Teaching Students to Evaluate Source Reliability during Internet Research Tasks

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Abstract: Despite the overwhelming use of the Internet as an educational/informational resource, research has found that learners are woefully in need of guidance on how to use this resource effectively, and subsequently identify reliable sources of information from unreliable. This study seeks to address this issue through the SEEK training program, which encourages learners to evaluate the source and quality of the information, and also how well it resonates with their existing prior knowledge. Learners were either trained or not trained using the SEEK program when they completed an initial Internet research task. Learners were then asked to complete a second Internet research task in another domain without any additional guidance several days later. Results indicate that learners who had received the SEEK training not only were better able to identify relevant from irrelevant sources, but also showed both higher overall levels of learning, and also greater learning gains.

Introduction

Internet research and inquiry tasks are a popular assignment in today's classrooms. A majority of both secondary school students and undergraduates report using the internet as the sole source for their class assignments, even when projects are not specifically assigned as an internet-based research task. Fewer and fewer visit the library and use actual books. Even published sources (journal articles) are being accessed in electronic form more and more. (Jones, 2002)

In previous studies investigating how students learn from internet research tasks on science topics, we have found that successful learning is directly related to the ability to discriminate between reliable and unreliable sources and the selection of reliable reading material for a high percentage of the research time (Wiley, Goldman & Graesser, 2002; Wiley, Goldman, Graesser, Sanchez & Ash, in preparation) Thus, the ability to recognize reliable sources seems to be a critical skill for effective learning from online research tasks. At the same time, even the best learners in our earlier studies seemed to have a fragile understanding of what reliability is. Very few could verbalize it or use it to justify their evaluations of reliability.

Based on these results, it was clear that students needed instruction in evaluating the reliability of information that they found on the Internet. Work by Brem, Russell & Weems (2001) has shown that in general students are fairly uncritical of the arguments they read on web pages.

Similar conclusions have been noted by other researchers. For example, Britt, Perfetti, Van Dyke, & Gabrys (2000) have noted the lack of use of source information and evaluation when students write reports in history from multiple sources in history. To address this they developed the Sourcer's Apprentice program to improve student sourcing skills in that domain. Slotta and Linn (2000) also incorporated web page evaluations as a part of WISE (a web-based inquiry learning environment). Based on our current findings, it seems this element of the inquiry environment may have been critical.

Using an analysis of the behaviors we observed in more and less successful learners in our studies, as well as information from the research cited above on student sourcing and evaluation skills, we identified 4 key areas in which students needed support: considering the source of the information, considering the evidence that was presented, thinking about how the evidence fit into an explanation of the phenomena, and evaluating the information with respect to prior knowledge. To address these needs, we developed an educational unit in which students were taught to consider the Source, Evidence, Explanation, and evaluate the information given in terms of their prior Knowledge (SEEK). This unit represents a set of activities designed to help learners adopt a critical stance while doing research online and with multiple sources by encouraging (1) thinking about the reliability of Sources, (2)

evaluating the Evidence and Explanations provided, and (3) relating new information to prior Knowledge. Thus, this training encourages learners to not only consider information about the source itself, but also the nature of the information that is presented by each source and how well this information coincides with relevant prior knowledge. The SEEK unit is based to some extent on the Sourcer's Apprentice program developed by Britt, Perfetti, Van Dyke, & Gabrys (2000).

The present studies was run to test the effectiveness of the SEEK training unit on learning from internet research tasks. SEEK training was given through a series of static web pages in a separate training session before the target learning task. The topic of the training task was to determine whether the Atkins Diet was safe. The topic of the transfer task was to determine the causes of Mt St Helens' eruption from the output of a Google search. Importantly, no SEEK training was given during this second task. The effects of the SEEK training were assessed on performance on the volcano task, by comparing groups who received training with a no-training control.

Importantly, although the SEEK training is similar in a number of respects to interventions used in earlier studies, this study is the first to look at how training students to evaluate the reliability and usefulness of information they read on web pages can affect the learning of new subject matter from internet research tasks.

Methods

Participants and Design

60 undergraduates (N = 60) from the University of Illinois at Chicago participated in this study. 30 were given SEEK training and 30 were not. Both groups were matched for prior knowledge of volcanoes, based on a volcano concepts pretest given at the start of the first session.

Materials and General Procedure

In part one of this study, all students performed an internet research task on the Atkins Diet. The search task consisted of a list of six sites that had been returned from a Google search on the subject. The participants' goal was to identify which of the 6 possible sources should be used if someone was interested in determining whether the diet is harmful or not. The six sites in this search task (in order of intended reliability) were: 1) The Journal of the American Medical Association (specifically a published article reporting a controlled randomized trial), 2) BusinessWeek.com (specifically an article describing the JAMA study), 3) atkinsdietalert.org, a not-for-profit organization of (vegetarian) physicians providing information for laypeople with questions and concerns about high-protein diets, 4) WeightWatchers.com (specifically a page on "the truth about carbs"), 5) Atkins.com and 6) a testimonial on the effectiveness of the Atkins diet from a personal homepage.

After reading all 6 of the sites, participants were required to rank the sites in order of reliability from 1-6 and justify their rankings of each site (i.e., explain why they had ranked a certain site where they did). Students in the SEEK training condition were given explicit guidance in their evaluations both before and after their reliability rankings (detailed below). The control condition was not given any additional information. This first portion of the study took no longer than an hour.

The SEEK training consisted of 3 distinct parts: an initial instruction page, a worksheet to complete while reading, and finally comparison of learner ratings to expert ratings. The initial instruction page (presented before the actual sources) identified several important considerations that learners should keep in mind before evaluating/reading the sites, such as: who the author is, how reliable the site is, and how well the site actually explained the information. Similarly, the worksheet (used during the actual search task) prompted participants to identify other relevant information about the author (i.e., motivation), and also whether or not the information was consistent with other reliable sources and based on scientific evidence. The worksheet accomplished this by requiring learners to answer such questions as: "Is the person who is providing the information someone who is knowledgeable?"; "Is the information based on scientific evidence?"; and "Does the explanation fit together with your prior scientific knowledge or with information from other reliable sites?". Finally, after completing their reliability ratings, SEEK participants were then asked to compare and contrast their ratings with those of 10 hypothetical 'experts', with an emphasis on identifying how their ratings differed from the experts and why.

In contrast, the control condition did not receive any kind of instruction on the initial search page, and were only allowed to take notes, and not given the worksheet while reading. Additionally, they did not compare their ratings to those of experts.

All participants returned several days later for the second part of the experiment, in which they were given a similar search page about volcanic eruptions. Just as in the first portion of the experiment, participants were presented with the output of a Google search, and were given the goal of developing an argument about what caused the eruption of Mt. St. Helens. Importantly, neither group received any instruction in this second part of this study. The volcano search output page contained 3 reliable sources, 3 unreliable sources, and 1 reliable but ambiguous source. The reliable sources were taken from the United States Geological Survey, NASA, and PBS. The unreliable sites were pages written by a business consultant who was selling his predictions of volcanic eruptions, an inventor who had developed an non-oil based engine (who claimed that oil drilling caused earthquakes and bad weather), and an astrology site giving the star chart for Mt. St. Helens at the time of the eruption. The ambiguous page was a commercial educational site on volcanoes, volcanolive.com, which contained reliable information (i.e., information that fits with the correct causal model provided by the USGS, NASA and PBS sites), but had a .com URL. Participants were given an hour to complete reading all 7 of the sources.

After the hour for research was up, students had about a half hour to write their essays. After essay writing, all students completed volcano concepts posttests. Then participants were asked to rate the 7 sites in order of their reliability, and to provide written justification for each of these rankings.

Results

Performance on the Atkins Diet Task Reliability Rankings

All students, regardless of condition, ranked the JAMA site as the most reliable and the Business Week site as the second most reliable. Both groups ranked the personal testimony site as least reliable. Thus, all students seemed to have some basic ability to recognize reliability. However, the average rankings of the reliable and unreliable sources were more ***extreme*** for the SEEK training group. On average, the SEEK group ranked the reliable sources around 2.5 and unreliable around 4.4, while the average reliable source ranking for the control group was 3.1, and for unreliable, 3.9. These between-group differences in rankings were significant, $t(31) = 2.13$, $p < .04$. Thus, the SEEK training produced a significant advantage in discriminating reliable from unreliable information.

Effects of SEEK Instruction on the Transfer Task

Students in the training condition received SEEK instruction only during the Atkins Diet internet research task. During the volcano task, neither group received any instruction. Thus, the volcano internet research task served as a test of whether the SEEK skills taught on the Atkins Diet task would transfer and support better learning during the second internet research task.

Reliability Ratings

The average reliability ranking of the 3 reliable pages for the volcano task was lower (2.21 vs. 2.59) and the unreliable pages higher (5.8 vs. 5.38) for the training group versus the control group. These results are presented in Figure 1. The difference between the reliable and unreliable rankings (which can be seen as the ability to discriminate between reliable and unreliable information) was significantly larger for the training group, $t(58)= 2.93$, $p < .01$.

Further, in their justifications for these rankings, the training group was more likely to refer to the evidence provided in the web sites and the source of the information, $t(58) = 2.00$, $p < .05$, whereas the justifications of the control group were more likely to refer to whether or not the page specifically contained information on Mt. St. Helens, whether or not they believed the page, and whether or not they liked the style of the page, $t(58) = 2.57$, $p < .01$. The control group was also significantly more likely to make vague/uncodeable justifications for their rankings, $t(58) = 2.29$, $p < .03$. Thus, the ratings of the SEEK group were more likely to be based in evaluation of the content, rather than based on the surface appearance of the site.

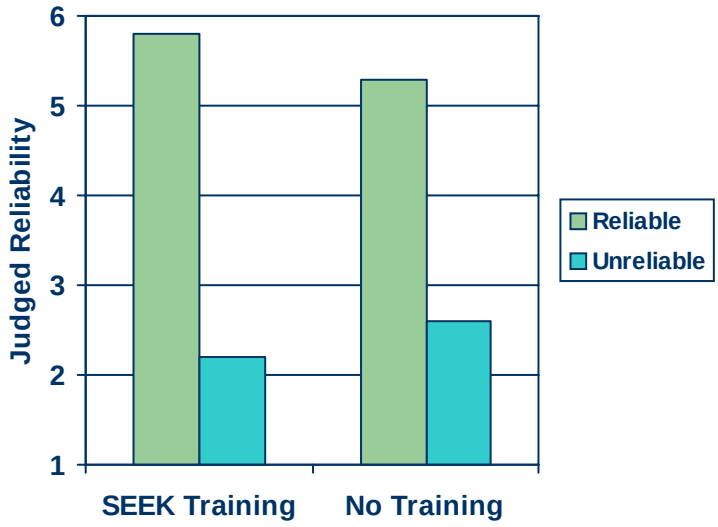

Figure 1. Reliability Ratings on Transfer Task.

Essay Results

Participants that received the SEEK training included significantly more correct causal concepts in their essays (M = 6.8) than the control group (M = 5.6, $t(58) = 2.02$, $p < .05$). Additionally, those that had received the SEEK training also included *fewer* misconceptions in their essays (M = .23) than the control group (M = .67, $t(58) = 2.13$, $p < .04$). Thus, in terms of the essay responses, those participants that had received the SEEK training not only included more correct causal information in their essays, but also *less* incorrect information, which can be taken as evidence of a more appropriate overall mental model. These results are presented in Figure 2.

Volcano Pre-Posttest Gains

Participants who received SEEK training on the Atkins Diet task showed greater learning gains on the volcano concepts task than did the control group ($t(58) = 2.04$, $p < .05$). The SEEK training group showed an average improvement of 2.4 correct volcano concepts from pre to post-test, while the control group only gained an average of .77 concepts. These learning gains are also visible in Figure 2.

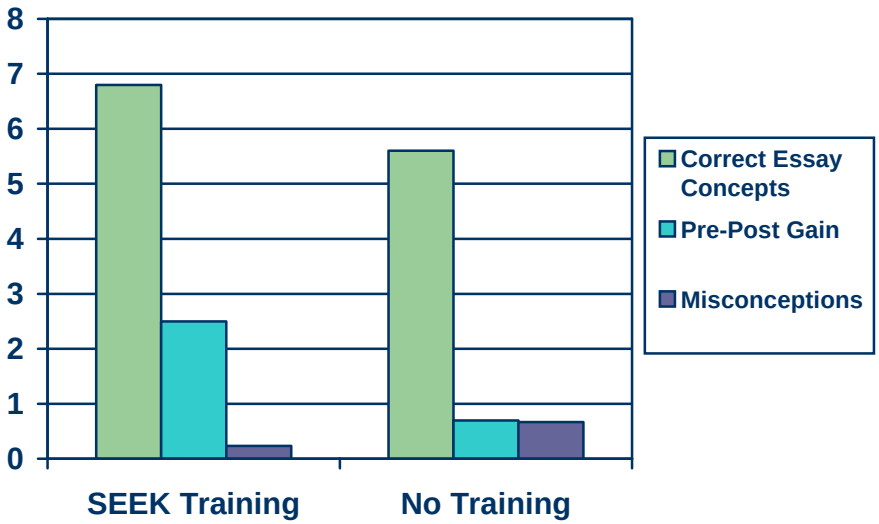

Figure 2. Learning Measures on Transfer Task.

Discussion and Conclusions

Learners that received the SEEK unit were not only able to learn to use critical evaluation skills during training (e.g., the Atkins diet task), but were also able to transfer these same inquiry based skills to another task (e.g., learning about the eruption of Mt. St. Helens). The critical skills taught in the SEEK unit allowed learners to better identify relevant from irrelevant information within an internet research task. This ability was evidenced by the larger difference between the ratings of reliable and unreliable sources, compared to the ratings of untrained students.

Similarly, the effectiveness of encouraging participants to take this critical stance was also evident on how well they learned from the volcano internet research task. Participants who had received the SEEK training not only included more correct causal concepts in an open-ended essay response, but also demonstrated a significant gain in knowledge over their initial levels of understanding. Additionally, the SEEK training also assisted in preventing irrelevant knowledge from intruding on conceptual understanding of the information, as evidenced by fewer misconceptions contained in the essay responses.

In conclusion, these results demonstrate the effectiveness of our SEEK educational unit on learning during internet research tasks. By encouraging a critical stance within learners using the SEEK unit, learners were not only able to better identify relevant sources of information, but also able to form a better understanding of the topic. These results are important for research in the learning sciences in the sense that it provides the first attempt at evaluating and encouraging appropriate strategies that are useful in developing understanding from internet research search tasks. Also, these empirical results, from a randomized, controlled study, suggest that the training unit itself is an important contribution. Thus, this project has provided a practical and effective tool for teachers to use before they permit students to do internet research projects.

Despite the mass of worthwhile information contained on the internet, the information returned from keyword searches are often fraught with irrelevant, misleading information. Encouraging potential learners to actively evaluate the motivations of authors who create this information, the nature of the information returned, and also how this information relates to their prior knowledge, should enable learners to better 'sift' through the overwhelming amount of information (both relevant and not) to get to facts that they actually need. Our SEEK training was designed to help learners do exactly this, and the above results demonstrate that the SEEK training does accomplish exactly what it was designed for.

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