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Original Paper

Typographic Effect on Learning Management System Effectiveness

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Abstract

Learning Management Systems (LMS) harness and share knowledge. The most extensive and well-populated knowledge networks are useless if they remain underutilized, with lower performing students 40% less likely to effectively use the LMS than higher performing peers. This study investigated the effect of four typographic elements—typeface, size, alignment, and emphasis—on perceived knowledge sharing effectiveness. With a sample size of 108 participants, typeface, size, alignment, and emphasis each had a significant ($p < .05$) effect on knowledge sharing effectiveness. Arial was the preferred typeface ($p < .0001$), 12-point the preferred font size ($p = .0001$), left or justified the preferred alignment ($p < .0001$), and sentence case the preferred emphasis ($p < .0001$). The ease and increased prevalence of adjusting these typographic elements thus leads to potential adverse effects on student use of LMS and their learning outcomes.

Keywords

learning management system, knowledge sharing, typographic elements

1. Introduction

Knowledge sharing is an amalgamation of individual and technological flows converging to disseminate knowledge (Reinholt, Pedersen, & Foss, 2011). Harnessing and contributing to the potential knowledge contained within Knowledge Management Systems (KMS) can lead to growth and expansion (Okyere-Kwakye & Nor, 2011). KMS is typically employed within education as Learning Management Systems (LMS) that are accessed by teachers and students to enhance the education process (Fritz, 2017). These systems, in turn, directly impact student knowledge sharing success and educational outcomes (Alshorman & Bawaneh, 2018).

As of Fall 2015, nearly six million post-secondary students were enrolled in at least one distance-learning course (National Center for Education Statistics, 2018), thus using an LMS. Moreover, online learning has bypassed the traditional classroom as a learning environment, creating nuanced technologic knowledge and community-building needs (Quong, Snider, & Early, 2018). While online learning provides the learner access and flexibility (Goralski & Falk, 2017), some online delivery platforms lack the robustness required for engagement and positive learning experiences (Gillett-Swan, 2017). The LMS platform is therefore critical as it is where students receive material, take tests, and interact with their peers in online class discussions, with the faculty monitoring, evaluating, and providing feedback. Yet, even the most extensive and well-populated knowledge networks are useless if they remain underutilized (King & Marks, 2008). Fritz (2017) noted that in online academia, lower performing students were nearly 40% less likely to effectively use the LMS than higher performing peers.

While there are many considerations that affect student use of and benefit from LMS, this study investigated the importance of visual aspects in knowledge sharing, using the approach of Tortoriello and Krackhardt (2010) in measuring reported perceptions of movement and transmission of information and knowledge from person to person. Examining the role of visual typographic attributes within LMS may provide valuable insight as both faculty and students access the experience within an online community fostered to deliver learning in the process (Chaw & Tang, 2018). Typography encompasses all components enabling the translation of audible language into a visual representation (Jury, 2006). The transmission of printed information and knowledge, whether physical or digital, is affected by typographic elements such as typeface, text size, alignment, and emphasis (Phillips, McQuarrie, & Griffin, 2014; Soleimani & Mohammadi, 2012). Typeface, a set of characteristics for a given text design (e.g., Times New Roman), affects overall readability and comprehension (Hurley, 2012; Yeo & Sim, 2012). Text size affects overall readability and comprehension (Rello & Marcos, 2012). Alignment of text within the page (e.g., centered or right justified) allows or disrupts reading (Hurley, 2012). Emphasis (e.g., italics and bold) affects readability and is one of the most commonly adjusted effects used in electronic communication (Yeo & Sim, 2012). Banerjee, Majumdar, Pal, and Majumdar (2011) found typeface choice could affect perception of mental workload, alter reading time, and alter reading comprehension, all aspects that would seem critical in student learning. Chaw and Tang (2018) further recommended that typography used in the online setting be free of distraction and adornments that fatigue eyes or cause strain to avoid compromising the learning process. Factors that impact usability and encourage (or discourage) LMS use must be understood to enhance LMS functionality that contributes to student success, with this study focused on the visual LMS aspects of typography.

2. Method

2.1 Research Question

This study centered on a single Research Question (RQ). *To what extent is there a difference in participant-perceived knowledge effectiveness among variations in typeface, size, alignment, and emphasis typographic elements?* The null hypothesis assumed no statistically significant differences ($p > .05$), while the alternative hypothesis assumed statistically significant ($p \leq .05$) differences, with each typographic element being analyzed separately.

2.2 Variables

The Dependent Variable (DV) was participant-perceived effect on knowledge sharing, measured as categorical Likert-scale values using a survey instrument. Independent Variables (IVs) were four typographic elements: (a) typeface/font style, (b) type/font size, (c) text alignment, and (d) text emphasis, with each being represented by four nominal value options.

2.3 Research Design

A causal-comparative research design with ANOVA used for analysis was used to determine to what extent there were differences in participant-perceived knowledge effectiveness among the variations in typographic variables.

2.4 Sample

A purposeful sample of 108 adults was selected from among a target population of experienced knowledge management system users, exceeding the minimum sample size of 85 indicated by G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009). The sample size was 54% male with 94.4% of the total sample having at least some college learning experience.

2.5 Instrument

An online survey represented in Figures 1-4 was used for assessing user perception of knowledge sharing effectiveness using a 5-point Likert-scale from 1 = ineffective to 5 = effective. A 30-word benign statement was the comparative test to focus on typography, not content (Koch, 2012). Subsequent Cronbach's alpha determined an internal consistency between questions, demonstrating instrument reliability of $\alpha = .05$. The online survey provided data in SPSS format.

2.5.1 Typeface Comparison

The typeface comparison element shown in Figure 1 was prefaced with: *Typeface* refers to the particular design style for all letters, numbers, and punctuation, followed by four examples.

2.5.2 Size Comparison

The size comparison element shown in Figure 2 was prefaced with: Size refers to the placement of text between left and right margins of a page, followed by four examples.

2.5.3 Alignment Comparison

The alignment comparison element shown in Figure 3was prefaced with: Alignment refers to the measurement used to discern how many characters and spaces fit on a line, column, page, or screen, followed by four examples.

2.5.4 Emphasis Comparison

The alignment comparison element shown in Figure 4 was prefaced with: Emphasis refers to the manipulation of text to make it stand out without changing its uniformity, followed by four examples.

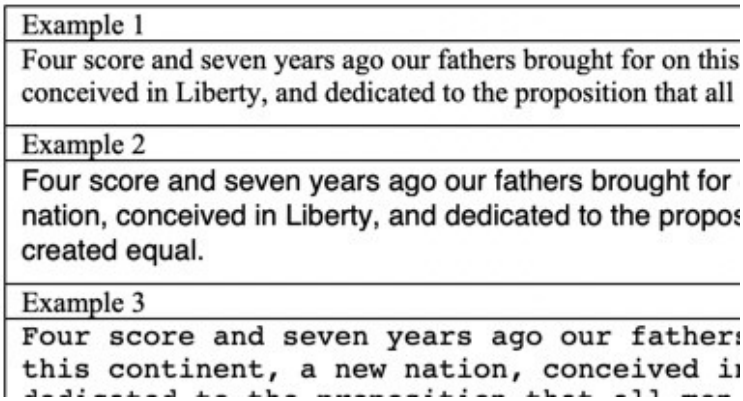

Figure 1. Times New Roman, Helvetica, Courier, and Arial Typeface Comparison

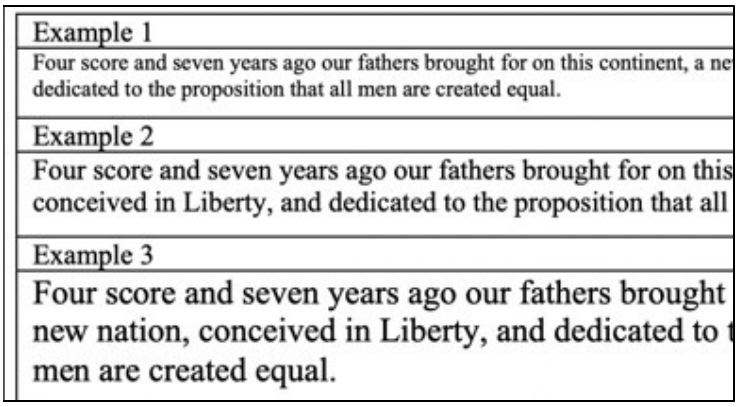

Figure 2. 8-Point, 10-Point, 12-Point, and 14-Point Size Comparison

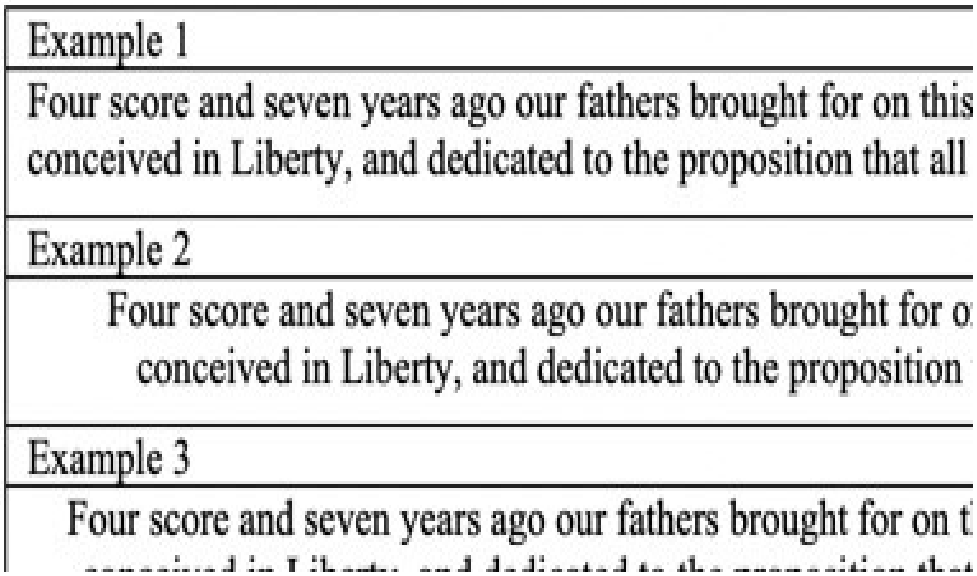

Figure 3. Left, Right, Center, and Justified Alignment Comparison

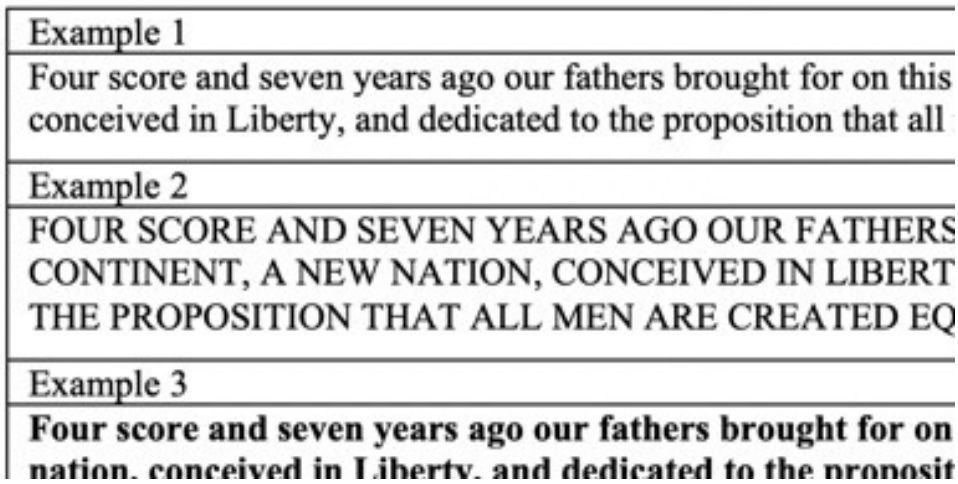

Figure 4. Sentence Case, All Capitals, Bold, and Italics Emphasis Comparison

2.6 Data Analysis

Prior to conducting data analysis, the ANOVA assumptions of normality, homogeneity of variance, and lack of outliers were assessed. Normality was verified using a Q-Q scatter plot (Bates, Mächler, Bolker, & Walker, 2014; DeCarlo, 1997; Field, 2013). Homoscedasticity was verified by scatterplot of the residuals and the fitted values (Bates et al., 2014; Field, 2013; Osborne & Walters, 2002). Lack of outliers was verified by absence of observation with studentized residuals exceeding the .999 quantile of the*t*-distribution (Field, 2013; Stevens, 2009). The ANOVA applied *F*-tests to determine significant differences between means at a $p < .05$ significance level.

3. Result

All four comparisons (typeface, size, alignment, emphasis) showed at least one significant difference among the four options, with typeface and size showing significant differences between each of the part combinations ($p < .05$) as shown in Table 1.

Table 1. Ratings of Typographic Element Effectiveness

Element	*M*	*SD*	Element	*M*	*SD*
Typeface			Alignment	3.92[a]	1.00
Arial	4.36[a]	0.98	Left justified	3.91[a]	1.10
Times New Roman	3.78[b]	0.97	Justified	1.65[b]	0.94
Helvetica	3.46[c]	1.15	Centered	1.51[b]	0.94
Courier	2.55[d]	1.00	Right justified		
Size			Emphasis	4.35[a]	0.91
12-point size	4.45[a]	0.83	Sentence case	3.18[b]	0.98
14-point size	3.95[b]	1.03	Italics	2.66[c]	0.83
10-point size	2.51[c]	0.89	Bold	2.53[c]	1.11
8-point size	1.60[d]	1.00	All capitals	3.92[a]	1.00

Note. $N = 108$. Ratings based on a 5-point Likert scale: 1 = Ineffective to 5 = Effective. Means with different superscript letters were significantly ($p < .05$) different.

4. Discussion

As shown in Table 1, certain typographic elements were perceived as more effective than others in supporting of knowledge sharing. Participants perceived Arial typeface ($M = 4.36$, $p < .0001$), 12-point text size ($M = 4.45$, $p = .0001$), left justified ($M = 3.92$, $p < .0001$) or justified alignment ($M = 3.91$ $p < .0001$), and sentence case emphasis ($M = 4.35$, $p < .0001$) as most suited for effective knowledge sharing, each with highly significant ($p < .0001$) advantage over second place choices. The implications stress the importance of considering typographic elements when making decisions regarding knowledge sharing within LMS. Some of the findings may be especially important when recognizing the importance of reading online LMS material, whether onscreen on when printed to hardcopy. For example, text size had been found to affect reading (Banerjee et al., 2011; Mayer & Villaire, 2009; Rello & Marcos, 2012), and by extension, knowledge sharing, although Darroch, Goodman, Brewster, and Gray (2005) disputed a connection between reading performance and text size. Even if reading differences were not significant, typographic preferences within an LMS may increase user satisfaction and desire to use, especially among lower performing students (Fritz, 2017). Contributions by both instructors and students are integral to the growth and value of knowledge contained within LMS. Finding small ways in which to attract and retain users to the institution's LMS has positive growth

potential for its entire online community. Additional research is needed to explore how students taking online courses use and interact with LMS material in concert with academic performance, investigating how significantly seemingly small typographic element change contributes to actual knowledge learning/sharing improvement.

Beyond the specific effect of typography elements on knowledge sharing, related aspects also might be considered. For example, while all LMS material is visible online, some users may prefer to print hardcopy of materials. When the preferred ($p < .0001$) Arial font is used, the typeface fits 15% more words per page than the commonly used and second choice Times New Roman (750 words vs. 650 words), decreasing the cost of ink and paper by 15% (Printing help pages, n.d.; Thomas, 2014). In keeping with the words per page aspect, further research might benefit from including passage length when addressing typography effectiveness, building on the work by Eschet-Alkalai and Geri (2010) who concluded that readers prefer long text in print but shorter text in digital format. This study used a single 30-word sentence text example. It would seem beneficial to extend study to determine how varying the length of electronic text (e.g., a short instructional manual, a lengthy knowledge sharing narrative, and a standard textbook) affects perceptions of best typographic elements for knowledge sharing. The current and future study into typographic preferences for knowledge sharing may be helpful in designing and implementing LMS norms.

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