THE DESIGN AND USABILITY ASSESSMENT OF A METACOGNITIVE SCAFFOLDING SYSTEM FOR ONLINE INQUIRY LEARNING

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ABSTRACT

Online inquiry learning is popular nowadays. Since students can reach a lot of information through internet too easily, many of them unconsciously put very few efforts to analyze and integrate information which they navigate on the web. Thus learning through the web inquiry often causes problems of lacking efficiency and learning effects. Some scholars propose that metacognition is important during the process of online inquiry learning, because the ability of metacognition is helpful to analysis, integration and application of information. This study developed an Online Inquiry Metacognition Scaffolding (OIMS) module to scaffold learners' metacognitive process while they are working on online inquiry learning projects. In order to evaluate the scaffolding quality and ease of use, the usability evaluation was administrated in this research.

KEYWORDS

Online inquiry learning, metacognition, usability

1. INTRODUCTION

Online inquiry has become a popular learning strategy which is increasingly applied by many instructors on campus. Since most instructors always have difficulty to investigate students' inquiry learning process, the abuse of copy and paste on their assignments without information digestion and rearrangement is popular among students, and misusing of quick and easy answers for online inquiry learning is serious.

Online inquiry is relevant to a set of interconnected cognitive activities, such as (1)generating a research question; (2)searching digital collections for relevant information; (3)evaluating, reading, and making sense of the information found; and (4)coherently integrating different pieces of information to answer the initial question (Eisenberg & Berkowitz,1990). Hill(1999) provides a conceptual model and framework of information-seeking strategies in open ended information systems, which includes navigational stage and process stage. Planning, organizing, selecting, scanning, browsing, searching, foraging, retrieving, and exploring are strategies used during the navigational stage. Differentiating, monitoring, encoding, formulating, integrating, extracting, angling, controlling, decision making, and reflecting are strategies used in process stage.

The metacognitive activities involved in online inquiry include metacognitive knowledge and metacognitive regulation. Metacognitive knowledge includes (1) knowledge about one's self as a learner; (2) task knowledge; and (3) strategic knowledge (Flavell, 1979; McCormick, 2003). Metacognitive regulation of online inquiry includes (1)planning the online inquiry; (2)monitoring and controlling the progress through the online inquiry process; and (3)reflecting on what was learned after reading certain information (Schraw , 1998; Howard et al., 2000)

Wallace et al. (2000) indicate that online information seeking is a complex and difficult process. The intension to develop students' understanding of content through use of the Internet is a challenging task for both students and teachers. Because Internet-based learning environment is with high degrees of freedom, it may favors students who possess mature computer skills and metacognitive skills (Park & Hannafin, 1993).

Tsai (2009) also reported that students' metacognitive strategies play important roles in their online inquiry learning.

In order to help teachers facilitate students' learning and to ensure learners are really involved in higher levels of cognitive activities rather than just copy and paste aggregately, this study developed an Online Inquiry Metacognition Scaffolding (OIMS) module to scaffold learners' metacognitive process while they are doing online inquiry learning activities. In order to evaluate the scaffolding quality and ease of use of this module, the usability evaluation was administrated.

2. RESEARCH METHOD

2.1 Participant

There is one expert selected to join the usability assessment. She is a college professor from the instructional technology area and she is responsible for evaluating the metacognitive scaffoldings design.

2.2 Expert Review and End-user Test

The usability testing for this OIMS module is somehow different from regular website evaluation. It does not only try to find out the problems of interface usage, but also try to investigate how the design as the metacognitive process scaffoldings integrate with the interface. Therefore, an instructional technology expert and 6 end-users participated in this study. Expert review was conducted for scaffolding design assessment. Observation, questionnaire and interview are applied for collecting end-users' data. During end-users using the program, the entire process has been recorded for later analysis. USE Questionnaire (Lund, 2011) which is a seven-point Likert rating scales includes four dimensions of usefulness, ease of use, ease of learning and satisfaction has been used to assess the usability, and personal interview has been done in the end.

2.3 Expert Review and End-user Test Usability Test Task

Surrogate motherhood is the topic learner confronted in this online inquiry tasks. On the task description page of OIMS, teacher portrayed a dilemma which a couple is facing. This couple is your best friend and they are bothered by sterility and infertility problems for many years, now they are considering a solution of surrogate motherhood. Since it involves argument over ethics, commercial act, employment relations, legal problems and medical arrangement, they discuss with you and hope you can give them some good advices. How you are going to help them to make a final decision? Please write a 3000 words report to give them good suggestions.

2.4 Scaffolding Design

There are four wizards in this OIMS module, learners can follow the OIMS 4-wizard- menu to proceed the online inquiry learning journey.

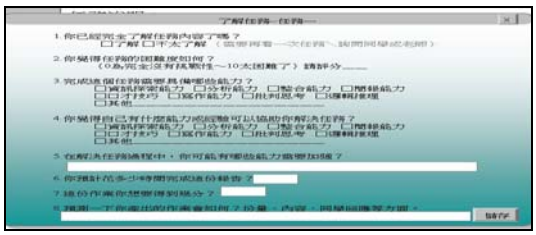

Figure 1. Task Reflection Wizard

"Task reflection wizard" is a set of interfaces to scaffold learners monitoring and evaluating their task understanding and searching plan. Through the interaction with the "task reflection wizard" learners can reflect on the task content and assignment format required, and how long they plan to finish and the difficulty level of this task they estimate.

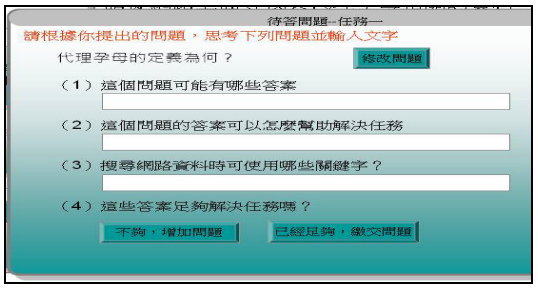

Figure 2. Question raising wizard

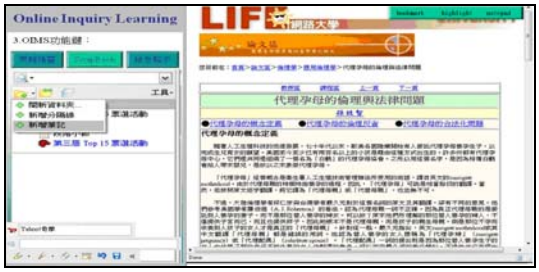

Figure 3. Scrapbook wizard

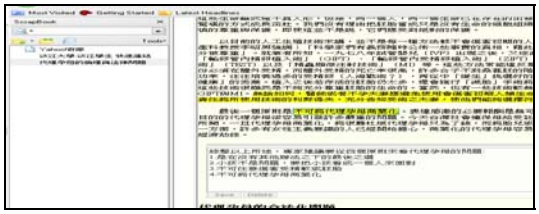

Figure 4. Scrapbook wizard

Figure 5. Composition wizard

"Question raising wizard" will proceed after the "task reflection wizard". In order to finish this task, there are some questions/problems relative to this task need to be answered /solved. "Question raising wizard" scaffolds learners to write down all the questions/problems they can think about. The wizard also asks learners write down possible answers and possible key words corresponding to each question they raise. Thus these answers and keywords can give some hints for internet information inquiring. All these thinking process will be recorded based on whatever learners type and interact with the wizard..

When learners move to the "scrapbook wizard", we intend to scaffold learners to read and evaluate the web content carefully. With scrapbook they can bookmark the web pages and highlight the content which they think important. Learners can also create notepad for a web page or a highlight.

All highlights and notepads for a same bookmark will be saved in learners' account when bookmarking a web page to the scrapbook. And Learners can assign tags to each bookmark, highlight and notepad so that all these information can be checkout in one time based on same tags.

Learners can always check out the questions and problems they propose previously when they confront this task in the beginning. Thus learners can always reflect on the issues they suppose to work on and monitor whether the searching process is approaching to appropriate directions.

As the information inquiry has come to some acceptable extent of satisfaction, the "composition wizard" is designed to scaffold the data organization and integration process. A new window will be created when users choose the "composition wizard". Learners can first choose a format of concept map then assign one tag to each node. When learners click on specific node, all data with the same tag will be shown on the screen next to the concept map. Learners can also limit the information shown with same categories such as bookmark, hightlight and notepad. Unnecessary content can be deleted while learners are looking at data information of a node. The information of each node will be saved as a html file. Learners can take the concept map as structure of their task reports and rearrange those html files to form a final report.

3. FINDINGS AND RESULTS

3.1 Expert Review

3.1.1 Metacognitive Scaffolding

The report of expert review is as following:

In terms of the "task reflection wizard", it is suggested to adjust a better introduction page. Term explanation and entry level knowledge should be provided besides the illustration of the task assignment.

"Question raising wizard" is confusing to low knowledge learner, unless it is used accompanied with well designed introduction page.

"Scrapbook wizard" is a good design to scaffold learners to mark up important message during the online inquiring process. The tag assign mechanism provides chances for learners to think over the main point of each message. And it is also a good chance to push learners to connect the web content with the task while assigning tags and make a notepad for each message.

"Composition wizard" is so creative though it seems not work so well. The concept map design is a nice way to scaffold learners to point out some main ideas and to look at all marked up messages relative to a same main idea in one time. Hence it is helpful of synthesizing and integration.

3.2 End-user Test

3.2.1 Questionnaire

This particular survey was trying to investigate learners' usability experience about this module. The results of the survey show that the total mean of the 30 questions was 5.36 (SD=0.83) out of 7-point scale. It indicated that learners provided quite positive feedback to this module. In part 1, the Usefulness, the subtotal mean of the 8 questions was 6.2 (SD=0.70) which suggested that the usefulness of the module is highly accepted by the users. In part 2, the Ease of Use, the mean was 4.11 (SD=0.9) which implied that users does not quite agree the ease of use of this module. Interestingly, the lowest rate average appeared in this section, question15, It requires the fewest steps possible to accomplish what I want to do with it, only 3.95 (SD=1.16). Yet, the result seems inconsistently to follow the rest of similar questions and it need to be further investigated. In part 3, Ease of Learning, the mean was 5.7 (SD=0.81) which showed the fairly similar agreement from users. In part 4, Satisfaction, the mean was 5.5 (SD=0.87).

3.2.2 Interview

The interview analysis of the perception of using experience is as following:

Q1. Can this module help you working on your task assignment? Why?

In this question, all 6 users agreed this module is helpful for their task.

Yes, the wizard makes the tasks easier and time saving.(S04).

I have no idea in the beginning. However, it guides me how should I start (S02).

The scrapbook wizard and composition wizard are quite useful, but it may not apply when users do not mark up enough messages (S03).

Q2. What part of OIMS module impressed you most and which part makes you feel difficult to use? Why?

That's amazing to save my highlights and notes of one bookmark in my account. That is really helpful to record information I want. And in this way I can put all pieces of messages together to answer questions relative to this tasks. (S02).

It is confusing sometimes. For example, I don't know what questions I should propose after reading the task description. I know nothing about this topic, I think I should google some background knowledge then I will be able to know what questions to ask.(S01).

Though this module is helpful of guiding me to think over this task, the interface seems not designed well, it is too complicated to check out the web page of one specific highlight. (S05).

Q3. Do you think it is helpful to guide your thinking? You may list some of them.

The question raising wizard forced me to think over the task and I was thinking of some news ever report on this issue, actually I do feel impatient to ponder on this issue, but I believe it is better to think over before starting browsing on the web (S05).

I always got lost when browsing on the web. Especially when I have no idea how to write my report. This module can not only help me save the web content, it can also help me organize my thinking(S02).

4. CONCLUSION AND DISCUSSION

The study aimed to investigate the usability and scaffolding design of an online inquiry learning module. In general, users gave very positive feedback toward the module in usefulness, ease of use, ease of learning and satisfaction. And the expert review and student interviews showed that the scaffolding design is acceptable and helpful for the learner.

Many metacognitive skills are implicit and difficult to detect by learners themselves (Tsai & Tsai, 2003). Whipp and Chiarelli (2004) suggested that proper self-monitor and tracking are important characteristics of computer-based learning, because students always confront with metacognitive challenges about task understanding, planning, monitoring, regulation, and reflection throughout the whole online inquiry process (Quintana et al. 2004).

In this research, metacognitive scaffoldings are included as simple reminders to reflect on the goal or a problem solving model, which is important to help learners monitor their cognitive activities. Metacognitive scaffolding tools such as bookmark, tag, highlight and notepad are used in this research to guide the learner to manage the messages collected, which are useful to organize their cognitive activities.

Generally speaking, the most critical factors to hold back learning is the interface design. The results of this study provided some very crucial indication about this issue. In order to enhance the quality of interface design, iterative cycles of usability evaluation are suggested (Quintana et al. 2004). Hence, the future studies can involve more experts to review the entire process and more homogeneous and heterogeneous participants to make the review more thorough and complete. Therefore, the program can be truly useful for the online inquiry learning process.

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