Supporting the Social Transfer of Web Search Expertise

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Abstract
The ability to effectively search the Internet is an increasingly critical skill. In this position paper we discuss how researchers can improve the manner in which students learn to search the Internet. We propose that social factors can play a large role in transferring expertise between parties and that existing tools for instruction and communication do not adequately support social learning. We use *cognitive apprenticeship* as a theoretical framework to motivate new studies and tools for the communication of search practices.

Keywords
Search, information seeking, information retrieval, learning, navigation, queries, instruction.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

The Importance of Search
Web search encompasses the skills and crafts necessary to find and synthesize credible, authoritative, and accurate information to satisfy one's information needs using a combination of search engines, browsing, hyperlinks, and online reading.

Search has emerged as one of several information literacies deemed necessary for workers as participants in the modern workplace. These literacies have been proposed in an attempt to mitigate the "participation gap" [8] that arises when people have unequal access to the "opportunities, experiences, skills, and knowledge that will prepare youth for full participation in the world of tomorrow." We use the term *search* to encompass Jenkins' notions of *judgment* ("the ability to evaluate the reliability and credibility of different information sources"), *transmedia navigation* ("the ability to follow the flow of stories and information across multiple modalities"), and *networking* ("the ability to search for, synthesize, and disseminate information").

Few schools have established rigorous and effective search curricula, in part due to a lack of time to devote to such a skill, but also due to a lack of effective pedagogical methods for search instruction. This motivates our investigation into how search technologies can be designed so as to improve user comprehension of the strategies, mental models, and skills involved.

Social Factors in Learning Environments

Recent work on search addresses little of how such expertise is acquired. Inquiry-based instruction and problem-based learning are effective environments because they motivate students to wrestle with generating queries from scratch instead of fitting needs to a template, as with many skills taught in school ([3],[10]).

At the age of 12, students begin to enter Piaget's *formal operations* stage, in which they are able to abstract out an information need and express it in multiple ways [12]. Through focus groups with 6th-grade students in the Seattle region, we have seen that students often have a concept of a "good searcher" but have difficulty expressing that concept concretely. The most common description the students provided for what makes a searcher good was that they "find what they are looking for," but the specific strategies that enabled this success eluded articulation.

Anecdotally, we've seen a great deal of variance in search expertise within and between classrooms and workplaces. This could be due to highly varied amounts of exposure to expert searchers, developmental and/or individual differences, effective curricula, or peer instruction.

Social factors

Unlike more traditional skills such as composition, algebra, and biology, the skills involved in information literacy are not emphasized as skills to practice, improve upon, or communicate about formally or informally. This implies that the transfer of knowledge about this domain through peers, friends, and relatives may be a primary mode of learning. Indeed, many students in our focus group mentioned that their parents or older peers taught them how to search, often via modeling rather than direct instruction.

Given this reliance on social factors for learning, it is interesting that most systems for Internet searching and navigation are designed for solo use, and the results of this process are typically not salient for conversation. There are two potential social environments where such knowledge transfer could occur: co-located and distributed.

Search-specific knowledge transfer could occur in co-located settings such as classrooms, at friends' homes, at home between family members, in community centers, and in other similar contexts. A primary advantage of this co-located search scenario is the ability to easily congregate around individual displays, use a shared display, and co-reference the same on-screen artifacts. Due to the fact that few schools set aside time explicitly for search instruction, there has been limited work on tools to support co-located search instruction; instead, most focus on distributed scenarios of use (e.g., [5],[7],[9]). In distributed scenarios, students use the Internet alone but may be communicating with each other through virtual media synchronously (e.g., via instant messaging) or asynchronously (e.g., through a wiki or via email). These relationships may be with peers or previously-unknown persons.

Learning frameworks

Whether co-located or distributed, there are different approaches and theories for explaining how to improve learning in this domain. Because we are most interested in social factors, we found *cognitive apprenticeship* [2] to be most applicable. Cognitive apprenticeship refers to revealing tacit and implicit components of the expert's thought processes to the learner in order to help them construct a valid mental model of how to enact the practice.

Improving Learning Opportunities

Researchers, librarians, search engine companies, and private consultants have all worked to improve search skills of students and adults. One means of doing so is through alternative search interfaces. Another is through training.

Alternative search interfaces

One vein of research on tools to improve Web and library search skill involves novel interfaces and technologies that enable new ways of specifying query goals and syntax (e.g., [5],[9],[12]) or student or instructor insight into those processes (e.g., [7],[10]). The goal of these interfaces is to scaffold Web navigation such that students can learn on a novice- or child-appropriate search engine and Web browser, and then progressively remove aids as they move towards standard interfaces.

Supporting explicit instruction

Select school districts around the world are experimenting with incorporating information literacy skills into their core and elective curricula. These are taught as part of a computer skills course, social studies course, English course, or library-skills lessons. The curricula of such courses could be formalized through incorporation into mainstream or educational search technologies. Games are often used to motivate engagement in such instruction (e.g., [4]).

Implicit instruction through collaborative tool use

Another approach is to leverage the social transfer of search skills. One vein of research in this domain is collaborative search, where a pair or group is actively searching for answers to the same question. These systems do not attempt to explicitly train searchers, but rather support communication between them to achieve a group goal with a potential byproduct (not primary goal) of learning (e.g., [1],[11]).

Supporting Co-located Instruction

We are interested in designing tools to support the learning of Web search skills through social means. One

context in which this may be most effective is when students search in co-located classroom settings. Such scenarios can occur with many different ages of students, from elementary school children to adults in continuing education. These contexts provide rich opportunities for social communication that can be transmitted verbally as well as through observation.

We speculate that part of the reason the process of search skill acquisition is unclear is because it is not easily communicated or analyzed. This is due to the nature of Web search: paths through the Web are ephemeral, have no standard representation, and are difficult to communicate in their present form.

Our plan is to focus on middle-school students because they have developed both formal operations skills and are in an educational period where such skills should be learned for later use in research and reports. We expect many students to often be more expert than instructors in Web search, creating a novel classroom dynamic that may require a highly distributed "instructor/student" interaction where students become temporary instructors for the class and for one another.

We plan to observe and interview teachers to identify what information they would like to see transferred between students and how such transfer currently occurs. Based on these findings, we will design a tool that would work alongside existing search interfaces and engines to make information navigation visible and enable lightweight knowledge transfer between peers. We will evaluate this prototype through in-class evaluation in multiple contexts to uncover insights into how technologies can be used to improve social communication around search skills.

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