Drawing on Interactive Tables: Examining Students’ Flow, Collaborative Process and Learning Outcomes

Hannie Gijlers and Lars Bollen
a.h.gijlers@utwente.nl, l.bollen@utwente.nl
University of Twente

Hanna Järvenoja, Arttu Mykkänen, and Sanna Järvelä
arttu.mykkainen@oulu.fi, hanna.jarvenoja@oulu.fi, sanna.jarvela@oulu.fi
University of Oulu

Abstract: This study explores collaborative knowledge construction using interactive tables for an ICT-based drawing task. Thirty-six students worked in small groups on science posters. Results show a significant learning gain from pre- to post-test. Furthermore, significant positive correlations were found between students’ science curiosity and pre-test scores as well as between flow and perceived collaboration. Analyses of the video-data suggest that the more successful group displayed higher proportions of domain related talk.

Keywords: collaborative drawing, flow experience, science curiosity

Introduction
The creation of self-generated representations in the form of drawing can facilitate students’ translation of information between different representational formats (van Meter & Graner, 2005) in science tasks. Drawing combines particularly well with collaborative learning, during the creation of a joint representation students are expected to exchange domain related information and make decision regarding their drawing. These discussions are associated with positive learning gains (Gijlers, Weinberger, van Dijk, Bollen & van Joolingen, 2013). Unfortunately, some students might get carried away during the activity, focusing on the aesthetic quality of their drawing or a single aspect of the drawing task at the expense of the unity of the learning task. For the learning process it is important that students not only exchange superficial information but engage in domain oriented dialogues and monitor their progress (Malmberg, Järvenoja, & Järvelä, 2013).

Activities where persons are deeply involved in a task, or highly focusing on distinct aspects of a task, are often described with flow (Csikszentmihalyi, 1990). Flow in a collaborative setting, however, is a different phenomenon than individual flow and is often describes as more beneficial than individual flow (Walker, 2010). Within the collaborative groups students may differ with respect to their interests, prior knowledge and skills. Individual differences might lead to uneven levels of participation on various activities within the overall task (Järvenoja, Volet & Järvelä, 2012). Social flow might occur in a collaborative group only if the situation can be characterized as interdependent, with high levels of agreement and clarity about goals and procedures.

In the present study we explore students’ collaborative learning process in a group learning arrangement. The aim of the study is to explore the relation between students’ collaborative learning experiences in terms of flow and collaboration in relation to their learning outcomes. We expect that science curiosity and prior domain knowledge are positively related to students’ perceived flow. Moreover, we expect that flow is related to collaborative learning experience and students’ learning gains. Subsequently, we explore the collaborative learning process of two groups with different group performance scores.

Methods: Drawing task and procedure
Thirty-six Finnish, eight grade students were randomly signed into nine groups of three to four students and participated in the collaborative drawing session on center of gravity. A domain knowledge pre-test and an opening lecture were organized by the researchers in the school facilities. In the following week students were invited to university facilities to perform a collaborative drawing tasks using the SimSketch drawing software (Gijlers, Weinberger, van Dijk, Bollen & van Joolingen, 2013). on interactive tables. Students were instructed to create a poster to explain the center of gravity to seventh grade students. Each session lasted approximately 40-45 min. per group. Before the start of the drawing session students completed a science curiosity scale (7 items $\alpha = .83$). After twenty minutes of working on the task, the students completed a self-report addressing their flow experience (7 items, $\alpha = .90$). After the students completed the drawing task, a second flow self-report (7 items,
Findings

Results of a paired sample t-test indicate that students improved significantly from pre- to post-test t(29) = 6.32, p < .000, with a mean score of 6.00 (SD = 2.18) on the pre-test and 9.17 (SD = 2.51) on the post-test. Results of a paired sample t-test indicate that the students perceived flow increased significantly during the session t(33) = 2.80, p < .001. Significant and positive Pearson correlations were found between students’ collaborative learning experience and their perceived flow experience on the first (r = .428 p < .05) and second (r = .523 p < .01) self-report. A positive correlation was also found between students’ scores on the science curiosity scale and the pre-test (r = .563 p < .01), suggesting that students with a high science curiosity were more knowledgeable concerning the domain at hand. Students’ science curiosity was also positively correlated to their scores on the second administration of the flow self-report (r = .366 p < .05). Correlational analyses did not reveal the expected correlations between students’ learning gain and their perceived flow and collaboration.

Two groups (a high and a low performing group with respect to the drawing task) were selected for a closer analysis of the collaborative drawing process. For these groups the equality of group members’ participation to the discussions was evaluated by calculating the relevant on-task (i.e. domain, task- and monitoring) utterances of group members. In the low performing group one of the students was monitoring, and initiating the task related discussion during the entire session. Furthermore, the low performing group engaged in deep-level domain discussions only in the beginning of the learning session whereas the high performing group engaged in deep-level discussions throughout the session. Development over time indicated that high performing group had more situations and a trend to engage more group members to the discussion throughout the learning session compared to the low performing group.

Conclusion and discussion

Correlational results provide no evidence for the suggestion that higher levels of flow are associated with higher learning outcomes. This might be explained by the fact that students can experience a high level of flow during the activity but were driven by activity-oriented incentives and therefore not focused on the goals of the activity. Also, in this study we didn’t measure the collectively the social flow experience, rather the focus was in individual interpretations. Furthermore, the first topics listed in the assignment might have been relatively easy for students with a high pre-test score and therefore not challenging enough to experience flow. This idea is supported by the fact that students reported a higher flow experience on the second administration of the flow self-report.

The results of the more detailed video analyses suggest that within the groups participation was not equal on domain related as well as the monitoring aspects of the discussion. Within the more successful group students worked more evenly towards the end of the session. It can be speculated whether the equal participation could be an indicator of the social flow state, where the group members are together engaged in their shared task. Further analysis and research is needed to explore the relation between the role students take on during the collaborative learning experience and the experienced flow and collaboration processes.

References