The Impact of the World Wide Web on Idea Generation

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Abstract

One apparent benefit Web use provides individuals is the opportunity to seek and find vast amounts of information on virtually any subject. By having more information available, it is reasonable to believe that a user would be able to generate more ideas than he/she would without Web support. Given that the Web is being used more frequently for information and research purposes, an experiment was performed to determine whether Web use can enhance idea generation performance. Preliminary results indicate that while Web use does not harm idea generation performance, it does not help. But, users perceive the Web to be significantly helpful. It is hoped the findings from this project will enhance Web use and development for information and idea gathering.

1. Introduction

In order for an organization to remain competitive in today's rapidly changing environment, organizational members must constantly produce new ideas [1] [2]. As a result, organizations are eager to find methods for enhancing an individual's ability to generate ideas [3]. Popular methods include training methods [4], and group support software with brainstorming tools[5]. Not surprisingly, research results generally indicate that these methods enhance idea generation performance [6] [7]. Consequently, to the extent that an organizational member has a support tool readily available, one would expect his/her idea generation performance to be enhanced.

One information technology tool becoming readily available to organizations is the World Wide Web (The Web) [8]. Because the Web allows access to vast amounts of information and ideas in a variety of forms, it is possible that more and better ideas may be generated from its use [9] [10]. However, it is also possible that the Web may hamper idea generation as a user could become overwhelmed with support features such as hypertext links, and become too distracted to produce ideas.

Because the Web is increasingly being used for research and information gathering in many organizations, and because creativity is becoming a highly desired employee skill [1], determining whether the Web can enhance an individual's idea generation performance may prove useful. Therefore, the current paper investigates how the Web impacts an individual's ability to generate ideas. It is hoped the results will not only help managers more effectively apply Web use within their organizations but also help Web developers design applications to better to support information and idea gathering on the Web.

1.1 Idea Generation and the Web

The ability to generate ideas is thought to be a facet of creative thinking and has been referred to in creativity research as ideational fluency [11]. While a variety of personal characteristics are thought to be needed for effective creative performance [4], idea generation is considered to be one of the most fundamental [12]. Based in probability theory, creativity researchers generally accept that the more ideas an individual generates, the higher the likelihood that one of them will be both novel and useful [13]. Consequently, to the extent that an individual can generate more ideas, he/she is considered to be performing more creatively [12].

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In general, an individual's creative performance can be enhanced in a variety of ways [14]. For example, Mumford et al [15] found that how an individual organized available information affected his/her creative performance. In their research, subjects solved ill-defined problems by selecting one of eight different topical-support categories. It was found that subjects performed more creatively when they selected the Long-term Goals category to help frame their solutions. In addition, creative performance has been enhanced by computer support at both the individual and group levels[16]. For example, Massetti [17] found that software use generated more creative ideas at the individual level, and Gallupe et al [18] demonstrated that group computer support generated more creative ideas for groups of various sizes.

The Web provides access to a wealth of information in a relatively structured format that can be used to spark ideas on virtually any subject (for example, visit http://www.waterw.com/~lucia/awlinks.html; and the Scientific American web site). Further, the Web allows users to move about sites of interest at their own pace, attending only to those ideas they choose [8]. Because of its "pull" rather than "push" nature, users may be able to overcome the potential for distraction that could hamper their idea-generation performance simply by limiting their attention to a few preferred sites. Consequently, the Web is more likely to enhance an individual's ability to generate ideas than hinder it. To determine how the quantity of ideas generated is affected by Web use, the following hypothesis will be examined.

> H1: Web use will produce more ideas than either categorical idea-generation support without the Web, or no support.

Although Web users can be provided with vast amounts of information to use in generating ideas, they must also actively consider whether the information and ideas they find directly apply to a given problem-task. Therefore, they are potentially expending more mental energy to generate ideas than individuals provided with categorical "idea-framing" support, or individuals provided with no support. Because Web users are expected to not only generate ideas, but also to actively recognize, sort, and associate information that may or may not be relevant, it is possible Web users may feel more drained and fatigued at the end of an idea generation effort than non-Web users. Further, because time spent recognizing, sorting, and associating information can mean time away from idea generation, Web users may feel more performance pressure than non-Web users. Moreover, since they are exposed to a virtually limitless information, Web users may begin to lose perspective and confidence concerning their idea generation performance. As a result, the mental fatigue and stress may cause them to feel less positive about their idea-generation experience than non-Web users. A hypothesis to investigate how using the Web for idea generation affects an individual's attitude follows.

> H2: Satisfaction levels for Web use will be lower than satisfaction levels for categorical idea-generation support or no support.

The following section provides a brief description of the experiment performed to test these hypotheses.

2. Methodology

The methodology selected to investigate the effects of Web use on idea generation was an experiment. The experiment entailed a 1 x 3 design whereby the same subject was exposed to each of three treatment conditions. In the Web-support condition, subjects were given access to the Web for use in generating ideas about an assigned topic. In the Category-support condition, subjects were provided five task-related categories to use for generating ideas about an assigned topic. In the No-support, control condition, subjects were provided with an assigned topic and asked to generate ideas. Each subject experienced each treatment condition to help control for potential effects from individual differences.

2.1 Variables and Measures

The independent variable investigated was the *Treatment Condition*, or the type of support an individual received for generating ideas (i.e. Web, Category, or No-support). Dependent variables included in the experiment were *Ideational Fluency*[1], or the number of ideas a subject generated and *User Satisfaction*, or how well each support condition enhanced idea generation performance. User Satisfaction was measured using a 7-point Likert scale. A copy of the evaluation form is included in Appendix A.[2] Control variables included the Creativity pretest and

[1] The current experiment is part of a larger project investigating the effects of Web use on the following: *Flexibility*, or the number of times an individual switched his/her train of thought; *Originality*, or the number of times an individual generated a unique response; and, *Creativity*, or the extent to which a subjects' ideas are considered novel and useful for a given task.

[2] Other measures of potential interest from the evaluation form are the

the order in which each subject received each treatment condition.

2.2 Task-Topics

The tasks were divergent in nature and designed to focus thinking on the future to help spark subjects' imaginations. A different task-topic was assigned for each experimental trial to control for training and/or fatigue effects. The topics were as follows:

Topic 1: Please think of as many devices as you can that are likely to be affected by robotics and artificial intelligence. You may write your ideas on the paper provided and/or type them into this file.(Subjects in the Category-support treatment were also provided with the following idea-support categories: Household Appliances, Office Tools, Industrial Machinery, Recreation and Leisure Paraphernalia, Educational Equipment.)
Topic 2: Looking 10 years into the future, please think of as many things that will change from how they are now as you can. You may write your ideas on the paper provided and/or type them into this file. (Subjects in the Category-support treatment were also provided with the following idea-support categories: Educational Changes, Recreational and Leisure Changes, Socio-political Changes, Technological Changes)
Topic 3: Given that the peace agreement for Ireland holds, and that international markets offer desirable business opportunities, please think up as many different types of businesses as you can that would do well in Ireland. You may write your ideas on the paper provided and/or type them into this file. (Subjects in the Category-support treatment were also provided with the following idea-support categories: High-Technology, Financial, Industrial, Construction, Leisure or Recreational.)

2.3 Procedures

The experiment occurred over a four-week time period with one experimental trial occurring at approximately the same time each week. Each experimental trial took approximately 20 minutes to complete. There was a five-minute introduction to each trial so that subjects could be seated, informed of which treatment condition they were to experience, and properly logged-on to their computers. Next, each subject spent seven to ten minutes generating ideas for the assigned task. Finally each subject completed the task/treatment evaluation forms.
Trial One occurred in the first week with subjects generating ideas for Topic One; Trial Two occurred in the second week with Topic Two as the idea generation task; and, Trial Three occurred in the third week with Topic Three as the task. The fourth week was used as a Make-up Trial for any subject who was unable to attend any of the previous trials. During the Make-up Trial, each subject received the topic and treatment condition he/she had previously missed.
Before beginning the experiment, the subjects took a creativity pretest designed to control for their natural creative ability. The pretest was similar to one developed by Guilford [19] and involved subjects generating alternate uses for a variety of items. Basically, the subjects were given four minutes to generate alternate uses for a newspaper, a brick, and a discarded rubber tire. The purpose of the pretest was to ensure that subjects were coming from the same creative-ability population.
Moreover, before beginning Trial One, subjects were representatively distributed to one of the three treatment conditions (i.e. Web-, Category-, or No-support). Approximately one third of the subjects were assigned to the Web condition, a third to the Category condition, and a third to the No-support condition to help control for potential ordering effects. These assignments were then randomly changed for Trial Two, and necessarily fixed for the Third and Make-up Trials.

2.4 Subjects

The subjects were 23 MBA students enrolled in the MIS core-course at a large Northeastern University. Their participation in the experiment was voluntary and they were not compensated.

3. Results

The following section provides a description of the techniques used to interpret and analyze subjects' idea generation performance and perceived satisfaction with the support mechanisms offered.

3.1 Data Compilation

The number of ideas generated, or Ideational Fluency, was determined by having two raters independently assess what they believed to be appropriate and separate responses for each subject's performance on each topic.

subject's perceived task knowledge (item 3) and enjoyment (item 6), the subject's perceived effort expended in idea generation (item 4), and whether enough time was allotted for idea generation by the treatment (item 5).

The researchers resolved discrepancies between these raters' assessments.

User Satisfaction was compiled by adding subjects' responses to items 1, 2, and 7 of the task/treatment evaluation form. This variable is interpreted according to the following scale: the lower the score, the higher the subject's satisfaction with the treatment condition.

3.2 Data Analysis

After a cursory inspection of the experimental data, the normality and variance assumptions needed to perform statistical procedures appeared justified and the analysis began. First, a frequency distribution of the subjects' Pretest scores indicated that the subjects were coming from a normally distributed creative-ability population. Next, to ensure ordering effects were not violating independence assumptions, one-way analysis of variance tests were performed for each of the treatment sequences. No significant differences were noted at the .05 alpha level.

Because no ordering effects were apparent, the idea generation data were then analyzed by topic and used to evaluate H1 and H3. Means and standard deviations for number of ideas subjects' generated for each topic can be found in Table 1.

Table 1*
Mean Number of Ideas Subjects Generated

Topic / Condition	Devices	Changes	Ireland	Condition Mean
No Support	9.71 (8.36)	10.25 (3.41)	8.50 (3.74)	10.52 (5.49)
Category Support	14.87 (9.62)	17.71** (4.99)	10.11 (5.25)	10.34 (5.89)
Web Support	5.75 (2.81)	11.25 (4.95)	11.50 (10.50)	12.04 (8.69)
Topic Mean	10.13 (8.14)	12.87 (5.40)	9.91 (6.40)	10.97 (6.78)

* Note. Standard deviations are in parentheses beneath the mean values

** Significant at p<.05

One-way analyses of variance were performed for each topic to determine whether the type of support subjects received affected their idea generation performance. No significant differences were noted for Topic One or Topic Three at the .05 alpha level. However, a significant difference was noted for the number of ideas generated for Task-Topic Two ($F = 5.968$, $p < .009$). Follow-up Least Significant Difference tests between the means revealed that subjects in the Category supported treatment produced significantly more ideas than subjects in the No-Support treatment (LSD = 7.46, $p < .004$) and subjects in the Web supported treatment (LSD = (6.46, $p < .01$). Consequently, the analysis does not support H1. Web support does not produce significantly more ideas.

In order to consider whether subjects perceived a difference in the type of support they received, means and standard deviations for user satisfaction are presented in Table 2.

Table 2*
Mean User Satisfaction Scores

Topic/ Condition	Devices	Changes	Ireland	Condition Means
No Support	17.28** (3.64)	8.38 (3.70)	11.50 (5.45)	10.61 (4.95)
Category Support	9.75 (4.59)	11.43 (4.35)	11.33 (4.06)	10.83 (4.98)
Web Support	6.88 (3.09)	13.75 (15.19)	6.50 (4.50)	9.22 (4.60)
Topic Means	11.04 (5.72)	11.17 (9.39)	10.13 (4.99)	10.23 (4.82)

*Note. Standard deviations are in parentheses beneath the mean values.

** Significant at the p<.05 level

One way analyses of variance were performed for each topic to determine whether the type of support subjects' received affected their satisfaction levels. No significant differences were noted for Topic Two or Topic Three at the .05 alpha level. However, a significant difference was found for Topic One ($F = 14.47$, $p < .001$). Follow-up Least Significant Difference tests between the means showed that subjects were significantly more satisfied with the Category-support (LSD = 7.54, $p < .001$) and Web-support (LSD = 10.41, $p < .001$) treatments than the No-support treatment. No significant differences were noted between the Category support and Web-support treatments a the .05 alpha level. Hence, these results do not support H3. Satisfaction levels with the Web-support treatment were significantly higher than the No-support treatment. And, subjects did not perceive a difference in satisfaction between Web and Categorical support.

4. Discussion

Even though subjects perceived a benefit, it appears that Web use does not enhance an individual's idea generation performance. Rather, similar to the findings of Mumford et al [15], using categories appears to

provide a sufficient amount of idea support to outperform both the Web and control conditions. These findings imply that while there is an expectation the Web is useful for information gathering and research, its usefulness has limits. When an individual is generating ideas, he/she is better off framing his/her thoughts by identifying a few relevant topical categories, than by relying on search engines or Web sites to provide the needed idea sparks.

Interestingly, because idea generation performance varied across topics, it is possible there is an interaction effect for idea generation performance concerning subject matter and support tool. Perhaps some topics are better supported by topic-relevant categories while others are better supported by Web use. Determining whether there are certain topics better suited to specific support types could not only help managers better deploy their idea generation support resources but also help developers better design their support tools.

5. References

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6. Appendix

Evaluation Form

Please respond to the following using the scale below.

1 = strongly agree
2 = agree / 3 = agree somewhat
4 = neutral
5 = disagree somewhat / 6 = disagree
7 = strongly disagree

1. The support provided helped me think up more ideas.
2. The support provided helped me think up better ideas.
3. My knowledge of the idea-generation topic prior to this exercise was (low = 1 / high = 7).
4. I feel I performed to the best of my ability.
5. Sufficient time was allowed for me to generate ideas on this topic.
6. I enjoyed thinking up ideas on this topic.
7. I was afforded adequate access to information for generating ideas.