Enabling Systems for Inquiry-Based Learning

Jamshid Beheshti  
School of Information Studies, McGill University, Montreal, Canada  
jamshid.beheshti@mcgill.ca  
Moderator

Charles Cole  
School of Information Studies, McGill University, Montreal, Canada  
charles.cole@mcgill.ca

Carol Kuhlthau  
Department of Library and Information Science, Rutgers, New Brunswick, NJ, USA  
Kuhlthau@rutgers.edu

Dania Bilal  
School of Information Studies, University of Tennessee, Knoxville, USA  
dania@utk.edu

ABSTRACT
The Panel discusses the background, the need, and the requirements for designing and developing enabling information systems to assist students in their inquiry-based learning school projects.

Keywords  
Children, teens, inquiry-based learning, information search process, Zone of Proximal Development

BACKGROUND
Rather than relying on traditional rote learning based on “authorized” textbooks, or ‘fact’ finding assignments, a growing trend among educators is to assign IBL projects to their students. Many students conducting these projects, however, are expected to develop research questions or thesis statements; complex skills, which are seldom taught in junior years, and for which students are rarely prepared. In most cases, students face major obstacles in order to complete the projects effectively and efficiently without much guidance and interventions by their teachers (Chu et al, 2008; Hongisto & Sormunen, 2010). Kuhlthau has demonstrated that a student’s activities during IBL projects may consist of stages involving cognitive and affective experiences, and information seeking actions (Kuhlthau, 2004). Through her observations of school students, she developed a seven-stage Information Search Process (ISP) model, designed from the user’s perspective. The ISP model and subsequent studies based on the model are constructivist (Rowley & Urquhart, 2007), and as such their “approach provides perhaps the most sophisticated views on information use so far” (Savolainen, 2009, p. 188).

Kuhlthau defined uncertainty as “a cognitive state that commonly causes affective symptoms of anxiety and lack of confidence” (Kuhlthau, 2004, p.84), which occurs during the third stage of ISP, the Exploration stage. Uncertainty, however, is “natural and essential for constructing personal knowledge” in the ISP, which may require an external intervention (a teacher, parent or some other kind of learning agent) to enable users to advance their knowledge (Kuhlthau, 2004). Intervention in information seeking through various agents is supported by Vygotsky’s theory (1978) of the Zone of Proximal Development (ZPD), which describes a bandwidth of competence. The lower limit of the zone consists of the tasks that can be accomplished independently, while the upper limit includes more complex tasks requiring interaction with “experts”. Kuhlthau’s notion of the Zone of Intervention is modeled upon the ZPD and is defined as “that area in which an information user can do with advice and assistance what he or she

INTRODUCTION

The purpose of this Panel is to discuss and elaborate on the need for built-in intervention agents in new information systems designed for students, who are engaged in inquiry-based learning (IBL).

IBL projects have become prevalent in the US and Canadian education systems and adopted by many teachers as a classroom assignment. IBL projects require independent knowledge construction, which tasks the New Generation’s information seeking and processing skills. Ideally, during an IBL project, the student selects a topic of interest in a particular subject area, such as history, explores resources through various information channels to develop an informed inquiry question, searches and selects materials, reflects on the ideas and information, and prepares a final product in the form of an essay or a presentation to share her/his learning. IBL projects have shown to benefit students by promoting independent and self-governed learning (see for example, Chu, 2009; Harada & Yoshina, 2004; Kuhlthau, 2007).

ASIST 2013, November 1-6, 2013, Montreal, Quebec, Canada.
Creating ‘enabling’ systems that can intervene in the ZPD has been advocated by a number of researchers (see for example, Cole, 2000; Ford, 2004), where the system may be able to mesh widely accessible information with deep-structure pedagogical knowledge representations developed by experts. It may be possible to build intelligent systems with novel interfaces that can include intervention agents, specifically designed to provide guidance at the right time during the ISP to reduce uncertainty and to assist students through their IBL projects.

**Panelists**

- **Carol Kuhlthau** is Professor II emerita, Library and Information Science Department, School of Communication and Information, Rutgers University. She is well known for her research and scholarship in information seeking behavior, development of the Information Search Process model, and impact on library and information services. She is ASIS&T Research in Information Science Award recipient and Sig-Use academy of fellows.

  In her book “Seeking Meaning” Kuhlthau summarized over two decades of work on the model of the Information Search Process and related concepts of uncertainty and zone of intervention. This research on the process of learning from a variety of sources from the users’ perspective particularly that of k-12 students, opens new ways of thinking about learning in the information age. Kuhlthau offers insights into the challenge of operationalizing these findings for elementary and secondary education through an initiative called Guided Inquiry.

- **Charles Cole** has been a researcher in information need, information seeking, and the design of information search systems for over 20 years. Cole has authored or co-authored over 45 articles in the top ranked information science journals. His book *Information Need: A Theory Connecting Information Search to Knowledge Formation* was published by Information Today Inc. in 2012. Along with Jamshid Beheshti (PI) and Andrew Large, he is currently conducting a Canadian government (SSHRC) funded study which will ascertain and build information seeking fundamentals into a virtual environment for 13-14 years olds researching a school assignment. He is currently Researcher, Affiliated Member, at the School of Information Studies, McGill University and an information consultant (Colemining Inc.).

  Cole will argue that information science research can be operationalized so that it can be incorporated into new, interactive, and student enabling information system design. He takes Kuhlthau’s 7 stage Information Search Process (ISP) Model, and with empirical evidence from a study of grade 8 students, operationalizes the students’ transition from ISP Stages 3, where they explore information on their topic, to Stage 4, where the students achieve a focus or critical perspective on their topic.

- **Dania Bilal** is a professor at the School of Information Sciences, The University of Tennessee at Knoxville. She has been a researcher in children’s information behavior since 1998. Her research focuses on children’s interaction with digital interfaces (web search engines; digital libraries); retrieval performance of web search engines, and interface design for children. Her current research examines the readability of results and web pages retrieval from web search engines on children’s search queries. She is co-editing a book with Dr. Jamshid Beheshti, titled: *New Directions in Children’s and Adolescents’ Information Behavior Research* (Emerald Publishing). She has published in top tier peer-reviewed scholarly journals including, but not limited to the *Journal of the American Society for Information Science* (JASIS&T) and Technology and Information Processing & Management (IPM), as well as in peer-reviewed national and international conference proceedings.

  Bilal will discuss Vygotsky’s conceptualization of how the ZPD supports and shapes learning through mediation and its implications for the design of system interfaces. Given the fact that ZPD focuses on cognitive mediation or intervention (Bilal, 2007), how do we move beyond the “pure cognitive system” (Norman, 1981, p.274) by adding the element that addresses user emotions (Norman, 2004) during ISP? To address “user affect” in systems with enabled intervention agents, we will need to equip the system with the ability to sense user affective expressions, express appropriate affect in return (Nahl, 2007), and intervene to alleviate negative emotions. This intervention has been theoretically conceptualized as the *Proximal Zone of System Intervention* (PZSI) by Bilal (2007) based on the ZPD. If the ultimate goal of any interface is to be successful and enjoyable, a “cognitive Agent” should also be an “affective Agent.”

- **Jamshid Beheshti** is an associate professor in the School of Information Studies at McGill University, where he was the Director of the School for six years. He was also appointed as the Associate Dean of the Faculty of Education, and the Interim Dean of the Faculty at McGill. Beheshti is the principal investigator on a Social Sciences and Humanities Research Council of Canada grant on *Virtual Environments as an Intervention Agent in the Information-Seeking Process of School Students*. His coedited book *The Information...
Behavior of a New Generation: Children and Teens in the 21st Century was published in 2012.

Beheshti will report on the design process of a low-tech paper-based guide as an intervention tool for an inquiry-based history project in grade eight classes in a high school. The guide was designed over 12 sessions by an intergenerational team consisting of researchers and students using the Bonded Design methodology (Large & Beheshti, 2011). The complex design process was recorded in several flowcharts, which were later utilized to implement a web-based tool. The low-tech tool was used successfully by approximately one hundred students, who conducted an inquiry-based learning project.

REFERENCES


