They can aid in making the website more engaging to the users.

ROLE OF WEB DESIGNERS

Web designers are in charge of how a website looks and how easy it is to use. They decide things like the layout, colours, images, and fonts of a site. Web designers use a company's brand identity to ensure the website matches its style. They can either create brand new websites or make changes to existing ones.

While web designers come up with the idea for how the website should look, web developers are the ones who actually build it by writing the code. Both front-end (what you see) and back-end (behind the scenes) parts of a website are created by developers.

One important part of designing a website is creating a **web outline plan**, which is a basic guide for how the site will be structured. If there is no dedicated web designer, sometimes a web developer will create the web outline plan.

What is a Web Outline Plan?

A **website outline plan**, or **web outline**, is a detailed guide that shows how a website will be organised before it is created. It acts as a blueprint for the site, helping to plan its structure, content, and how it will work. Developing a web outline is usually a process that might need to be repeated to improve it, especially after testing or receiving feedback. For instance, changes might be made to the Home page based on how users interact with it. The first step in making this plan usually starts with what the client and web development team have agreed on as to how the website should look and do.

General Guidelines in Developing a Web Outline Plan

1. *Identify website's goals and target audience:* Before creating a website, it is important to identify its **goals** and who its users will be (the people who will use it). The goals might be to attract more traffic (visitors) or increase online sales.

2. *Create a user persona:* A helpful step is to create a **user persona**. This is a fictional character that represents the typical person who will visit the website. The user persona helps in making decisions about what content to include and how the website should look. It is like imagining the kind of users who would access the website and designing it to meet their needs. Figure 5.6 gives one possible template that can be used when creating a user persona.

Figure 5.6 User Persona

3. *Categorise the information:* Group the website content into related categories and subcategories. Consider the main topics or sections the website will include. This will help determine the number and names of the main pages and subpages.

4. *Create a sitemap*: This will show the basic structure and organisation of a website. You will find explanations and examples later.

5. *Create a content outline:* A content outline is a detailed plan that shows what each page of a website will include. It lists all the sections and features needed for the website, just like a sitemap but more detailed. You can make this outline as a graphic, which shows how everything is organised, or as a simple list. For example, you might see a website's navigation bar as a graphic (Figures 5.7 and 5.8), and another website's Home page layout as a list (Figure 5.9). Both ways help you see and organise the website's content before building it.

Figure 5.7: Home page of weignitegrowth.com

Figure 5.8: Home page of ignite

Homepage
- Header with menu and logo
- Hero image with text and call to action (cta)
- Product Value Section
- Why the Production Content section
- Competitor Comparison Chart
- Feature Content Section
- Testimonials
- CTA Form
- Footer

Figure 5.9: Home page

Note that **CTA/cta** stands for call to action which is a prompt that encourages visitors to take a desired action on a website. It is often designed in the form of a button with a clear command or action phrase.

An example of a CTA is the "CHECK", "SUBMIT", "APPLY NOW" and "CHECKOUT", buttons on the images below:

Figure 5.10 : Example of a CTA

6. *Wireframing and Prototyping:* Wireframes and prototypes are like rough drafts for web pages. They help both clients and developers see how a website will look and how it will be arranged before it is fully built. We will learn more about how to create and use these tools later.

Activity 5.7

1. Think of a website you like and list two or three goals that the website might have.
2. Imagine a typical visitor to your chosen website. Give them a name, age, interests, and reasons for visiting the website.
3. Organise the content types into main categories and subcategories in your notebook.
4. Share your findings with your peers and discuss.

Sitemap

What is a sitemap?

A sitemap is like a map for a website. It shows how different pages of the website are connected and how they are organised. Search engines use sitemaps to find and understand all the pages on a website more easily.

Think of a sitemap as a guide for building a website. It shows the basic layout of the website without worrying about the fancy design. This helps web designers plan how the website will look and how it will work.

There are two main types of sitemaps: visual and XML. For now, we will focus only on visual sitemaps.

Examples of Visual Sitemaps

To make a website's structure easier to understand, you can use a visual sitemap. This is like a drawing that shows how different pages or sections of the website are linked together.

A visual sitemap can be drawn in two main ways: vertically (up and down) or horizontally (side to side). For simplicity, we will focus on horizontal diagrams. You can create this diagram with pen and paper, in Microsoft Word, or with special software designed for making these kinds of diagrams.

Designers generally recommend that a website should not have more than four levels of pages, as if a website is too complicated, with too many layers or hard-to-find links, it can be frustrating for users. The goal is to make sure that all of the important pages are easy to access from the main menu or other links on the site.

Example 1

See Figure 5.6 for an example of a horizonal sitemap with two levels drawn using Microsoft Word. It consists of a home page with a navigation bar (indicated in this example by shading) that gives clear links to four main pages.

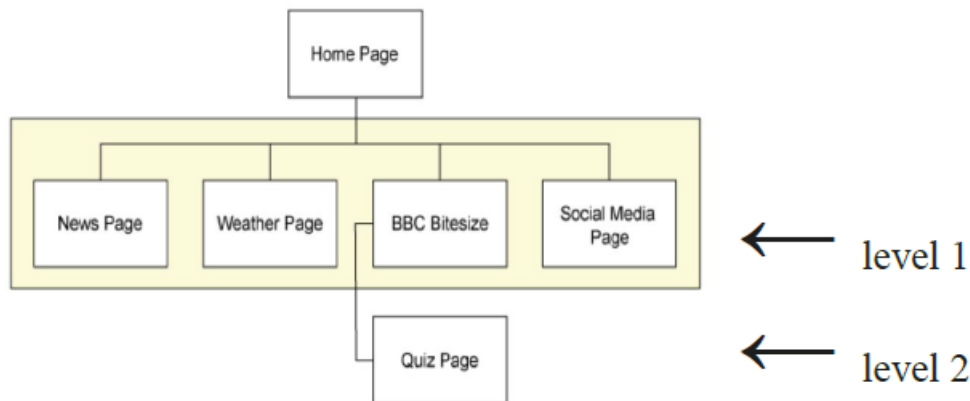The BBC Bitesize page has a link to a sub-page (Quiz page).

Figure 5.11: *Sitemap example 1*

Example 2

Barefoot is a business that sells shoes in Tamale. The website being developed for this business should have a homepage and three linked multimedia pages of the shoes currently on sale. These three pages (Men, Women and Children) should be navigated backwards and forwards. A link should exist to the www.howtomeasure.co.uk website from the home page.

A design of a single-level visual sitemap for Barefoot's website, created manually, is shown is figure 5.7. Note that the arrow to the external link is in one direction only, this indicates that there is no link from www.howtomeasure.co.uk back to the Barefoot's website.

The navigation bar is not indicated but is obvious in this case, and has links to three pages: Men, Women and Children.
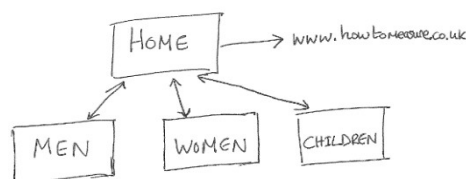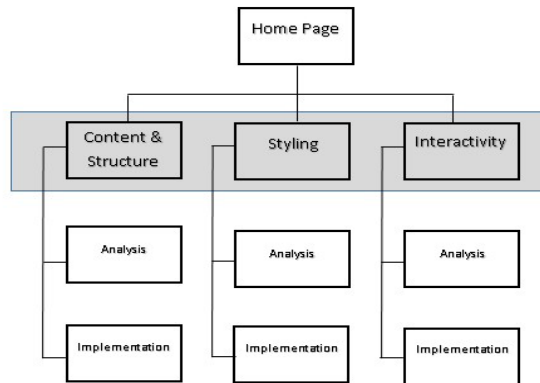

Figure 5.12: *Sitemap example 2*

Example 3

Digital Centre, an IT training company in Wa, is developing a website for their customers about web development. A horizontal navigation bar will be used with links to three pages: Content & Structure, Styling, and Interactivity. Customers should be able to access further pages to learn about analysing or implementing the code for each of these three elements of web development.

Figure 5.13: *Sitemap example 3*

A design of a multi-level visual sitemap for the *Digital Centre's* website created in Microsoft Word is shown in Figure 5:8. A dotted line is sometimes used to indicate the navigation bar. In this example and in example 1, the navigation bar is indicated by shading.

Activity 5.8 (building on Activity 5.7)

1. Using paper or a digital tool, sketch a simple sitemap for your website in activity 64. Include the main pages, navigation bar and any subpages.
2. Choose the Homepage from your sitemap and list all the sections and features that will appear on this page.
3. Draw a simple wireframe of the homepage, placing each component in its designated spot.
4. Develop three CTAs (call to actions) for your website's homepage. Consider their placement and wording.
5. Share your work with your facilitator for review.

Activity 5.9

1. A1 Bakery is a chain of bakery shops in Ghana. There is a need for a new website to be developed for this business. This website should have a home page and three linked multimedia pages of the products that the bakery currently sells. These three pages (Breads, Pastries, and Cakes) should be navigated backwards and forwards from the home page.

   Create a single level /top-level visual sitemap for this website.
2. Additionally, the owner of A1 Bakery wants the customers to be able to access a further page on the website with an order form for a celebration cake.

Amend the sitemap from (a) to include this page.

Next steps

Content creation: The content creators make or gather content for different parts of the website and ensure that this content aligns with the website's goals and that it is engaging for the visitors. For example, a video editor may be commissioned to produce a promotional video for a university website. Copyright needs to be considered when making and gathering content for a website.

Activity 5.10 (Building on Activities 5.8 and 5.9)

1. Highlight the key contents on your chosen website.
2. Suggest alternative content which may enhance the websites' goal (if applicable).
3. Have you identified any copyright issue on your chosen website? If yes, how can you correct it?
4. Share your response with peers in the class using PowerPoint slides.

Development and testing: Web developers will use the web outline plan to code and test the website. Testers can use the web outline and sitemap, as they adopt the role of the user personas as part of usability testing, following the structure of the website to test that it works as expected.

Deployment and launch: This is where the developer will set up hosting, configure the domain, and deploy the website to a live server. They will conduct final checks to ensure all elements, functionality, and links work correctly. They will then create a backup and have a plan for ongoing maintenance and updates for the website.

Analytics and monitoring: This the stage where the developers will set up tools to see how users are using the website. This includes how many people visit, what they do on the site, and how well the site meets its goals. Developers will regularly check the collected data to monitor and understand what is happening on the website. They will then use the data to find out what's working well and what needs fixing, as well as make any improvements as necessary. This helps make the website better, easier to use, and more effective in reaching its goals.

Activity 5.11

1. In your own words, explain the following in your jotter:
   a. Development and testing.
   b. Development and launching.

    c. Analytics and monitoring.

2. Share your responses with your colleagues.

Conclusion

A web outline plan is like a detailed map for building a website. It shows how the website will be organised, including the main sections, sub-sections, and how everything will link together. This plan helps make sure the website's content is easy to find and understand. It also guides the team creating the website, including designers and content writers, to make sure everything fits together well. Good planning is important because it helps make the website easy to use, saves time and money, and can help the site perform better in search engine results.

Hello learner, we saw in our previous learning that one of the general guidelines in developing a web outline plan is **wireframing** and **prototyping**, our focus will be on them in this learning.

Let us look at them now!

Activity 5.12

Now, imagine you are building a house,

1. What is the first thing that you would do?

2. Sketch the layout of the house (Hint: Think about where each room and auxiliary would go).

3. How does this relate to wireframes in computing?

4. Share your responses with your peers and facilitator in the classroom for discussion.

The first thing you would do is to create a blueprint or a sketch that shows the structure of the house. This is like a wireframe in computing, which is a basic visual guide to the layout (structure) of a website (how the website would look like).
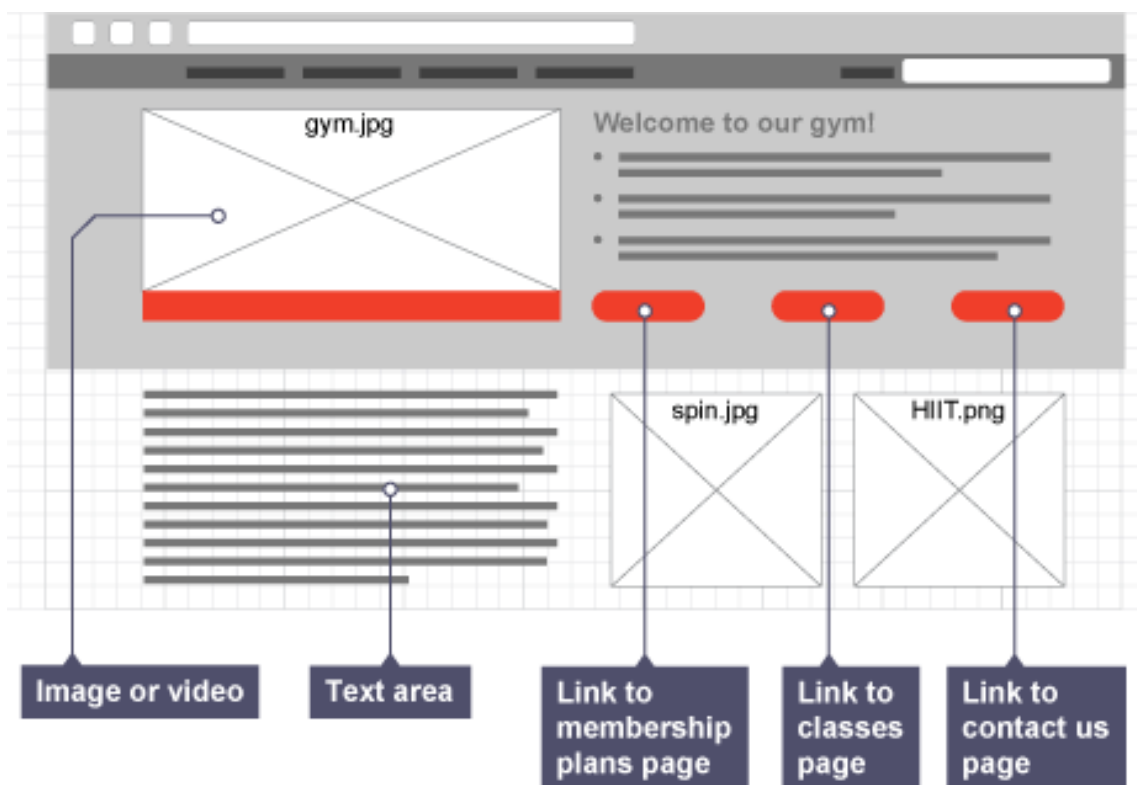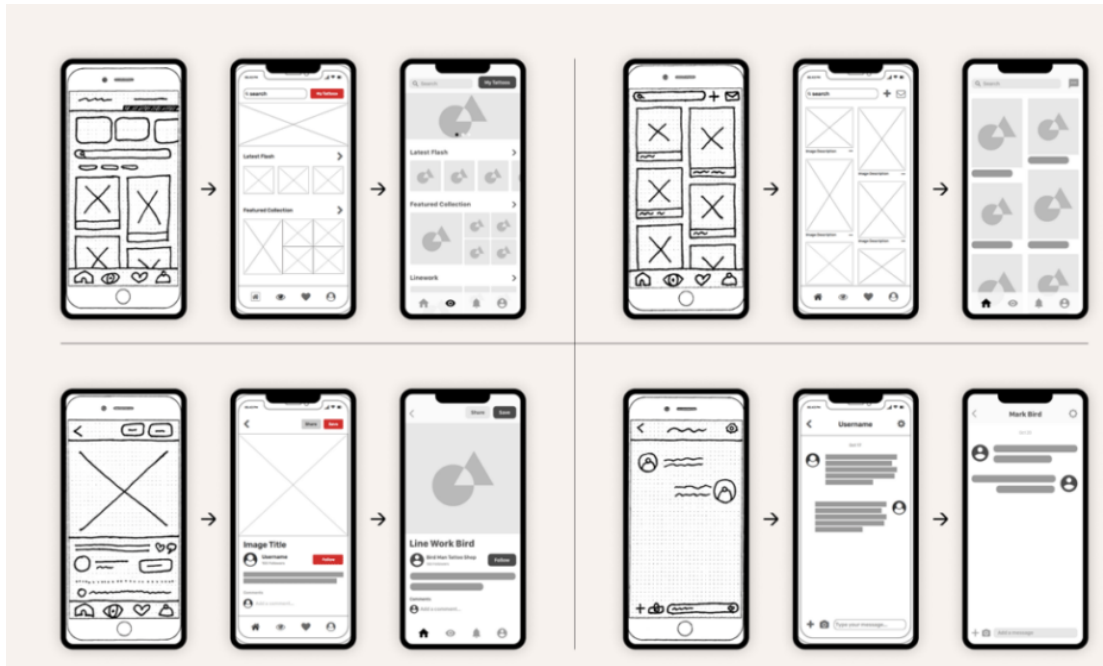
WIREFRAMES

What are wireframes?

Wireframes are simple drawings that show how a webpage will be arranged. They are like a rough plan that shows what information should be on the webpage and where everything should go. A good wireframe should clearly show:

1. navigational links.
2. text areas.
3. media used (including file format).
4. position and type of hyperlinks on a page.

Wireframes are basic designs that focus on where things will be placed on a webpage. They use simple shapes and shades of grey to show where content and buttons will go, without using distractions such as colours, pictures, or detailed images. This helps to focus on how the webpage will work, not how it will look. Figure 5.14 and Figure 5.15 show some examples of wireframes.

Figure 5.14: Wireframe for a gym website

Figure 5.15: Wireframe for a mobile App

Boxes with an 'X' are used as placeholders to show where images will go. For videos, a plain box with a play button or controls in the middle is used, and audio placeholders show media controls. The names of media files should also be written.

Text areas are shown with horizontal lines. Sometimes, these lines are replaced by a short summary or sample text. Headings are added to help make the layout easier to understand.

Links are shown in a different colour and are labelled. Wireframes may also have notes, called annotations, that give design details (specifications) like background colours, font styles, and the sizes of images.

How to Create a wireframe?

A wireframe can be made by hand (manually) using a pen/pencil and paper, or it can be created electronically using online or installed software tools that come with templates to help design the layout. Some online platforms to draw wireframes include Wireframe.cc and Moqups.com. Digital tools include Microsoft Word, Adobe XD, Figma, Sketch, and Balsamiq, as well as Axure RP. A screenshot of a digital wireframe template is shown in Figure 5.16.
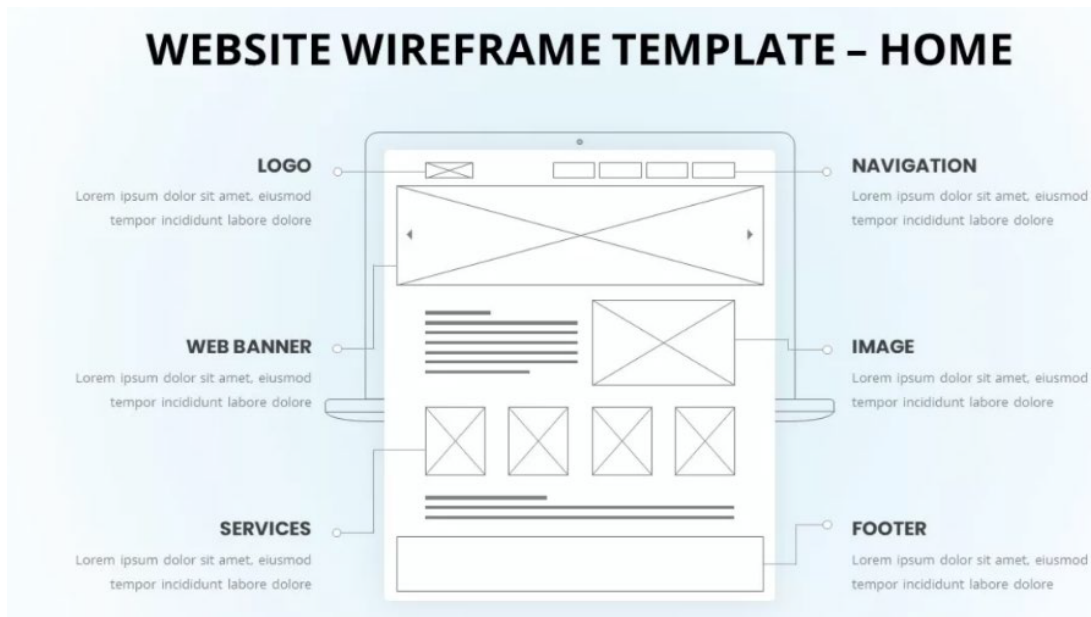
Figure 5.16: Digital wireframe template

Activity 5.13

With your peers, read the design specification below and perform the activity that follows.

DM Photography is a business that takes photographs of family events and celebrations. This includes birthdays and weddings, as well as photographs of other special occasions.

The business wants a website containing the following elements:

1. the title 'Pretty Pictures'.
2. a short statement about the business's quality assurance to customers.
3. separate pages for each category of photograph package: birthday, wedding and other special occasions.
4. a 'Recommend a Friend' page that gives details on how to register for rewards for customers and their friends.
5. at least one photograph on each page showing previous examples of images taken.
6. a video on the home page showing the business owner talking about their three packages on offer.
7. an external link on the 'Recommend a Friend' page to 'The International Photography Awards' website (www.tipa.com),GES (https://ges.gov.gh/) and T-TELL (https://t-tel.org/) websites.

Perform the following tasks;

1. Design a top-level visual sitemap for this website.
2. Draw a wireframe for each page manually and electronically.

3. Share your responses to your peers in class using SlideShare.

Activity 5.14

Alhaj Habib and Sons' BikeStore is a charity bike shop. They need a single page website to encourage donations of bikes and to advertise what bikes they have in stock.

This web page should have:

1. the charity logo (PedalPower.jpg) and name at the very top of the page.

2. a heading with the title "We need your old bikes!"

3. a graphic of a bike (bike.png).

4. a subheading entitled "What we need".

5. a numbered list detailing the top 5 types of bikes the charity shop would like donated.

6. a subheading titled "Our current stock".

7. a video showing the current stock (ppstock.mp4).

8. a page background of pale blue/cyan.

9. other design specifications are at the discretion of the designer.

Perform the following tasks;

1. Draw a wireframe for this page either manually or electronically.

2. Show your design to your facilitator for review.

Activity 5.15

1. Using a pen/pencil, draw a wireframe for the following individually in your notebook:

    a. A web page about your family.

    b. A web page about your favourite animal.

    c. A Home page of a website about Ghana.

2. Share your drawing with your facilitator for review.

Activity 5.16

1. Individually, using the shapes in Microsoft Word or an online wireframing tool, create a wireframe for the following:

    a. A web page about your family.

    b. A web page about your favourite animal.

c. A Home page of a website about Ghana.

2. Share your drawings with your peers and facilitator.

Prototypes

Compare the wireframe of your house to building a small model of the house to test the design and see how things will function. This is like a prototype, where the basic interactivity and functionality are tested.

What is a website prototype?

A website prototype is a visual representation (model) of a website design used to show how it works and how users can interact with it. The main difference between a wireframe and a low-fidelity prototype is that the prototype allows you to interact with the pages, click on buttons and test how the website functions.

A low-fidelity prototype builds on wireframes and is a simple way to turn basic ideas from the wireframes into a testable product. It usually includes more detail than a wireframe, allowing users to interact with buttons and links to test how the website will work:

1. text areas might include the full text that will be on the website.

2. image and video areas might show hand-drawn versions of the final images or videos.

A low-fidelity prototype can be made quickly and cheaply by hand using pen/pencil and paper. It can also be created electronically with presentation software or specialised online/installed tools that provide templates.

Figure 5.17: *Testing with a low-fidelity prototype*

When using paper-based prototypes, you need two people to show how the website works. One person acts as the user, pretending to click on 'hyperlinks' on the page,

while the other person plays the role of the computer browser, moving from page to page or section to section. At this stage, you will use the user personas you created earlier to guide the demonstration.
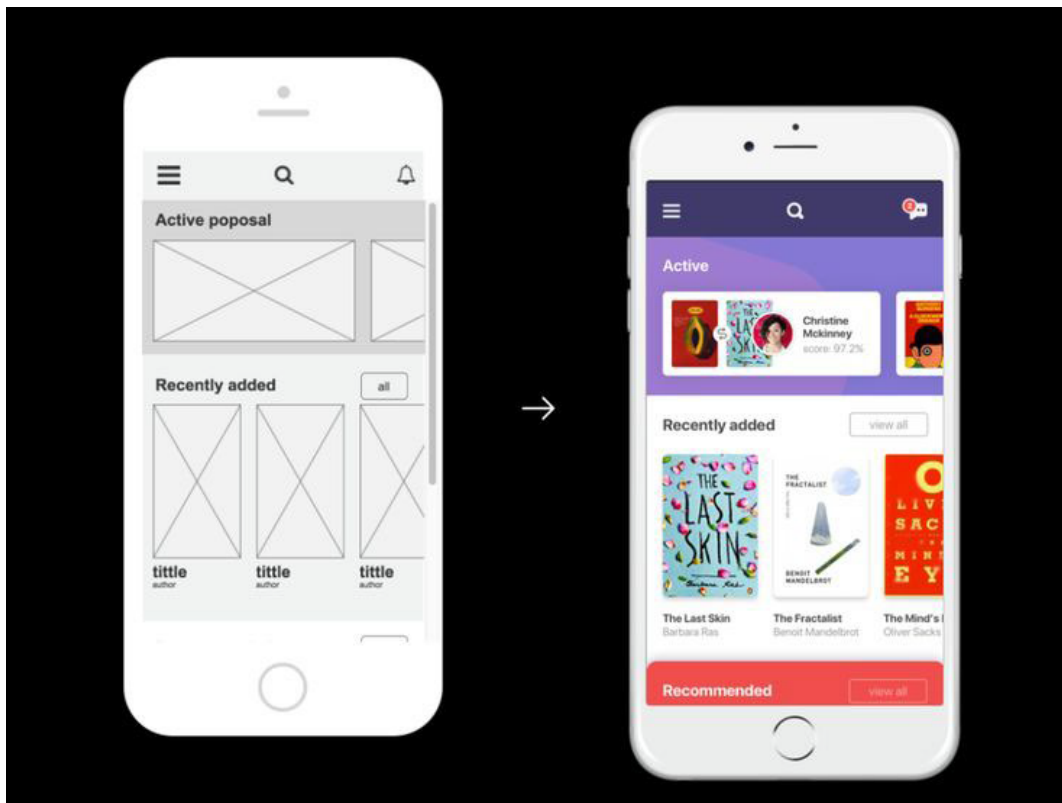
Figure 5.16: *Low-fidelity and high-fidelity prototype*

A high-fidelity prototype is a very detailed and interactive version of a website. It closely resembles how the final website will look and work, with many of the features and functions already included. An example is shown in Figure 5.16.

Advantages of Using Wireframes and Prototypes?

Showing to a client the wireframes and both low-fidelity and high-fidelity prototypes before starting more detailed work can be very useful. It helps the client make sure that the site includes all the necessary functions and information. If you only show a final design, the client might focus on how the site looks and not notice any functionality issues until the site is built. At which point, it can be difficult to go back and fix.

To summarise, some of the main advantages of using wireframes and prototypes in web design are:

i.   Identifying design flaws early on in the development process.

ii. Reducing the costs of the website development.

iii. Receiving feedback from the client.

iv. Improving communication between the client and those creating the website.

v.   Testing functionality and interactivity using prototypes.

vi. Providing a guide to the web developers on how the website they are tasked to create should look and behave.

Activity 5.17

Individually, do the following:

1. Explain what a prototype is and why it is important. Use the house model analogy to illustrate the concept.
2. Think of a simple website. What is its purpose, target audience, and key features?
3. Sketch the main pages of the website on paper. They should include:
   a. The homepage.
   b. Key pages (e.g., About, Contact, Blog).
   c. Navigation elements (e.g. menu, links).
4. Show the layout, content placement, and how users will navigate between pages.
5. Use digital tools if available or continue with paper sketches to create a low-fidelity prototype. It should include:
   a. Basic page layout and structure.
   b. Main navigation elements (menu, links).
   c. Key content areas (header, footer, main sections).
6. Present your website prototypes to the class. The presentation should include:
   a. The purpose of your website.
   b. The main features and content areas.
   c. How users will interact with the site.
7. Discuss what you learned from the prototyping process by answering the following questions:
   a. What aspects of website design were challenging?
   b. How did feedback from peers help to refine your design?
   c. What improvements would you make based on the feedback?

Activity 5.18

1. With your peers, prepare a PowerPoint slide of answers to the following questions:

   a. What is the difference between a wireframe and a prototype in web design and how could both be used when designing a website for your school?
   b. Where do wireframes and prototypes fit in a web outline plan?

    c. What happens in web development after wireframes and prototypes have been made?

2. Present your answers to the class.

EXTENDED READING 5.1

1. Explore other websites and identify their headings and menus. Notice how different sites use these elements to enhance the user experience.

2. Use simple web design tools like Google Drawings or Canva to create a digital version of your web page layout.

3. Write a short guide on website accessibility. Consider a variety of potential website users in your guide, including those who are visually impaired, hard of hearing, colour-blind or elderly.

EXTENDED READING 5.2

1. Robbins J. N. (2018). A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. Published by O'Reilly Media, Inc., page 3 – 46.

2. Robbins J. N. (2012). Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. Published by O'Reilly Media, Page 10 – 25.

3. Osborn J., Smith J, and AGI Training Team (2011). Web Design with HTML and CSS Digital Classroom. Published by Wiley Publishing, Inc. ISBN: 978-0-470-58360-9. Pages 1 – 34.

4. Research what is meant by an XML sitemap. Create a report on your findings. Include a description of how it differs from a visual sitemap and how search engines use XML sitemaps.

5. Investigate the following and create a presentation summarising your findings:
   a. The various techniques used in website usability testing such as the think-aloud protocol, co-discovery learning, and eye tracking.
   b. Other types of website testing such as compatibility testing.

EXTENDED READING 5.3

- Click here or https://www.youtube.com/watch?v=qpH7-KFWZRI to watch how wireframing and prototyping are done.

- Osborn J., Smith J, and AGI Training Team (2011). Web Design with HTML and CSS Digital Classroom. Published by Wiley Publishing, Inc. ISBN: 978-0-470-58360-9. Pages 1 – 34.

- Robbins J. N. (2012). Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. Published by O'Reilly Media, Page 10 – 25.

- Robbins J. N. (2018). A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. Published by O'Reilly Media, Inc., page 3 – 46.

- Use the link or https://flatironschool.com/blog/wireframing-and-prototyping-in-product-design/ to find out more about wireframing and prototyping.

Review Questions 5.1

1. All the web pages in a bank's website contain a footer with a number of links. Describe two items that would be expected to be linked from the footer area of this website

2. A website is being developed that will be used by runners to register online for an upcoming marathon. What components must this website have? Explain your reasoning.

3. A business having a social media presence can benefit both the business and its customers. Describe how a social media presence can be incorporated into a website

Review Questions 5.2

1. Mr. Gyampo, a computer science teacher, has created a website about AI (artificial intelligence).

   The website has a home page and linked pages on four areas of AI: NLP, computer vision, robotics and machine learning. All pages can be navigated backwards and forwards. The file structure of the website is as shown below. There is a link from the homepage (index. html) to the external website – www.google.ai.

   Draw the navigational structure for this website.

   CSS

   Media

   JS

   index.html

   NLP.html

   computer_vision.html

   robotics.html

   machine_learning.html

   virtual_assistants.html

   chatbots.html

2. Describe what is meant by the following:
   a. Website structure

   b. A hierarchical navigation website structure

3. With respect to web design, give one difference between a sitemap and a content outline

4. Imagine that you are the owner of a new gym, and you are working with a web designer to create a website for this business. Create a slideshow that will show the following for your website:
   a. At least three goals

   b. Three different user personas

   c. A multi-level visual sitemap

   d. A list of the items that you wish to appear on the Home page

Review Questions 5.3

1. Explain how presenting wireframes to a client early in development can prevent future functional issues with a website.

2. Evaluate how each of the main elements of a web outline plan can impact the effectiveness of a website.

3. Why do web designers seek feedback from the client on wireframes and prototypes?

REFERENCES

- Computing – Teacher Manual (2024), Year One Book 2 for SHS, SHTS, STEM curriculum – pages 96 – 130.

- NaCCA (2023) Computing curriculum for Secondary Education (SHS1-3) pages 50 – 53.

- Osborn J., Smith J, and AGI Training Team (2011). Web Design with HTML and CSS Digital Classroom. Published by Wiley Publishing, Inc. ISBN: 978-0-470-58360-9. Pages 1 – 34.

- Robbins J. N. (2012). Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. Published by O'Reilly Media, Page 10 – 25.

- Robbins J. N. (2018). A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. Published by O'Reilly Media, Inc., page 3 – 46.

- The Interaction Design Foundation (2015). UX Tools: Wireframing and Prototyping Tools retrieved from https://www.interaction-design.org/literature/article/ux-tools-wireframing-and-prototyping-tools?srsltid=AfmBOoqCI4vkBjz1dPTnsIUey GtouprMgoyz-IQQjpEaXNNtnjL-RXPD on 17/09/2024.

GLOSSARY

- Database: A digital system for storing and organizing data.

- Moqups: A tool for creating rough sketches of websites or apps.

- Model: A simple representation of a system or process.

- Null Pointer: A variable that does not point to any data or memory location.

- Programming: Writing a set of instructions (program) for computers to perform tasks.

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