Student Strategies for Collaborative Note-Taking and the Influence of Floor-Control

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Abstract: In this paper, we examine student dyads' emergent collaborative note-taking practices in a shared text editor during face-to-face project meetings. We describe the individual actions that students perform and show that turn-taking rather than simultaneous access is the most common collaboration strategy. We identify *implicit round-robin* and *complementary interruption* as two policies regulating the turn-taking strategy. We also investigate floor-control mechanisms, showing that dyads with free access trade turns at a higher frequency, and that the tendency towards turn-taking in this blended learning situation may lessen the need for floor control mechanisms. Overall, we find that collaborative note-taking as a pedagogical practice provides rich opportunities for epistemic deepening and tight collaboration between students.

Introduction

Note-taking, in the right circumstances, can become a tool for conceptual change and knowledge construction (Castello & Monero, 2005). Studies of collaborative note-taking have typically involved environments in which students are working simultaneously, with access to each other's notes on a collaborative whiteboard (e.g., Kam et al., 2005), rather than situations in which students are collaboratively writing to produce a single text.

Floor control has been shown to be a positive influence on collaboration, channeling the possibilities for chaos inherent in collaborative and distance learning environments into a situation which is more similar to the structure of face-to-face discussion (Schwarz & Glassner, 2007). McKinlay, Procter, Masting and Woodburn (1994) show that discussion through a chat with turn-taking proves better for producing consensus than discussion through a chat with free for all access. Floor control can also be a source of frustration, drawing discussion focus away from the task and onto turn-taking (Harris *et al*, 2009).

In this paper, we examine students' emergent collaborative note-taking practices using a shared text editor with two forms of floor control during face-to-face project meetings with their tutor. We describe a typology of individual actions students undertake and illustrate the ways in which they combine to form overall collaboration strategies for note-taking. We show that the presence or absence of a floor-control mechanism has a significant influence on the collaboration strategies which emerge. In conclusion, we first discuss the appropriateness of collaborative note-taking, both as a pedagogical tool to foster epistemically rich collaboration, and as a fertile terrain for research into joint meaning-making. We also discuss the role of floor-control mechanisms in regulating productive collaborations.

Individual and Collaborative Note-Taking

Castello & Monero (2005) describe note-taking along two dimensions with regard to the original content: in terms of relevance and coverage, notes can be *comprehensive*, *incomplete* or *selective*; in terms of form, notes can be *literal* or *personalized*. They find that students who consider the act of note-taking as a method to store information tend to take literal, comprehensive notes, while students who consider note-taking as an act which helps them better understand the topic tend to take personalized, selective notes, using different procedures to elaborate upon and organize information. Better students incorporate four key practices: organizing and structuring information in a *personal* way; *amplifying* content by relating it to existing knowledge and resources; *reflecting* by adding information and comments; *synthesizing* by paraphrasing and including only relevant information.

Kam et al. (2005) investigate students' appropriation of an environment in which collaborative annotation of teacher slides on a shared whiteboard is possible, contrasting it with a single-user contribution. This form of collaborative note-taking allows simultaneous contributions (there is no floor control), but makes it difficult for students to edit and transform either their own or other people's contributions. They define a unit of annotation which they call a *mark* as "a spatio-temporally contiguous segment of pen-strokes or keyboard entries by one user to express a single logical idea." (p. 4). They draw up a typology of five kinds of marks. *Note-taking*: someone taking notes on the lecture. *Commentary*: someone making a statement, as opposed to recording notes. *Question*: someone soliciting a response. *Answer*: answer to a question or clarification to some confusion. *Reinforcement*: someone's encouragement or response to others' comments

They find that students can overcome the limitations inherent to a single note-taker, for instance, by adding new notes while another student is still transcribing earlier lecture statements. They can take turns authoring notes, allowing other students to pay better attention to the lecture (they call this behavior

synchronized, turn-based note-taking). They can also ask questions and seek additional information if they are confused or think they have missed something. Students in a collaborative note-taking condition took better quality notes in terms of content amplification and reflection and more varied notes in terms of the presence of commentary and questions.

In this paper, we begin to examine to what extent these results on collaborative note-taking on a shared whiteboard apply to collaborative note-taking in a shared text editor. Our first research question is, will we find the same forms of marks (individual actions) for note-taking in a shared text editor as in a shared whiteboard? Our second research question is what collaboration strategies will emerge in note-taking in a shared text editor? Our third research question concerns the effect of a floor-control mechanism on the collaboration: does it help in regulation of the interaction; does it provoke more reflection and planning?

Empirical Study: Student-Tutor Meetings for a Programming Project

We observed nine dyads during the first meeting (and up to 4 subsequent meetings, not analyzed in this paper) with their tutor for an introductory-level computer-programming project at a French university. These meetings took place face-to-face with the assistance of a synchronous shared text editor, visible on laptops by the two students and the tutor. This study was pedagogically motivated by a desire to see students actually take notes during these meetings and define tasks to be accomplished before the next meeting in a way that was visible to all participants, in opposition to the situation of past years where students often did not make progress from one meeting to another.

Data collected for each session includes audio, video, the interaction log-file produced by the shared text editor, and field notes taken by an observing researcher. There were three different project topics and two tutors involved (one tutor supervising three groups and the other supervising six).

We also wanted to examine the role of floor control and compared two forms of shared text editor: with and without floor control. The first form in our study (used by 5 dyads) is a free-access text editor, which allows participants to write concurrently with no conflict, unless they are attempting to insert text at the same point. The second (used by 4 dyads) provides a token-based floor control mechanism, requiring participants to request and relinquish the "token" which gives permission to edit the shared text editor.

Analysis and Results

The data was analyzed with Tatiana (Dyke, Lund, & Girardot, 2009), which provides the means to replay the note-taking in the text editor, synchronized with the video, transcriptions, and log files, and to construct new analytic representations. In the replay mode, the text is colored by user to assist analysis, whereas during the actual study, color fades over a 20s period. The character-by-character log data for the shared text editor was abstracted into *marks*, adopting the terminology of Kam et al. (2005): a mark is a single logical idea or action, expressed in a spatio-temporally contiguous series of keystrokes. The main forms of spatial non-contiguity we found were: the use of new lines to initiate a new idea; the use of parentheses to add clarification, elaboration or reflection; the use of periods to construct sentences; and the use of colons in preparation of an enumeration. Other forms of mark consisting of a unique action included copy-pasting, formatting and editing.

In this analysis, in answer to our first research question, we look at the kinds of marks the students contributed and refine the typology defined by Kam *et al.* in order to categorize the various marks. We then, in answer to the second research question, examine the collaboration strategies that emerged and the situations in which turn-taking occurred. Finally, in answer to the third research question, we examine the effect of the floor control condition on these collaboration strategies.

Research Question 1: Individual Actions Performed During Note-Taking

The main difference between our situation and that of Kam *et al.* is the nature of a shared text editor. Unlike with a shared whiteboard, which comprises multiple different objects, a shared text is a single object with a natural insertion point for new material (the end of the text), and which can be edited at other points, by inserting or removing characters. As such, we introduced a top-level distinction between marks affecting the *content* of the text and those which do not contribute new content (i.e., various forms of *editing*).

Among the editing marks, we distinguished three categories: editing of *spelling*, editing of *formatting* and *other* (typically false starts). Among the content marks, we found two dimensions of distinction: position and type. The position dimension comes from the nature of a shared text editor: sequential marks occur at the natural insertion point (typically the end of the text, except in circumstances where text is deliberately spatially demarcated); inserted marks add commentary or elaboration to earlier contributions, returning to a different area of the text than the natural insertion point. The type dimension is similar to that of Kam and colleagues. We find *note-taking*, *commentary*, *questions*, and *answers*. In addition, we find two new categories: *fragments* and *word selection*. *Fragments* are *note-taking* marks which are temporally but not ideationally demarcated (i.e., they do not, on their own, constitute a single logical idea, but cannot be associated with other content written contiguously in time by the same author). Such fragments are typically elaborations on previous content. We

also find *word selection*, only in inserted marks, where a word or phrase is replaced by another apparently more appropriate one. We would expect to see another two hypothetical categories, *deletion*, where content is removed, and *reinforcement* (reported by Kam *et al.*), where one user encourages or responds to another user's commentary. There were, however, no deletions in our corpus, unless false starts might be counted as such, and no reinforcements.

The majority of marks in our corpus were sequential note-taking (65%). Next come various forms of editing: spelling (7%), formatting (8%) and other (6%). Inserted content is rare overall (totaling 4%), as are fragments (totaling 8%), the remainder being made up of other categories.

Research Question 2: Collaboration Strategies and Policies Regulating Turn-Taking

The overwhelming majority of the collaboration strategies we observed occurred without explicit planning. Overall, collaboration was of good quality with students in all 9 groups contributing actively to the joint note-taking process, apparently having little problem achieving alignment and agreement (Baker, 2002). Because of the improvised nature of the collaboration, it was rare for students to adopt fixed roles. *Sequential single writing* (Lowry, Curtis & Lowry, 2004), where one group member writes at a time, was the most common strategy, along with occasional *parallel writing*, either in distribution of "assignments", such as being responsible for a topic, or of roles, such as editing to adjust formatting and spelling. In each group, the variety of practices (e.g., organizational formatting with numbers, elaboration with parenthetical fragments, correction of spelling) was small, but when a practice did occur, both students tended to adopt it.

The only exception to the general strategy of sequential single writing, was a group for whom an initial attempt at simultaneous writing at the same point resulted in conflict. This led one student to demarcate two zones, one for each student's notes. They then proceeded to take individual notes. Aside from this exception, none of the groups took advantage of the possibility of simultaneous editing in more than a few isolated instances, tending instead to trade turns, in both floor control and free access conditions. This is consistent with the strategy of *synchronized, turn-based note-taking* found by Kam and colleagues. We observed two main policies that seemed to regulate a change of turn. The first is *implicit round-robin*: when a student has finished authoring a note-taking mark (or a small, thematic collection of marks), it is no longer "their" turn and authorship switches (without explicit coordination) to the other student. This was the initial policy adopted by 6 out of 9 groups and was used by all groups at some point or other. The second policy, also found in all groups is *complementary interruption*: when a student keeps the authorship for a period of time, the other student appears happy to let them be the note-taker, until a point at which they feel that something has been overlooked; they then interrupt, adding the complementary information and often becoming the *de facto* note-taker at that point. Unlike the loose cooperative behavior described by Kam and colleagues, where turn-taking seemed to occur when the group saw that the teacher had moved on to a new topic before the current note-taker had had time to write everything down, the two policies which regulate the overall turn-taking strategy we found indicate a much tighter collaboration, with constant maintenance of alignment and agreement.

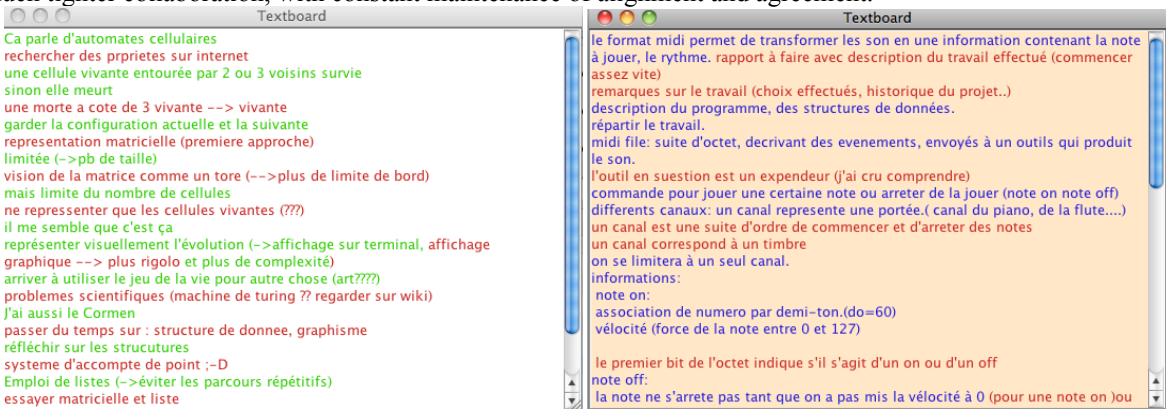

Figure 1. Typical note-taking with free access (left) vs. floor control (right), colors indicate which student authored the text.

Research Question 3: Effect of Floor Control on Collaboration Strategies

In neither condition was there much explicit planning or coordination, with the exception of a few requests for the other student to release the floor in the floor control condition. However, when examining the final products in the two conditions, we noticed an overall effect that in the floor control condition, the size of chunks of text (consisting of multiple marks) by a single student seemed bigger. This is illustrated by the comparison in figure 1. Because of the turn-taking mechanism, it seems that an authoring student has more inertia, thus writing longer, regardless of whether the turn change happens because of complementary interruption or implicit round-robin. In order to validate this emerging hypothesis, we counted the number of consecutive content marks by

different authors and calculated their proportion in terms of total content marks for the 8 groups which used turn-taking. We found that the free access groups *all* had higher proportions of turn changes (median value 42%) than each of the floor control groups (median value 23%). Although this sample size is too small to read much into the result, this difference is significant according to the Wilcoxon rank-sum test ($U=0$, $n1=n2=4$, $p<0.05$). We have not yet, however, found in a difference between groups in the quality of notes, or in the quantity of reflection and planning.

Discussion and Conclusion

For all the groups analyzed in this study, our pedagogical goals were met: students came away with a record of their meeting and a contract for the next meeting. Furthermore, there are advantages to the tutor in seeing these notes: gauging students' comprehension and engagement, and being able to respond to their comments and questions, expressed through the back channel of the shared text editor.

In answer to our first research question, by investigating the kinds of marks created during the collaborative note-taking, we have highlighted the opportunities for epistemic deepening present in this kind of situation, surpassing even the reported advantages of taking notes on a shared whiteboard. Indeed, *inserted* marks in general, *word selection*, and *fragments*, create greater opportunity for *personalization*, *amplification*, *reflection*, and *synthesis*, the positive qualities described by Castello & Monero (2005). However, we also found that the rate of adoption of these opportunities was not high and that note-taking practices had a strong inertia, indicating that we cannot necessarily expect students to develop optimal practices (for either good note-taking or productive collaboration) when appropriating a shared text editor for collaborative note-taking, without scaffolding or prior instruction. However, these opportunities for epistemic deepening suggest that collaborative note-taking is a promising pedagogical instrument in CSCL settings.

In answer to our second research question concerning the types of collaboration that would emerge, each of these records was a jointly constructed artifact, resulting from a collaboration in which both members of each student dyad were invested. The most common collaboration strategy of students (in both conditions) was taking turns, with limited amounts of revision. This is similar to the *synchronized, turn-based note-taking* found by Kam et al (2005), but the policies of *implicit round-robin* and *complementary interruption*, which we identified as regulating turn-taking, require a deeper collaboration.

In answer to our third research question, we found an unexpectedly strong effect of the floor control condition. We expected the floor control mechanism to have a structuring effect on the collaboration. However, either because of the nature of the situation (blending face-to-face with computer-mediated collaborative note-taking), or because of the nature of a single text (as opposed to a whiteboard), turn-taking was already the preferred strategy. In such a situation, there is perhaps no need for a floor-control mechanism. This indicates that for other CSCL situations, both technological and situational affordances might be a means for scaffolding productive collaboration, without having to resort to floor-control mechanisms.

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