T. Hirashima et al. (Eds.) (2011). Proceedings of the 19th International Conference on Computers in Education. Chiang Mai, Thailand: Asia-Pacific Society for Computers in Education

Analyzing the Dimensions of Social Knowledge Construction of a Socio-scientific Issue Instructional Activity under an Online Collaborative Discussion Environment: A Preliminary Quantitative Content Analysis

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Abstract: Socio-scientific issues combining both dimensions of science and social science (e.g., issues of energy policy etc.) will help students cultivate interdisciplinary thinking and decision-making abilities. Through quantitative content analysis, this study preliminarily explored the distribution of each dimension of social knowledge construction that learners showed by discussing socio-scientific issues in the environment of online asynchronous discussion collaborative learning. Also, this study discussed and provided relevant suggestions as references for instructional practices based on the research results.
Keywords: socio-scientific issues, collaborative learning, asynchronous discussion

1. Introduction

We people face many important, interdisciplinary socio-scientific issues presently. These issues combine the intellectual issues of both dimensions of natural science and social science (e.g., energy policy and gene modification issues etc.)[1][2]. Also, it is an important task to develop students to have this decision-making ability [3]. This kind of issue is usually more complicated, so students needed more time to think, argue, and conduct extensive information searching to get evidences for argumentation. In a real classroom, discussion activities will make learners' knowledge construction restricted because of the limitations of time and lack of instant interaction with online information. Applying the computer-supported collaborative learning (CSCL) environment to help the discussion on this issue may be beneficial for students to develop interdisciplinary thinking and decision-making abilities, and further to construct more knowledge. We have more relevant studies on social knowledge construction through online discussion instruction now (e.g., [4]), but the studies on applying computers to help students have socio-scientific issues collaborative discussion instruction activities are still limited. Also, the analysis of the dimensions of learners' social knowledge construction in socio-scientific issues collaborative discussion is lacking. Therefore, with quantitative content analysis and applying Interaction Analysis Model (IAM) coding scheme of social knowledge construction [5], the purposes of this study were to preliminarily explore the distribution of each dimension of social knowledge construction that learners showed by discussing socio-scientific issues under the online asynchronous discussion collaborative learning environment. Also, the discussions and relevant suggestions were provided as references for instructional practices based on the research results.

2. Method

In this study, the participants were 24 college students majoring in the same course related to energy technology. In this course, we implemented an online asynchronous discussion instruction activity. During a 16-day period, students were asked to discuss relevant issues based on a certain energy policy, share their opinions, collect relevant data as references, and discuss different policy views (e.g., whether you support to build a nuclear generating station in a certain specific ocean city or not). Finally, students were asked to collaboratively integrate views and display in the form of project. Students discussed in a general discussion board, and they could post new topics or respond to others' topics. To explore the process of learners' knowledge construction in socio-scientific issue discussions, we adopted IAM coding scheme [5] to code the data. This coding scheme was extensively used in many studies related to CSCL (e.g., [4], [6]). The coding scheme was shown in Table 1. One researcher coded all contents of topics and replies gradually; besides, to assure the inter-coder reliability, the other coder also coded these messages. The *Kappa* coefficient representing the inter-coder reliability between the two coders was 0.85, which showed high degree of agreement.

Table 1 Gunawardena, Lowe, and Anderson (2007) Interaction Analysis Model (IAM)

Code	Phase	Descriptions
C1	Sharing / comparing of information	Statement of observation or opinion; statement of agreement between participants
C2	Discovery and exploration of dissonance or inconsistency among participants	Identifying areas of disagreement; asking and answering questions to clarify disagreement
C3	Negotiation of meaning/co-construction of knowledge	Negotiating meanings of terms and negotiation of the relative weight to be used for various agreement
C4	Testing and modification of proposed synthesis or co-construction	Testing the proposed new knowledge against existing cognitive schema, personal experience or other sources
C5	Agreement statement(s)/application of newly constructed meaning	Summarizing agreement and meta-cognitive statements that show new knowledge construction
C6	Others	Discussions irrelevant to knowledge construction

3. Results and Discussion

The frequency and proportion of each code are shown in Figure 1. Among these, we can discover that learners display "Sharing/ comparing of information" most (C1, 60.65%); the next is "Discovery and exploration of dissonance or inconsistency among participants" (C2, 34.19%). Also, "Negotiation of meaning/ co-construction of knowledge" simply have 1 percentage (C3, 1.29%). Other phases "Testing and modification of proposed synthesis or co-construction" (C4) and "Agreement statements/ application of newly construct meaning" (C5) are not found in this study. From the preliminary results, we know that the major components of social knowledge construction are knowledge sharing and clarification of disagreement in online socio-scientific issue CSCL discussion. This will help students collect and share more information as evidence by asynchronous technologies; also, conduct an analysis based on different data and views between each other. Besides, the percentage of off-topic discussions (C6, 3.87%) is extremely low, indicating that students have level of concentration on socio-scientific issue CSCL discussion to a certain degree. However, the depth of students' deeper argument and debate, schema testing, and the aspects of creative thinking is still limited.

4. Conclusion and Suggestions

This study preliminarily explored college students' dimensions of social knowledge and component structure in socio-scientific issue discussion under the CSCL environment. To promote deeper and diverse discussions to reach more knowledge argumentation (e.g., C3, C4, C5), we suggest teachers can consider the adoption of problem-solving strategy instruction by appointing learners concrete open-ended unsolved problems to motivate their inference and deeper discussions. From the past studies taking college students as samples on non-socio-scientific issue online problem-solving discussions, we have discovered that

the application of this strategy did help students have better learning behavioral patterns (e.g., [6]). Also, the present studies on socio-scientific issue CSCL discussion-based learning are rather limited, we suggest more diverse research methods, such as social network analysis [7] and progressive sequential analysis [8] can be applied in the future to explore students' specific online learning behavior patterns on socio-scientific issues.

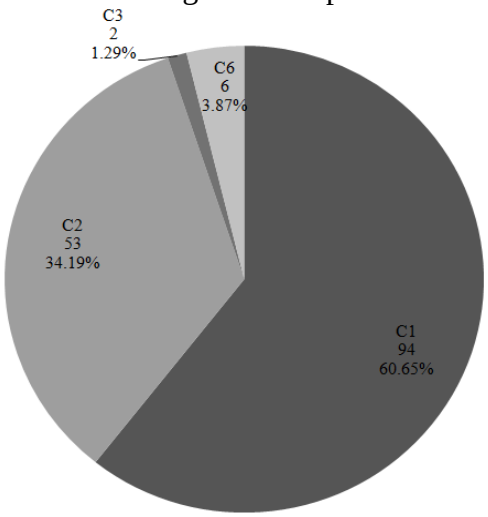

Figure 1 The frequency and proportion of each social knowledge construction code

Acknowledgments

This research was supported by the projects from the National Science Council, Republic of China, under contract number NSC-100-2628-S-011-001-MY4,
NSC-100-3113-S-011-001, NSC -99-2511-S-011-007-MY3, and
NSC-97-2511-S-011-004-MY3.

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