

Developing an Online Map Mind-tool to Help College Students Learn Socio-Scientific Issues: An Example of Disaster Prevention Knowledge

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Abstract: This study aims to develop an online map mind tool to help college students learn about the socio-scientific issues regarding disaster prevention knowledge. This mind tool provides functions for location search, annotation, and data collection that can help the students to construct knowledge and knowledge combinations. Through empirical research, this study explores the students' learning effects and attitudes. Based on the preliminary research results, we find that this tool promotes the college students' learning about the socio-scientific issues around disaster prevention knowledge.

Keywords: Online Map, Mind tools, Socio-Scientific Issues

Introduction

Socio-scientific issues (SSIs) are related to both technology and society [1]. The application of SSIs to a science curriculum not only helps students to better understand the scientific content but also helps them to make decisions [2]. This study tried to adopt the issue of "urban disaster prevention planning" to promote college students' critical thinking skills and to explore how to apply the appropriate technology to assist in SSI learning. The mind tool, or cognitive tool, proposed by Jonassen [3] is a computer-based tool and learning environment whose function is to assist students in critical thinking and higher-level learning. Mind tools can help students to think deeply and extend what they have acquired; they can also promote students' ability to actively formulate a plan and make decisions while further enhancing their own knowledge database to construct the knowledge [4]. Therefore, this study develops a set of mind tools as the instructional technology to assist in the learning of SSI issues. SSIs include issues related to environmental science and geoscience such as disaster prevention, environmental protection, and energy development. All of these issues are related to location, so users must search maps to construct their knowledge. However, a quick, automatic search is not possible using static maps; thus, digital maps have been developed. Favier [5] noted that digital map tools allow students to visualize, create, manipulate, read, query, summarize, analyze, and present digital geographic data in a quick and flexible way. Digital maps can effectively improve the speed of geographic data processing and assist students in the construction of knowledge. Therefore, this study would like to develop an Online Map

Mind Tool for SSI learning (OMMT-SSI), which would include functions for location search, annotation, and data collection to assist users during SSI learning. Additionally, through an empirical study, this study explores the learning effects and attitudes of this online mind map tool on college students' learning about socio-scientific issues.

1. Method

1.1 Participants and Research tools

There were 15 junior and senior students from four college schools in Taiwan, including 8 males and 7 females, whose average age is 21. The content of the pre/post-test questions was designed according to the Handbook of Spatial System Planning for Urban Disasters Prevention, published by Taiwan government in 2007 [6]. There were 20 multiple choice questions and both the pretest and the post-test had the same questions.

1.2 Online Map Mind Tool for SSI learning (OMMT-SSI)

The OMMT-SSI was developed by this study. Users can search for the location and relevant information on the module of *Location Search* in the system. The search service adopts the 3rd edition LBS Location Search Service of Google Map. Users can search for the keyword to get the places near the center of the map and add the selected disaster prevention spot into *My Note* module to construct knowledge via managing and annotating the locations. On the page of *My Note*, those marked places are listed in tables, and also the locations of all places are displayed on the map. Users can know the distribution of the marked places and revise the content of each marked place to conduct information analysis (As shown in Figure 1.). The *Project Writing* module provides the service of a great deal of hyperlink/text editing. On this page, users can fill in the reasons why they choose each disaster prevention spot to reach the knowledge reflection, organization and expression.



Figure.1 My Note Page of Online Map Mind Tool for SSI learning (OMMT-SSI)

1.3 Research procedures

To test the degree of students' prior knowledge, we conducted a 5-minute pretest on the knowledge of disaster prevention and spent 5 minutes teaching them how to use OMMT-SSI. Then, we provided students a SSI project, and asked them to use the OMMT-SSI to write the project during a 30-minute period. The activity assumed that the participants were the planners of the disaster prevention refuge space, who came from four nearby universities in Taiwan. The participants' task was to try to find the proper location of each

disaster prevention spot. Within the last five minutes in class, students were asked to finish the post-test and an open-ended question. The purpose of the open-ended question is to understand students' experiences and attitudes toward the whole learning process.

2. Results

As shown in Table 1, there is a significant difference between the pretest and the post-test ($t=-3.224$, $p=.006<0.01$). The score of the post-test is much higher than the score of pretest, indicating that OMMT-SSI can effectively promote the learning effects of the SSI issues regarding disaster prevention knowledge.

Table 1 Paired sample t-test

	Mean	N	SD	<i>t</i>	<i>p</i>
Pretest	74.3333	15	10.32796	-3.224**	.006**
Post-test	81.3333	15	6.93507		

**
 $p < 0.01$

Based on students' attitudes in the open-ended question, many students mentioned that it's very interesting to use such a mind tool to learn. For example, some students said that this tool can arouse their learning interest. S5 said, *"Everything is fresh for me. I never feel bored in class. It really enhances my learning motivation."* S13 said, *"The use of this tool allows me to understand the surroundings around my life more. In case of disaster, I will know where to escape."* We found that the use of the mind tool can arouse students' learning interest and help them to understand their surroundings. However, many students reflected that the time of operating the mind tool is too short to finish the assignment in time. We found about 20% of the participants did not finish the task. In addition, two students suggested that the system should combine (i.e., *Project Writing* and *My Note*.) The time reduction of switching these two pages may make users feel more convenient.

3. Conclusion and Suggestions

The OMMT-SSI developed in the study can improve college students' learning of SSI issues about disaster prevention knowledge. With the tool, college students may deeply realize the space of disaster prevention and enhance their abilities of estimation, selection, and decision-making in the process of selecting the proper location of disaster prevention.

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