Visualization Scaffolds for Decision Making in a SSI Context

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Abstract: In this paper, we aim to describe how to embed a computer simulation in learning activities for cultivating students' decision-making ability in a socioscientific issue (SSI). The simulation displays data in a visualization way to help students select useful information for their decision. The prompts of worksheet aligning with the simulation guide students through the process of decision making. We also document the design of simulation interface and learning activities to demonstrate how a simulation can enhance learning in a complex context.

Keywords: Guidelines, formatting instructions, author's kit, conference publications

Introduction

People make decisions on social issues related to science and technology in daily life. The ability to deal with Socioscientific issues (SSI) becomes an important goal of science education (AAAS, 1993; Osborne, 1997; Sadler, 2009). Most of SSI is ill-structured and complex to the learners, especially environmental issues (Nicolaou, Korfiatisa, Evagoroub and Constantinou, 2009; Jimenez-Aleixandre and Pereiro-Munoz 2002). Technology can organize data in different representations to help learners select and analyze the data as evidences to support their hypothesis or claims (Gresch and Bögeholz, 2012). This study attempts to present a design of learning environments on how a computer simulation supports learner's scientific decision making.

1. An simulation embedding in a SSI context

We selected a SSI topic, "where to build water reservoir", to cultivate students' decision-making ability. In this SSI context, students were guided to generate criteria for their decision making on where to build water reservoir. Information about the functionalities of reservoirs and possible impacts on the environment after building a reservoir was provided. Then, students were asked to review few reservoirs in Taiwan to synthesize the common conditions for building a reservoir from geology, metrology, ecology, population, distribution of factories, and heritages. After reviewing the information, students tried to generate criteria. A software tool called "Reservoirs in Taiwan" which embedded the information of two famous reservoirs in Taiwan was used to support students' discussions on generating criteria. The role of the software was to make information visualized to students and to district complex information within students' manageable range (as shown in Figure1).

After generating criteria, students were engaged in a context of where to build Jing-Si Reservoir with aid of a computer simulation, "Jing-Si Reservoir". The simulation allowed

students to search and evaluate the data in six locations along with a river area. Students firstly refined the criteria they generated after browsing the Jing-Si Reservoir Software. Then, they analyzed and evaluated the data of the six locations based on their criteria and chose only two candidates for building a reservoir. After careful evaluations, they made a decision on which location would be the best choice to build a reservoir and discussed its impact on future sage of water resources and surrounding environments.

The interface of "Jing-Si Reservoir" simulation includes several main functions, "Tip", "About reservoir", "Data center", and "Simulation" (as shown in Figure 2). Students could find necessary information on how to use the software in the "Tip" interface, and look for relative knowledge on construction cost of reservoir, calculations of water supplies based on rainfalls, geological conditions of the river and catchment area in the "About reservoir" interface . The "Data center" interface allows students to query the data of six locations and to judge which location is suitable to build a reservoir based on their own criteria. Students were required to organize the data they find in the simulation into the worksheet which guides them to reason based on the data or evidences. After choosing a location for the reservoir, students could use the "Simulation" interface to see a 3D bird view of water cover area after building a reservoir at the chosen location which helped students evaluate the impact of building a reservoir. We designed such learning activities to guide students learn how to select suitable data, make judgments, reason based on the evidences, apply decision-making strategies and evaluate their decisions based on their own criteria.

2. Conclusion

We design the learning environments to support students' development of scientific decision making under a SSI context including generating criteria, analyzing data, reasoning based on the selected data, and selecting a location of building a water reservoir. Under this SSI context, students need to recognize the useful information and apply learning strategies for their decision making. The worksheet embedded learning strategies in the prompts which guide students through the process of making decision. With the aid of simulation, students learn how to select and analyze the simulated data as useful information for their decision. Therefore, the prompts in the worksheet aligning with a computer simulation can engage students in a complex situation and support their decision making.

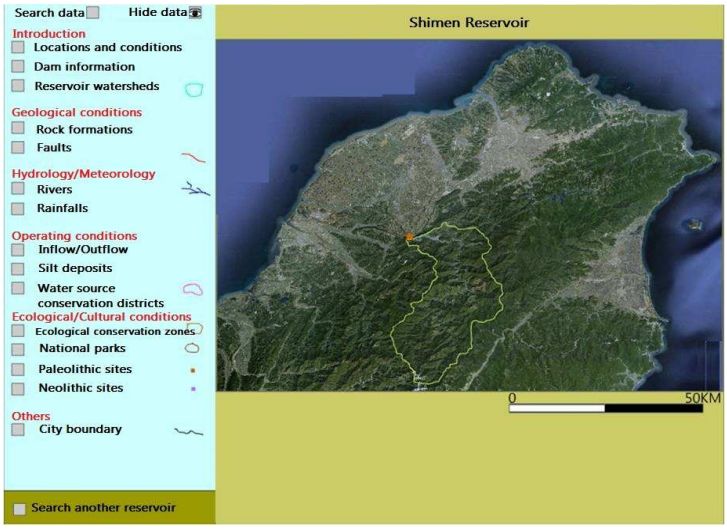

Figure1 The screenshot of "Reservoirs in Taiwan" software

Figure 2 The screenshot of "Jing-Si Reservoir" simulation

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