

Viewing Online Searching Within a Learning Paradigm

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ABSTRACT

In this research, we investigate whether one can model online searching as a learning paradigm. We examined the searching characteristics of 41 participants engaged in 246 searching tasks. We classified the searching tasks according to Anderson and Krathwohl's Taxonomy, an updated version of Bloom's taxonomy. Anderson and Krathwohl is a six level categorization of cognitive learning. Research results show that *Applying* takes the most searching effort as measured by queries per session and specific topics searched per sessions. The categories of *Remembering* and *Understanding*, which are lower-order learning levels, exhibit searching characteristics similar to the higher order categories of *Evaluating* and *Creating*. It seems that searchers rely primarily on their internal knowledge and use searching primarily as fact checking and verification when engaged in *Evaluating* and *Creating*. Implications are that the commonly held notions of Web searchers having simple information goals may not be correct. We discuss the implications for Web searching, including designing interfaces to support exploration and alternate views.

Categories and Subject Descriptors

H.3.3 [1] Information Search and Retrieval – *Search process*.

General Terms

Experimentation, Human Factors

Keywords

Information searching, Bloom's Taxonomy

1. INTRODUCTION

A widespread paradigm for analyzing Web searching is problem solving or decision-making. Donohew and Tipton [3, p. 251] state that information seeking research is intertwined with decision making. Much information and Web searching research is intertwined with this view of searching as a decision making process. However, there is little empirical evidence supporting the relationship between information searching and problem solving [3]. We therefore explored other possible paradigms in which to view Web searching, namely as a learning activity. We present a brief literature review, research questions, preliminary results, and implications for future Web searching systems.

2. REVIEW OF LITERATURE

There is information searching literature that refers to an on-going

learning process while a person is engaged in information searching [c.f., 4]. However, there has been little research into how or even if learning explicitly manifests itself in the searching process. Bloom's Taxonomy may be a method for investigating Web search as a learning process. Bloom's Taxonomy is a primary classification of learning in the cognitive domain [2]. An updated version, Anderson and Krathwohl's Taxonomy [1, p. 67-68], redefined Bloom's original classification [1]. Anderson and Krathwohl's Taxonomy is a six-tiered model for classifying learning according to cognitive levels of complexity.

3. RESEARCH QUESTIONS

Our research question is: *Is a learning paradigm effective for analyzing information searching?* Using Anderson and Krathwohl's taxonomy of learning in the cognitive domain, we developed searching tasks for each of the six taxonomy's categories. We then analyzed the exhibited searching characteristics to detect differences in searching behavior.

4. METHODS

We constructed searching scenarios for each level in Anderson and Krathwohl's Taxonomy, with each scenario correlated to one classification. The searching scenarios were pilot tested twice before we used them in a laboratory study. The six classifications with definitions and example searching scenarios are shown in Table 1. Forty-one subjects participated in a laboratory study. Each participant engaged in six searching scenarios and were instructed to address the scenarios. Each participant had access to an individual computer with Internet access. All user interactions with the computer were logged using a non-intrusive logging software package. We analyzed participant interactions in accordance with standard characteristics of information searching using transaction log analysis as the methodological approach.

5. RESULTS

We investigated whether or not there would be a significant difference in (1) the *number of queries* and (2) the *number of topics per session* among the classifications in Anderson and Krathwohl's Taxonomy. A topic is the information focus of one or more queries. A searching session may have several topics.

Results from an ANOVA analysis indicate that there is a significant difference among the groups ($F(5) = 4.175$, $p < 0.01$) in terms of queries per session. *Applying* was significantly different than the classifications of *Remembering*, *Understanding*, *Analyzing*, and *Evaluating* ($p < 0.05$). *Applying* was not significantly different in number of queries per session from *Creating*.

Table 1. Anderson and Krathwohl's Taxonomy with Searching Scenarios

Classification	Definition	Example Scenario
Remembering	Retrieving, recognizing, and recalling relevant knowledge from long-term memory	List 5 movies directed by Steven Spielberg.
Understanding	Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining	Give a brief plot summary of the TV show, Veronica Mars.
Applying	Carrying out or using a procedure through executing, or implementing	What are some possible characteristics of a person who would enjoy trip-hop music?
Analyzing	Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing	A certain television show contains intense violence and coarse language. Which rating should it receive?
Evaluating	Making judgments based on criteria and standards through checking and critiquing	Create a list of pros and cons for the new iPod Shuffle. Based off of this, would you purchase it (assuming you had the money)? Why or why not?
Creating	Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing	Which do you think will have better overall sales -- the XBox 360, the Nintendo Wii, or the Playstation 3? Why?

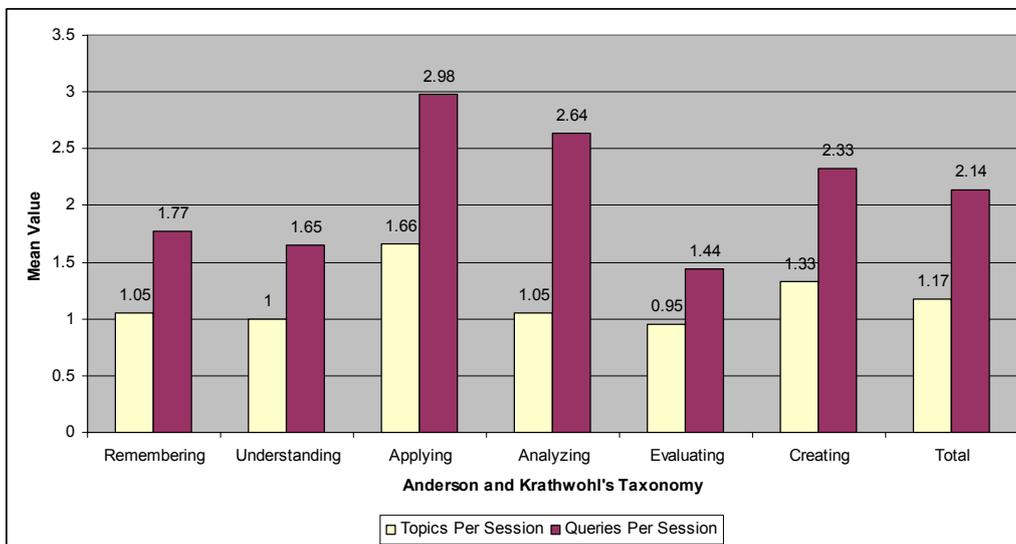


Figure 1. Queries per Session and Topics per Session.

Concerning topics per session, an ANOVA analysis indicate that there is a significant difference among the groups ($F(5) = 6.869, p < 0.01$). *Applying* was significantly different then the classifications of *Remembering*, *Understanding*, *Creating*, and *Evaluating* ($p < 0.05$). *Applying* was not significantly different in number of topics per session than *Analyzing*.

6. CONCLUSION

From these initial research results, searching as learning may be a more appropriate paradigm to analyze online searching than decision making. The implications of this study are that commonly held notions of Web searchers having simple information needs may be incorrect. These simple searching expressions may be supportive of higher-level information goals at the *Evaluating* and *Creating* levels of learning. Using this view, the goal of systems design shifts to one of not closing uncertainty too quickly but instead offering alternate points of view.

We consider this an exploratory study to investigate whether learning is an appropriate paradigm for online and Web searching. Along with further analysis of the existing data (such as session duration, systems used, etc.), we aim to conduct larger scale studies that focus on required system design changes.

7. ACKNOWLEDGMENTS

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8. REFERENCES

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