Steps towards the development of mobile learning for smartphones and mobile telephones

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1. Install a web-authoring tool, for exampleMacromedia Dreamweaver MX version 1.0, to aid the efficiency of page development. Dreamweaver automatically updates all pages sharing a common template and provides a validator that checks for errors in the markup.

2. Install a desktop browser that has page rendering characteristics similar to those of the browser on the mobile phone, for example, Opera 7'spage rendering characteristics can simulate Opera 6.32's behaviour (Opera 6.31 is Opera's mobile phone browser) more closely than a different vendor's (i.e. Microsoft) desktop browser. Using a desktop browser for previewing pages under development is quicker that previewing them on the mobile phone browser.

3. Use XHTML 1.0 Transitional to code the web pages. It is a W3C (World wide Web Consortium) technology introduced to promote the development of pages that are wukk-formed (well-structured, use correct syntax and with all elements in the document nesting properly).

4. Use Cascading style Sheets (CSC) to separate presentation style from document content. If presentation rules are centralised in an external .css file, the XHTML documents need only to ser out the basic structure of each web page.

5. Investigate the level of support for Javascript available on the mobile phone bowser for which the pages are being developed. Find out if there is an implementation of the Document Object Model (DOM) on the mobile phonebrowser. The DOM can connect any element (for example a table, a table cell, an image, a container element etc.) on a page to a Javascript function. Adding Javascript to web pages makes them more dynamic. Javascript could be used, for example, to change the background colour of visibility of an element in response to mouse clicks by the user.

6. Arrange each web page as a vertical column of content. Use a div generic container element (with its width set to less than or equal to the

screen width on the mobile phone) to hold all page content in a vertically stacked design. The aim is to avoid horizontal scrolling of pages on phone screens.

7. Table elements are not automatically constrained by the width settings of the div container element, and require extra CSSrules to ensure that their widths remain less than or equal to the column width. The CSS 'border-collapse' and 'table-layout' properties are particularly useful for exerting tight control over table behaviour.

8. A well-designed user interface is essential so that telimited screen space is utilised as efficiently s possible. An iframe can be included in the user interface (the latest mobile phone browsers Opera 6.31 provide stable support for iframes). This means that the user interface remains static after it has been downloaded by the mobile phone, and content can be downloaded as separate web documents for the iframe.

9. Stacking titles or headings above one another on separate layers can e used to develop pages with a simple dynamic capability. Javascript can be used to toggle the visibility of the headings or titles so that they appear and disappear to correspond with the user's location in the course.

10. Concise, neat diagrams need to be designed that fit on the small device screen but convey information effectively. To produce neat, clean and concise diagrams the following steps can be taken in Photoshop:

11. Adobe Photoshop can be used to save images as Graphics Interchange Format (GIF) files. Photoshop provides settings that enable developers to produce lightweight GIFs with a transparent background and web-safe colours.

12. Start to build up image. Usually best to put individual lines/shapes/words on individual layers. Whether a particular line or shape appears over or beneath another line or shape depends on the order of layers. Layer order can be changed by simply clicking over a layer and dragging it up or down the order.

13. Open up the original image in Photoshop to use it for reference. Color eye dropper tool can be used to pick colours from the original.

14. The zoom-in/zoom-out (Alt click) tool can be used for close-up, accurate work on an image, e.g. using the rectangular marque selector to neatly clear fixed length sections from a line (to produce a reasonable-looking dashed line).

15. To create a straight or curved line use the pen tool. The first click creates the anchor for one end of the line, the second click will create the anchor point at the other end of the line segment. Before 'de-clicking'/'de-pressing' the left mouse button after creating the end point of the line segment, handles are available (through dragging mouse) for creating a

curved line. (Pressing shift while you left click the mouse to create end point of line segment ensures that a straight, horizontal line segment is produced '_____'.) Now that you have a line segment, on the layers palette, go to Paths →Save Path. You are prompted to name path. Now you can stroke this path (once it is selected under Paths) to produce your line. Make sure the narrowest brush is selected, use a black #000000 foreground colour and then (in Paths on Layers Palette)→Stroke Path. Tool: Paintbrush OK. Be sure that you are drawing the line on the desired layer (if necessary double check by clicking the Layers tab on the Layers palette) before stroking a path. After a path is stroked, be certain to deselect that path (in Paths on Layers palette) before proceeding. Remember after the click to create the first or second line segment point, you can use the arrow keys to shift/reposition that individual point.

16. The history palette can be used at any stage to go back any number of stages and start again from an earlier point or stage in the work.

17. The rectangle or ellipse marquee selection-shapes can be used to create selections (check that anti-aliased *is* flagged on Marquee Options on Info/Navigator palette when ellipse selection is being made) and these are then filled with your choice of colour to produce rectangular/ellipse shapes. A particular selection shape can actually be saved to be reloaded later. Select→Save Selection. You can manipulate the glowing selection outline itself by right clicking the mouse and choosing 'Transform Selection'.

18. With the Move-Tool you can position (simply by clicking and dragging) any line, text or shape you have created, providing, of course, you are in the layer that the line, shape or text is on.

19. To add some text (usually best to place individual words, numbers, phrases) on their own separate layers select the Text Tool, and click on the area in the layer where you want to add the text. You do not type the text directly into the image; after clicking, a window appears and you type your text into that. Use the Move-Tool for subsequent repositioning.

20. Areas of shapes or images can be selectively cleared/deleted using marquee selections.

21. Free Transform or Transform under the 'Edit' menu can be vital to achieve the image you are after.

22. Finally, turn off the visibility button of the background layer you created initially (see Step 2) before File→Save for Web.

Earlier on in the Steps it is important to begin saving your image at regular intervals (not Save for Web version of the work but a .psd photoshop version.

It is usually best to build up your image with shapes (ellipses/rectangles) *first* (lower layers); *then* lines, curves; and *then* text on top.