Inquiry Web-Based Learning to Enhance Information Problem Solving Competence in Science

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Abstract Early research on using web information indicates that secondary students fail to explore much web tools, use them naively and have serious difficulties to understand and integrate web information. In response to these challenges, the main goal of this research has been to design, implement and evaluate an instructional approach that helps students learn from web information. We have developed on-line learning materials which focus on specific curricular contents and provide specific scaffolds to help students accomplish web-based tasks and develop specific information problem-solving competencies. These scaffolds were intended to give support to students involved in information-seeking activities as they were asked questions, searched for information, organised and assessed their findings, and created rich representations of their newly-constructed understandings. We have designed a one year long study to investigate the depth and accuracy of 127 secondary students with regard to their content understanding as well as their development of information problem-solving competencies when using on-line resources to solve instructional tasks. Our research demonstrates that the experimental group performed computer-based activities statistically better than the control group. Our findings also suggest that students were able to develop accurate and in-depth understanding from web information if they could appropriately use search and managerial strategies. This research lends evidence to questions regarding the value of students engaging in on-line inquiry web-based learning to enhance content understanding and to develop more efficient information problem-solving competencies in secondary education.

Introduction

Educational research highlights the potential of the World Wide Web (WWW) as an instructional tool for classrooms. Since the Internet can change the nature of learning, it is important to highlight its potential by increasing access to instructional
materials in a variety of media, promoting students’ skills in information gathering and problem solving, encouraging network collaborations, and having access to decentralized resources (e.g., Hoffman, Wu, Krajcik & Soloway, 2003).

Focusing on science learning, several researchers (e.g., Prince & Felder, 2006) state that inquiry learning has been frequently found to be more effective than traditional science instruction at improving academic performance, development of thinking, problem-solving, and laboratory skills.

Many studies have introduced the use of World Wide Web resources into the inquiry process: in Inquiry Based Learning (henceforth, IBL), students conduct science research as practicing scientists do. In science classes, IBL helps learners get involved with diverse ideas and knowledge integration and make connections between their existing ideas, information, observations, and diverse perspectives with the goal of developing more coherent and generative scientific knowledge (e.g., Lim, 2004).

Science educators agree that the use of WWW resources in classrooms as well as the use of IBL activities have a positive effect on learning science. However, the implementation of web resources to support IBL presents some challenges that should be considered. Research indicates that students experience certain difficulties in regulating their learning when they use hypermedia environments to learn about complex topics (Azevedo, Cromley, & Seibert, 2004).

All the skills, knowledge and attitudes needed to carry out the different electronic information activities can be defined as information problem solving (henceforth, IPS). Research concerning the process of IPS proposes various theoretical models to represent the cognitive processes involved in carrying out a web-based activity. Our frame of reference is based on the Big6™-model (Eisenberg & Berkowitz, 1990) that distinguishes six phases or general skills: task definition, information-seeking strategies, location and access, use of information, synthesis and evaluation.

Several research studies reveal that students fail to master IPS skills all by themselves (for example: Lazonder, 2000; Guinee, Eagleton, & Hall, 2003), which suggests that attention should be paid to the design, implementation and evaluation of explicit, intensive and effective instruction.

In response to this educational necessity, our work offers more insight into the challenge of combining information and communication technology with IBL and procedural guidance in order to increase the students’ involvement and responsibility in their own learning of complex science topics. Our research group designed on-line learning materials focusing on specific curricular science-based contents and specific scaffolds to help students accomplish web-based tasks and construct their knowledge.