Patterns of Collaborative Convergence in a Scenario-based Multi-user Virtual Environment

Shannon Kennedy-Clark, Kate Thompson, Centre for Computer Supported Learning and Cognition, Faculty of Education and Social Work, The University of Sydney, Sydney, Australia,
Email: shannon.kennedy-clark@sydney.edu.au, kate.thompson@sydney.edu.au

Abstract: This paper presents the findings of a study that investigated how participants collaboratively solved a scientific inquiry problem in a virtual environment. 12 participants worked in pairs to complete either a structured or unstructured problem. The study used a modified version of the Decision Function Coding System to identify decision making processes. The results of the study indicate that those in the structured group showed a more direct route to convergence on a goal.

Introduction

This paper presents the findings of a study that investigated how participants collaboratively converge on a goal in *Virtual Singapura*, a scenario-based multi-user virtual environment (MUVE) designed for scientific inquiry learning.

Background

A number of authors have investigated collaboration in science education (Jeong & Chi, 2007; Oliveira & Sadler, 2007; Suthers & Hundhausen, 2003)). These authors identify convergence as the main advantage of a collaborative learning environment. Convergence occurs when students engage in collaborative inquiry learning and mutually construct understanding of the phenomenon (Roschelle, 1992). Jeong and Chi (2007) analyzed conversations and determined that the convergence in their study could be attributed to collaborative interaction. These authors say that convergence is due to the shared input of ideas, and exemplified in the materials produced by the students. They also found that a modest amount of convergence is typical in an unstructured, naturalistic collaborative learning situation. These findings are confirmed by Kapur and Kinzer (2009), who found that participants in an unstructured activity showed more feedback loops and more random pathways to convergence than those in a structured activity. Thus in our study, less convergence is expected for students randomly allocated to unstructured dyads compared to dyads allocated to the structured problem solving task.

Research Design

Participants

This study recorded the in world actions of 12 university students (seven females and five males). Eight of the students were undergraduate education students and four were postgraduates.

Materials

The study used *Virtual Singapura* as the problem solving platform. *Virtual Singapura* is a scenario-based multi-user virtual environment (MUVE) that presents users with a series of inquiry problems relating to disease epidemics in 19th Century Singapore (Kennedy-Clark, Jacobson, & Reimann, 2010). The participants were provided with a paper-based activity that focused on reducing a cholera epidemic in 19th Century Singapore. There were two versions of the activity, one version provided participants with a structured or guided inquiry activity. The second version was unstructured and did not guide the participants through the activity.

Data Collection

The participants completed their in world activity in pairs. The activity took approximately 40 minutes to complete, which included the completion of a virtual activity and a survey. The participants were recorded using *Camstasia* screen capture software.

Data Analysis

The recordings provided three sources of information audio, visual and screen shots. The audio transcriptions were transcribed and coded according to a modified version of the Decision Function Coding System (DFCS) (Poole & Holmes, 1995). We selected DFCS as it allowed for problem definition, orientation and solution development. The resulting coding system has seven main categories and five sub categories. We also selected this coding system as we have used it before to analyze chat data, so this research is building on existing work (Reimann, Frerejean, & Thompson, 2009). The data were then manually tracked to identify the relationships

between the coded items. This did not identify the role of the speaker, but focused on identifying patterns in the decision making processes.

Results

The results of the study indicate that the structured groups (Groups 1, 3 and 5) showed a more direct route in their convergence to arriving at a decision. Two of the unstructured groups (Group 2 and 4), as was predicted, showed more random routes and less convergence and ultimately failed to arrive at a conclusion. Group 6, which was an unstructured group, proved to be an exception in their problem solving process; however, Group 6 was composed of two PhD students both of whom are conducting research in problem solving and inquiry. Figures 1 and 2 provide an example of the patterns of decision making.

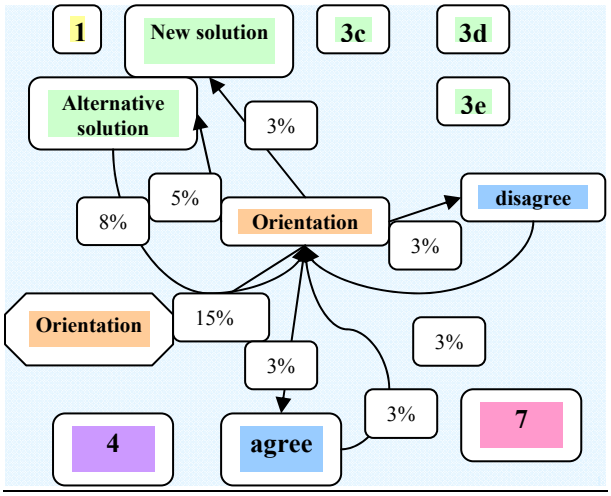

Figure 1. Group 3 Decision Making Processes.

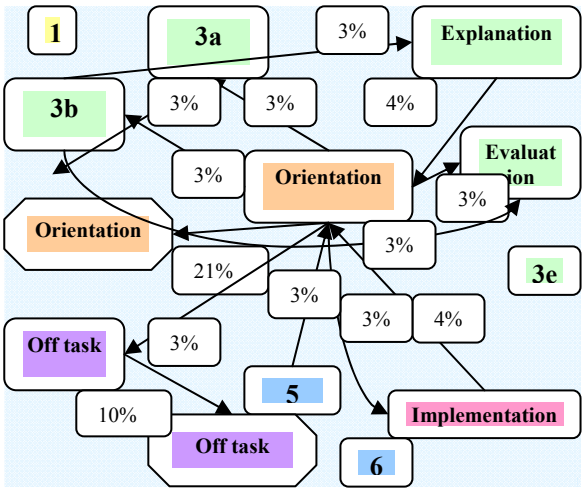

Figure 2. Group 4 Decision Making Processes.

Conclusions

This paper presents the initial analysis of collaborative problems solving in a scenario-based MUVE. The results do indicate that participants in the structured activity showed a more direct route to arriving at a conclusion. The data were coded manually and while patterns do emerge, the next stage is to prepare the data in order to apply process mining techniques to extract patterns in the strategies that students used in solving problems.

References

Jeong, H., & Chi, M. T. H. (2007). Knowledge convergence and collaborative learning. *Instructional Science, 35*, 287-315.

Kapur, M., & Kinzer, C. K. (2009). Productive Failure in CSCL Groups. *International Journal of Computer-Supported Learning, 4*(1), 21-46.

Kennedy-Clark, S., Jacobson, M. J., & Reimann, P. (2010). *Scenario-Based Multi-User Virtual Environments: Productive failure and the impact of structure on learning.* Paper presented at the In Sustaining TEL: From innovation to learning and practice. EC-TEL 2010, Barcelona, 402-407.

Oliveira, A. W., & Sadler, T. D. (2007). Interactive patterns and conceptual convergence during student collaborations in science [Electronic Version]. *Journal of Research in Science Teaching*, *Early View: DOI 05/11/2007*. Retrieved 03/12/2007.

Poole, M. S., & Holmes, M. E. (1995). Decision Development in Computer/Assisted Group Decision Making. *Human Communication Research, 22*(1), 90-127.

Reimann, P., Frerejean, J., & Thompson, K. (2009). *Using Process Mining to Identify Models of Group Decision Making in Chat Data.* Paper presented at the Computer Supported Collaborative Learning Practices, CSCL 2009, Rhodes, Greece, 98-107.

Roschelle, J. (1992). Learning by collaborating: Convergent conceptual change. *The Journal of the Learning Sciences, 2*(3), 235-276.

Suthers, D. D., & Hundhausen, C., D. (2003). An experimental study of the effects of representational guidance on collaborative learning processes. *Journal of the Learning Sciences, 12*(2), 183-218.

Acknowledgments

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