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Digital Learning and Memory: The Role of Visual Design

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Abstract

In this study participants' (N=120) free recall memory performances were measured in two purposely designed digital learning environments. An award winning context-free science fiction story was structured and visually programmed as the content of the (1) Text Presentation and the (2) Pictorial Presentation online learning environments. The independent samples t-test results were not significant; therefore memory performances were better for encoding from the text than the pictorial presentation.

Keywords: Free recall; memory; digital learning; text presentation; pictorial memory; visual design

1. Introduction

Digital or traditional, in most of the learning environments, text is the main medium through which students acquire and process information. Effective text presentation is therefore crucial for learning in the various learning media (Sinatra & Broughton, 2011). Purposely designed, digital or printed learning materials include text and visual graphic information representations. *The picture superiority effect* (Paivio, Csapo 1973) suggests that the memory is usually better for the items presented as pictures. The importance of pictorial information is usually underlined as a memory aid in learning by educational researchers Pictures are more discriminable and distinctive than words (Madigan, 2014). Thus, by adding different visual design elements or illustrations to the digital learning environment, it could be possible to see how learners' memory performances change (Cangöz & Altun, 2012). The ways the designers use, locate and integrate the visual representations, illustrations and elements in a digital multimedia learning

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environment are also important. Researches that focus on online cognitive processing of a visually illustrated text can also focus on learning and memory performances from classical text reading and pictorial presentation processing. These studies can lead to a better understanding of text and graphic based comprehension in order to design visually more effective digital learning environments.

2. Problem Statement

The visual characteristics of the digital learning environment may influence the learners' memory performance and the quality of learning in digital learning.

3. Research Questions

Does the encoding type of the memory trace depend on the visual design characteristics in digital learning environments?

4. Purpose of the Study

The purpose of this study is investigating the role of visual design types on memory performance in digital learning environments.

5. Research Methods

An experimental design based, quantitative research model was followed. A total of 120 students (87 female, 33 male) aged 17 from a high school participated in the study. The participants were randomly recruited in 2 experimental groups. The first experimental group (n=60) read an online story (Kocagöz, 2011) from the screen which was designed in a simple text presentation format. The second experimental group read the story in pictorial presentation format.

The online text and the pictorial presentation visual designs were programmed in linear navigation design type that participants navigated from one page to another in a linear order instead of a complex navigation design.

The online story and the digital learning environments were structured within 10 chapters and 10 pages. 25 words from the text were selected as target words. In the text presentation digital learning environment 3 or 4 words on each page were highlighted with red font color in the text. In pictorial design, the same target words were replaced with a picture instead of written words in the text screen. For example the word “chair” was replaced with a chair picture in pictorial presentation.

The online story visual designs were to fit on one screen on 15 inch monitors with standardized screen resolution by the computers running Internet Explorer 8 in full screen mode without scrolling.

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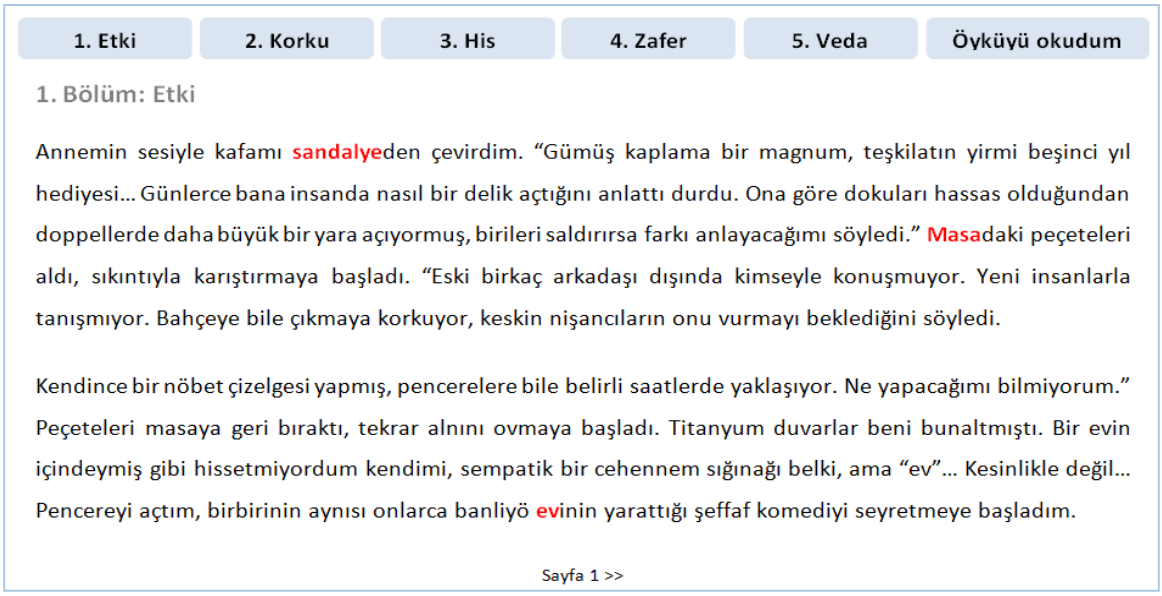

Figure 1. Screenshot of the online story designed in simple linear text presentation. The story was originally written in Turkish. The target words selected from the text were typed in red font colour. The chapter title list panel including interactive buttons is above the text screen. Page numbers are located below.

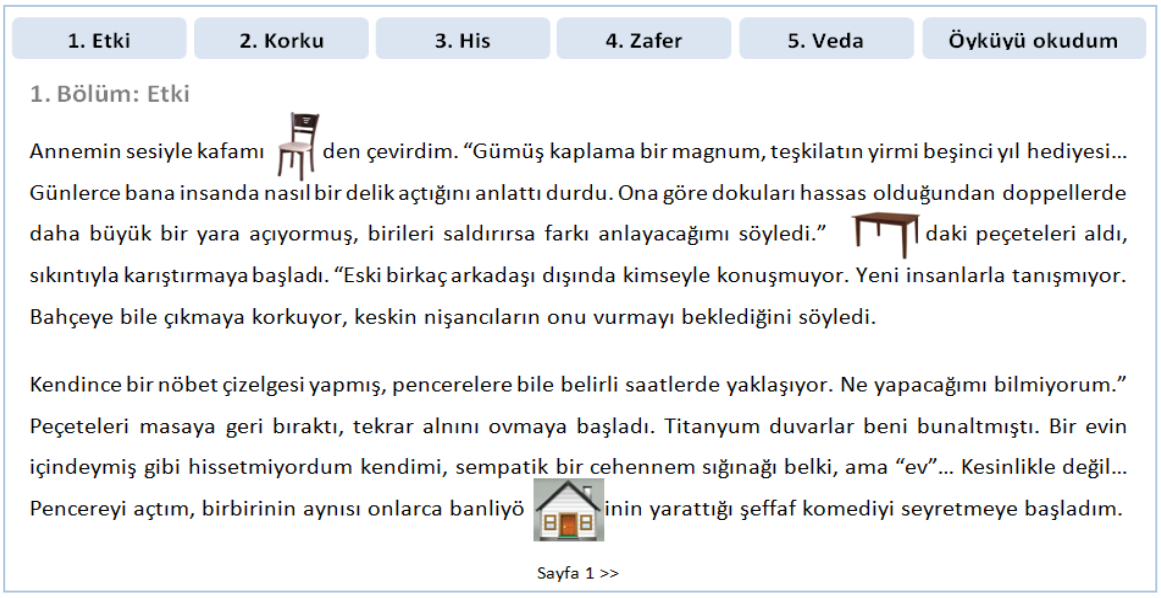

Figure 2. Screenshot of the online story designed in pictorial visual presentation design. The target words selected from the text were replaced with picture representations.

The immediate memory performance tests were applied online to the groups on free recall at the end of the reading task. Participants were informed to recall as more target words as they can from text. An independent samples t-test was utilized on data.

6. Findings

Table 1 demonstrates the means and standard deviations for the 2 groups on measures of memory performance of free recall in the text and pictorial screen visual designs.

Table 1: Mean number of free recall test scores, correctly recalled target words (N=25) from the text and pictorial presentations

Presentation Type	Mean	SD
Text	8.64	3.98
Pictorial	8.30	3.47

An independent-samples t-test was conducted to compare memory for free recalled words in text and pictorial presentation conditions. There was no significant difference in free recall scores for text presentation (M=8.64, SD=3.98) and pictorial presentation (M=8.30, SD=3.47) conditions; t(118)=0.50, p=0.062. The results suggest that presenting words in pictorial format does not have an effect on memory for free recall.

Results demonstrate that participants' free recall performances are better in simple text presentation than pictorial visual design. Participants recalled more target words when they read the text from a simple text screen. Free recall memory performance is better when the text is presented as linear simple text screen in digital learning design.

7. Conclusions

The way of encoding determines the memory performance in digital learning. Depending on the presentation and design type of the learning environment, free recall memory performance scores change according to the text structure. Presenting some of the words from the text in pictorial representation can be perceived by readers as a more complex process than reading the text in its classical written format. The integration of the visual design elements in learning content has a very crucial role in digital learning. Further research is needed to explore the instructional design and memory performance in digital learning environments in the framework of designing effective visual presentations with purposely integrated visual web elements.

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