

## **Examining the Writing Phases and Revision Patterns in Online Collaborative Writing: What Can We Learn from Them?**

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### **Abstract**

Collaborative writing has become a current interest in higher education and the work-place. The rise of Web 2.0 genres, such as Wikis, has allowed us to perform online collaborative writing. However, writing in an online collaborative manner is hardly taught and practised in tertiary education. The only forms of online collaboration in the writing process that students experience are typically variants of peer review; however, even then, the goal is still to improve upon an individually authored document. This study investigates the relationships between writing phases and revision patterns during the online collaborative writing process. Three groups were observed. The study compared texts from and investigated the nature of the writing process in each group. The study found that the groups developed unique patterns. In the future, the discovered patterns provided by performance sequence and dotted chart analyses can be used to provide feedback to students during their writing so that they are aware of the writing activities and can coordinate effectively.

**Keywords:** online learning, computer-supported collaborative learning, collaborative writing, writing phases, revision patterns

## **Introduction**

The rapid development of Web 2.0 has provided us with the new possibilities for learning instruction and for creating an engaging learning environment, optimal learning opportunities, and alternative and innovative learning experiences for both educational and work-related purposes. This development has not only allowed for us to be more productive, but also has helped us to become more reflective and creative. Pea (2004) argued that technology should be used not only to amplify our thinking but also to reorganise our mental functioning. Web 2.0 technology, which is characterised by information sharing, collaboration, user-generated content and knowledge creation, has shifted learning and instructions to a new perspective. From this new perspective; learners are no longer passive information recipients; but rather active participants whose role is to direct their own learning, to construct and create knowledge and to contribute to a virtual community. Moreover, teachers are no longer knowledge dispensers but rather guides, coaches, and mentors who facilitate learning (Bonk, 2009). The challenges now are how to develop innovative learning environments and build virtual learning communities that will motivate and engage learners meaningfully and interactively, focusing on developing the 21-st century skills that emphasise innovation, creativity, communication, collaboration, critical thinking, decision making and problem solving (Scardamalia and Bereiter, 2006).

According to Bereiter and Scardamalia (1993), a pivotal aspect of the development of expertise is converting formal knowledge into an expert's informal knowledge, which occurs when formal knowledge is used in solving problems. This idea, combined with the development of Web 2.0, has created new possibilities of using online collaborative writing for the purposes of learning. Lowry, Aaron and Rene (2004) defined collaborative writing as an iterative and social process that involves a team that is focused on a common objective and that negotiates, coordinates and communicates during the creation of a common document.

Although online collaborative learning is by no means unproblematic (see, e.g., Lay and Karis, 1991; Lowry et al., 2005; Weinberger et al., 2005), this activity generally provides a good context for learning to write and writing to learn. Web 2.0 does not necessarily improve the quality of

writing or learning but does create opportunities for improvements. The advanced development of Web 2.0 may facilitate or provide a vehicle for better writing and learning. In this way, Web 2.0 provides a good platform for supporting peer interaction and teacher' feedback, such as by allowing students and teachers to communicate and share their ideas throughout the process, without being in the same place (Hartley and Tynjala, 2001; Neuwirth, Chandok and Morris, 2004); making revisions more visible (Southavilay, Jacef and Calvo, 2009); encouraging students to actively reflect on their writing (Villalon et al., 2008); and encouraging students to participate in more meaningful learning and discussion (Weinberger, Stegmann and Fischer, 2010). In addition, writers may have much greater control over the appearance of the finished product (Hartley and Tynjala, 2001). Furthermore, visible revision allows authors who are writing lengthy documents over time to better understand and explain the topics on which they are writing (Hainsworth, 2006). The process of knowledge transformation, which occurs in the writer's mind and in continuously developing text, leads to enhanced understanding and even changes in thinking (Bereiter and Scardamalia, 1996). These changes lead to learning.

Normally, of course, we do not see the initial draft and the semi-completed version. We only read the final or published version. The final or published version does not show us the debates in which the authors engage with themselves and/or with colleagues about what they are trying to say. Moreover, the final or published version does not reveal the collaborative writing process of the authors. We also cannot tell how the document evolved from the initial draft to the final version. Similarly, we cannot know what types of problems were faced by the authors during the collaborative writing process. Obviously, the effects of writing on learning are not apparent in the text that we read.

So far, most of the studies on online collaborative writing have focused on developing technology to support online collaborative writing (see e.g., Baker, 1999; Neuwirth, Chandok and Morris, 2004; Southavilay et al., 2009; Villalon et al., 2008), on knowledge construction during on the collaborative discussion (see e.g., Arvaja, 2007; Arvaja and Hamalainen, 2009; Wienberger, 2003), and on the role of discussion in individual writing form (see e.g., Mason, 2001; Rivard and Straw, 2000). There is currently a shortage of firm evidence in the literature on how online collaborative writing proceeds.

This study explores the processes in which writers engage in when they write collaboratively. In particular, this study focuses on the writing phases that writers experience, the revisions made to develop the content of an online collaborative document, the significant group process that emerges, and the problems that arise during the collaborative writing process.

Examining the entire set of versions generated by a group can give us the most tangible information that we can obtain about at least part of the process. An analysis of the versions reveals the goal or ends of the process and may direct us to specific parts of the process that can be investigated further. Understanding what types of writing phases are involved and how documents evolve will help students and other writers to develop a better understanding of the many different options available when they are creating an online collaborative writing document.

### **Writing to Learn**

Etelapelto and Light (1999) stated that expert knowledge consists of three major components: first, the formal and theoretical knowledge, which is declarative and explicit in nature; second, procedural knowledge that is learned in practical situations and is often informal and implicit (or tacit in nature); and third, self-regulatory knowledge, involving metacognitive and reflective skills. According to Anderson (1982), the development of expertise is a long process during which the different elements of expert knowledge are integrated into a coherent whole. Ebner et al. (2010) stated that theorising practice and particularising theory are the key developments of expert knowledge.

According to Bereiter and Scardamalia (1993), a pivotal aspect of the development of expertise is converting formal knowledge into an expert's informal knowledge and skills, which occurs when formal knowledge is used in solving problem(s). In particular, formal knowledge is converted into a skill by being used to solve a practical problem. Bereiter and Scardamalia's idea implies that we should integrate theory and practice in student learning and arrange problem-solving tasks to promote students' expertise development. Students should be able to analyse their experiences of practice periods and to systematically conceptualise and explicate their practical knowledge. Ideally, students should have

opportunities to use their knowledge for solving authentic, real-life problems. Writing can serve as a mediating tool for these purposes, showing that writing can successfully be used as a tool for enhancing analytic thought, making implicit presuppositions and beliefs explicit, and thus as the object of transformation (Brown and Palinscar, 1989; Harrison et al., 2001).

Bereiter and Scardamalia (1996) hypothesised that knowledge transformation in writing simultaneously enhances both writing expertise and subject matter understanding. Therefore, the authors recommended that experts in learned fields continuously read and write about their special domain to develop their expertise.

To ensure that the writing task promotes active knowledge construction, Tynjälä (1998) mentioned five requirements that must be fulfilled: (1) the tasks should induce students to engage in knowledge-transforming processes rather than in reproductive activities; (2) the tasks should make use of students' previous knowledge and existing conceptions of and beliefs about the topics that they are studying, leading them to reflect on their conceptions in the light of new knowledge; (3) the tasks should encourage students to reflect on their own experiences and to conceptualise and theorise about these experiences; (4) the tasks should involve students in applying theories to practical situations; and finally, (5) writing assignments should also include solving either practical problems related to the given professional field or problems of understanding that involve conceptualising phenomena and engaging in generating personal meaning.

### **Collaborative Writing**

The term *collaborative writing* (CW) refers to projects in which written works are created by multiple people (collaboratively) rather than individually. Lowry, Aaron and Rene (2004) defined CW as an iterative and social process that involves a team that is focused on a common objective and that negotiates, coordinates, and communicates during the creation of a common document. Wikis, Galaxiki and the New Worlds Project are examples of CW products (Lave and Wenger, 1991).

There are two main influential directions/conceptual approaches in CW. The first approach is based on the Neo-Piagetian concept of socio-conflict (Doise and Mugny, 1984). This theory refers to the mechanism through which an individual realises that her/his thoughts or ideas are inconsistent with others' views. This internal conflict leads the individual to reflect on her/his thinking and may serve to initiate conceptual changes. From this perspective, CW situations can be observed as generators of discussions, leading to higher levels of thinking (Doise and Mugny, 1984).

The second theory is based on the Vygotsky's view of social nature of learning. According to Vygotsky (1978), learning primarily occurs on the social and inter-psychology planes, and only secondarily on the intrapsychology plane. This theory implies that knowledge is internalised not directly but by means of mediating psychological tools and especially language (Bonk and Dennen, 1999). Through this internalisation, communicative language is transformed into individual inner speech and verbal thinking. In addition, Vygotsky (1978) stated that the distance between the learner's actual states of development is determined by independent problem solving and the potential level of development that she/he can reach through the guidance of adults or collaboration with more capable peers. This concept is known as the *zone of proximal development* (ZPD). The Vygotsky culture gives learners more cognitive tools needed for development. These tools include cultural history, social context, and language (Storch, 2005). Today, the tools also include electronic forms of information access (Rummel and Spada, 2005). Moreover, Vygotsky regarded the function of teachers and peers who are more advanced to aid mastery in concepts and ideas that learners cannot understand on their own (Schellens, Van Keer and Valcke, 2005).

The degree of collaboration in CW may vary from collaborative planning to joint authorships (Tynjala, 2001). In collaborative planning, group members discuss their ideas about what to write and share their drafts and plans with other collaborators, but ultimately, each of the group members completes her/his own writing (Nelson and Carson, 1998).

In joint authorships, the form of collaboration between/among partners may vary between horizontal and vertical collaboration (Tynjala, 2001). In horizontal collaboration, the group members divide the subtopics among themselves, whereas in vertical collaboration, the group members

divide the tasks of gathering information, drafting, revising, and editing (Lowry et al., 2005). In this study, a combination of horizontal and vertical collaboration was adopted to induce interaction without spoiling the richness of collaborative interaction.

CW is a useful form of group work because of its many potential benefits, such as learning (Trimbur, 1985); socialisation and new ideas (LeFevre, 1987); maximum input, varying viewpoints, checks and balances, experience, joint knowledge, writing expertise, accuracy, and more understandable documents (Ede and Lunsford, 1990); higher document quality (Beck, 1993); and enhanced interpersonal relationships (Rice and Huguley, 1994).

However, there are difficulties in CW, arising from the complexity of the CW process (Lowry et al., 2005). Lay and Karis (1991) provided several reasons why CW can be complex, including that (1) CW documents are complex artefacts, (2) processes of preparing documents are more multifaceted during collaboration, (3) writing processes generate strong emotions, (4) groups can revise CW documents infinitely, (5) it is challenging for collaborative writers to converge on a common goal and understanding of a document or to even use a common language, and (6) success in CW is difficult to predict and guarantee. There are two ways to overcome these problems: (1) by using CW software/tools that enable us to resolve the coordination problem, such as SASSE and Trac or (2) CW groups may adopt procedures that enable them to launch their work; to circulate draft versions among group members; and to refer to specific portions of their documents as pieces of text are created, revised, and incorporated into a unified whole.

Modern information technology has provided useful tools for CW. Bahr and Harrison (2000) classified these tools into synchronous and asynchronous communication tools. Synchronous communication tools consist of brainstorming and dialoguing devices (e.g., SASE), direct/real-time text collaboration (e.g., ether pad), and collaborative hypermedia (e.g., Adobe Connect), whereas asynchronous communication tools consist of email messaging tools and delayed/asynchronous collaboration systems (e.g., Trac). Recent developments in CW software have enabled us to reduce the coordination problem by providing information on current changes and new task(s) (e.g., Trac, SASSE). However, CW tools have

not been able to tackle the problem of achieving consensus on how to proceed (Harrison, 1996). Moreover, the extent to which CW tools can reduce/overcome the coordination problem in CW will heavily depend on the phase of the writing project (Rice and Huguley, 1994).

Although there is an abundance of literature on CW, most studies pay more attention to the development of the writing process and writing skills than to domain-content learning (e.g., Dale, 1996; Elder and Paul, 2002; Gubern, 2004). Rigorous studies on the learning-related effect of CW are still rare. Dale (1994) and Keys (1994) indicated that CW assignments are successful in developing writing and reasoning skills but do not appear to automatically lead students to a higher level of argumentation or explorative talk. This finding suggests that studies on CW in general and in higher education in particular, need to pay more attention to the learning process and not merely on the learning outcomes. This study tried to fill this gap.

## **Methodology**

The participants were 13 postgraduate students enrolled in the Introduction to the Learning Sciences course in the first semester of 2012 at a university in eastern Australia. This core course was for the postgraduate students in the Learning Sciences and Technology Program. Initially, the students were divided into three different groups of five, four and four. This grouping was based on their closest research interest and/or their previous study background. This grouping was performed so that the group members would find it easier to discuss and propose certain types of innovation that would be useful in their field, given that these individuals were familiar enough with the real conditions in their field. Prior to the assignment, the lecturers provided training for one week to all students about the platforms used during the task. The lecturer also introduced the idea of CW, including the script that would be used during the writing process and the advantages of CW. The students and groups used this time to familiarise themselves with the platforms used in the assignment and to report whether the platform worked as expected. As it was assumed that the students were not familiar with the idea of CW, the lecturer provided the students with guidelines, which included the milestones and a detailed explanation of the components of the design document rationales, team writing process, and team writing roles and guidelines for holistic scoring



for the assignment. There were four milestones: (1) problem analysis, (2) pedagogical innovation, (3) details and ICT, and (4) finished document. Each milestone was to be completed within two weeks.

All data gathered from the participants were collected with explicit permission from the participants and in full compliance with the university's ethics guidelines.

This study used a multiple case-study design (Yin, 1994), with each group representing a single case. Onrubia and Engel (2009) noted case studies as an appropriate strategy for the analysis and interpretation of interactions between participants in CSCL environments. Each group was separately analysed using content analysis, and interpretations were performed on a case-by-case basis. General results were then compared across the cases.

Data collection occurred during the first semester of 2012. Prior to the writing task, the lecturers provided an introduction and a unit overview of the course. The writing task was a design innovation paper that aimed to find a new solution to a learning/training problem that the students in each group considered important. The paper was a 5,000-word essay. The class was delivered online using Adobe Connect, Google Docs and Trac (Wiki) and was taught by two lecturers. The project was to be completed within eight weeks. The group could revise the initial document based on the feedback given by their peers (within the same group) or by the lecturers. There was no specific number of revisions to be made by the groups in the CW project. The main body of gathered data corresponded to the log file (Google Docs) made by the students in the analysed groups throughout the entire duration of the research period.

The writing activities were coded based on the scheme developed by Lowry et al. (2005). Lowry's scheme was chosen because this scheme considers writing as a dynamic and iterative process. Based on this scheme, writing activities can be categorised into six common activities: (1) outlining (O), (2) brainstorming (B), (3) drafting (D), (4) revising (R1), (5) reviewing (R2), and (6) editing (E).

Lowry et al. (2005) mentioned that revision is one stage in CW. Based on Lowry's scheme, revision activity is defined as responses to reviewers' comments by making changes in the draft that reflect these comments.

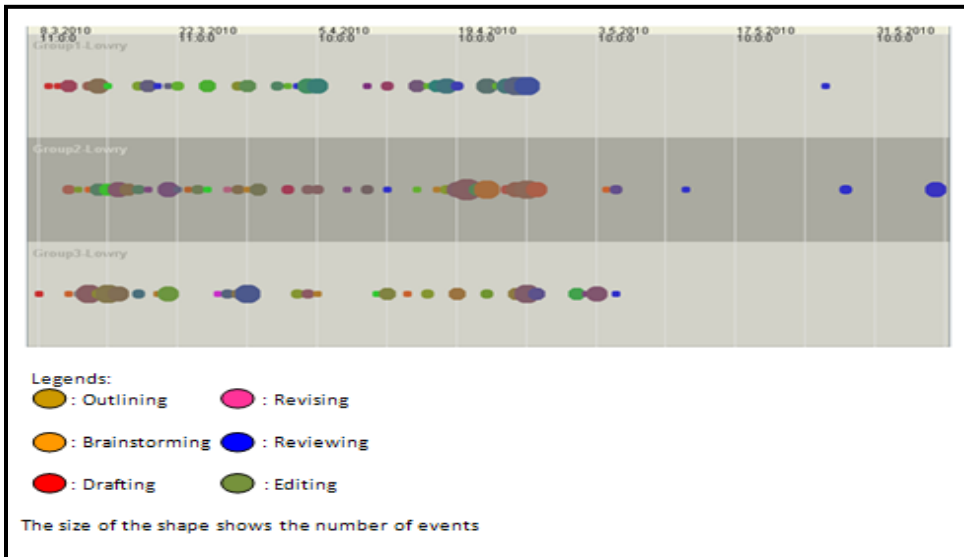
However, Lowry's scheme does not specify what type of writing activities are performed by group(s). To learn what type of revision activities were performed group(s) in detail, the author developed a modification of the typology for revision proposed by Boriartsky (1985) to reduce the role of language aspects (grammar and mechanics). Based on the proposed scheme, revisions were categorised into seven activities: (1) reordering (C1), (2) consolidation (C2), (3) distributing text (C3), (4) the expansion of information (C4), (5) the deletion of information (C5), (6) erasing the entire text and starting (again) from scratch (C6) and (7) making microstructural changes (C7). A writing segment was chosen as the unit of analysis for coding writing stages and revision. One paragraph was considered as one unit, and a list was considered as one unit. A writing segment was chosen as the unit of analysis for documents because the size of a paragraph or a list is (usually) small enough that it is still comprehensible by itself and large enough that the basic idea can still be captured (Grey, Kaplan and Raswell, 1965). Moreover, a paragraph or list contains one idea, one episode, or a piece of information (Krippendorff, 1980) making coding easier.

To assist our understanding of group interaction and writing process variations, five relevant collaborative organisational strategies suggested to us by Ede and Lunsford (1990) were used. The establishment of collaborative organisational strategies was mainly based on the consideration of two aspects: (1) the continuity or discontinuity of each group member's participation in the writing process, and (2) the level of reciprocity and contingency of the group members' contributions to the revisions made by the other participants. It should be emphasised that these aspects specifically refer to the task of elaborating an online written document, which means that the degree to which aspects are present or absent is related to the contributions made by the participants that appear in the written documents.

To ensure reliability, two coders independently coded the log files (Google Docs), and their analyses were compared to identify places of agreement and disagreement. The inter-coder reliability was calculated by using Cohen and Holsti's CR method. The measured inter-coders reliability was 0.87 for the Lowry writing scheme, 0.78 for the Boriartsky revision scheme, and 100% for the CW strategies, which was suitable (Willis, 2007)

## Results

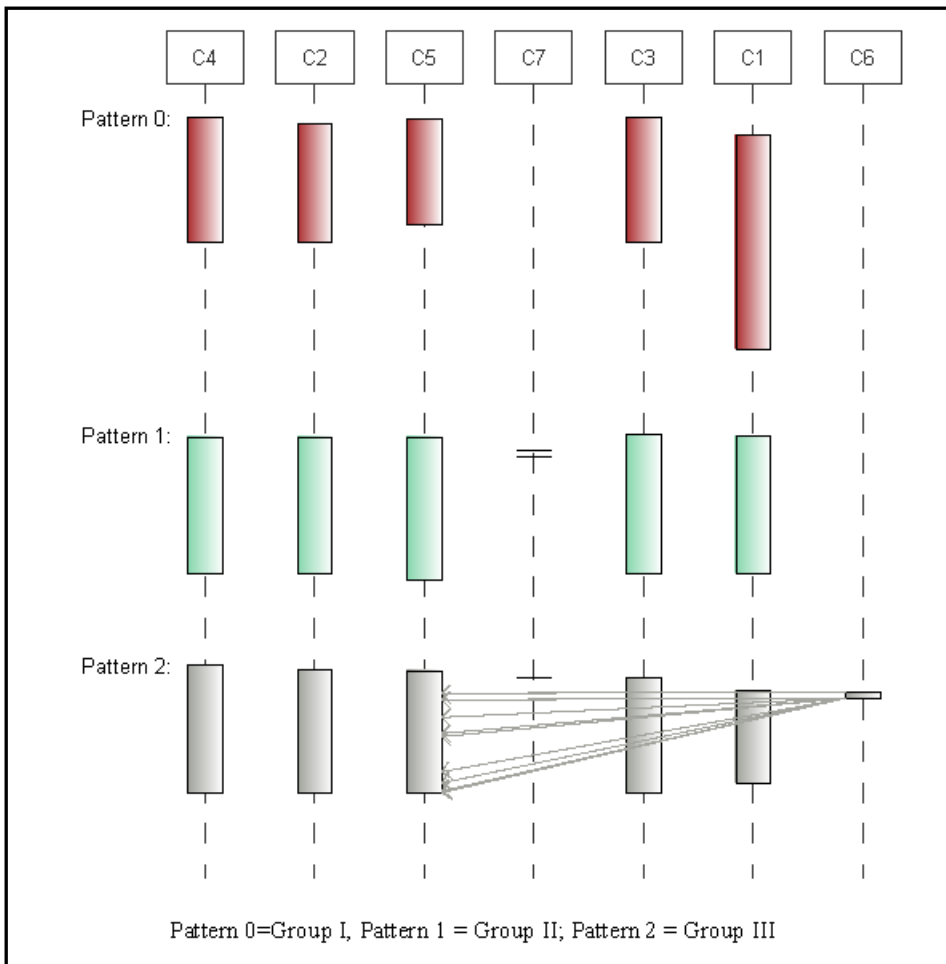
Figure 1 shows the time needed by each group to complete the online writing task. Groups I and III started the work with brainstorming, whereas Group II began the work with outlining. Group III was the only group that completed the task within the time frame set by the lecturers. It took 12 weeks for Group I to complete the task, and 13 weeks for Group II. In contrast to writing a short essay, for which most of the work/activities are generally performed close to the due date, here, the work/activities spread from Week 2 to Week 7. Group III used Week 8 to finalise the task, and Week 9 to make final revisions. Interestingly, it seems that Groups I and II had finalised the final draft at the end of Week 7. There was a 3.5-week gap for Group I before finally completing the editing in the middle of Week 12. It appears that Group II was still working on the draft and revision in Week 9, followed by a week-long gap and major final editing at the end of Week 13.



**Figure 1** Dotted chart for the writing phases

The researcher was naturally interested in learning about the individual group activity and the paths in each group. ProM provides a performance

sequence analysis plug-in to find the most frequent paths in an event log (Bozkaya, Gabriel and van der Werf, 2009). Figure 2 illustrates the interaction for the saved online documents of the three groups in the course. All three revision patterns on the horizontal bar are according to the revision type discovered by the process model mentioned above.



**Figure 2** Performance sequence analysis of the documents of Groups I, II, and III

Figure 2 shows that each group had a unique pattern of revision. Group I spent most of the revision time on reordering (C1). Group I was the only group that never made the microstructural changes (C7). Group II spent most of the time on reordering (C1). These observations may indicate that Groups I and II had difficulties in finding the right structure for the CW documents. From figure 2, it can also be inferred that making microstructural changes (C7) was not the type of revision often made by the groups. Thus, the groups had no difficulties in editing. Figure 2 also shows that the proportion of the expansion of information (C4), the consolidation (C2), the deletion of information (C5), the expansion of information (C3), and reordering (C1) was nearly the same in Groups II and III.

Group III was the only group that erased and started again from scratch (C6), meaning that this group changed its idea in the middle of CW production. Further examination of the documents produced by Group III, showed that the biggest changes occurred in at the middle of Week 4, immediately after a large review conducted by Group III at the end of Week 3.

There were two types of group dynamics in the groups that were examined. The first dynamic was a typical feature of the groups that appeared in the log files and particularly in the Google Docs. This feature pertained to the number and types of contributions made by each team member during the document writing process in the group. The second dynamic was the activity level of the students and the level of their contributions. Assessments were performed by combining the contributions of group members and examining the comments that the students made during the revision and reviewing processes. These types of group dynamics were coded using a data-driven analysis. A contribution over 40% was considered as high, whereas a contribution from 25% to 40% was considered as 'some', and below 25% was considered as low. Regarding the activity level, the group member who had a high-contribution label was considered as a captain if the review and comments that she/he made during the revision process also included an effort to manage the group's work. If she/he was merely doing the revision without trying to manage the group's work or explain the reasons for the reviews, then she/he was labelled as 'some'. However, if she/he was doing the revision while ignoring others' comments and revised the main content of

the documents the way that she/he wanted, then she/he was labelled as an over rider. The level of contribution was determined by examining all of the reviews and comments made by each group member during the writing process, from outlining until the editing processes. Here, the researcher would like to high-light the most outstanding feature that appeared during the writing process for each group.

**Table 1** Variation between the student groups

Group	Number of revisions	Typical feature of the group	Activity level of the students	Level of collaboration of the actively participating students
Group I	679	Unequal contribution	1 = free rider 2 = high 2 = some	Team work in which the participants listened to each other
Group II	635	Equal contribution	1 = over rider 2 = high 1 = some	Good and based on experiences
Group III	390	One group-member dominance	1 = captain 1 = quite active 2 = some	Collaborative, except for certain equality in the activity level

In Table 1, it can be observed that unequal participation was evident in Group I. Despite unequal participation, the group members were still able to listen to each other. Two members of this group were actively involved in the task and developed an analytical and reciprocal collaboration process. In addition to these two students in the groups, one member was contributing to the work, but not actively or effectively. The fifth group member could be characterised as a free rider, who was apparently seeking maximum benefit from the group task with minimum personal input. Within this group, the active members did not blame the non-active member; instead, the active members distributed the job of the free riders to the highly active group members.

Group II was very practically oriented. Two group members organised the work in the beginning, and the group then followed the given structure accordingly. One group member displayed certain activity during the work, but to a lesser degree than the others. An in-depth analysis of the documents showed that level of the contribution of the group members was good and that they shared similar interests, as all of the group

members either had interest in the group's writing topic or had real experiences on the writing topic.

Groups II and III both included one dominant member. The influences of the dominating group member differed greatly. Whereas Group II suffered from an over rider dominating the group work, Group III was led by a captain, who had a strong orientation towards the group and tried to manage and facilitate the CW task. The over rider in Group II tried to dominate the group work during the entire working period by giving orders and providing the right answers to the group, and he even outlined the structure of the CW project.

## **Discussion**

From the explanation above, it can be inferred that Group III was the only group that could finish the online CW assignment within the timeframe set by the lecturers. The fact that Groups I and II could not complete the task within eight weeks (plus one week to familiarised them-selves with the platforms used for the online collaboration) and the fact that the time to complete each milestone for Groups I and III took more than two weeks might indicate that most of the groups lacked a sense of time management. Time management is a critical factor in online collaborative learning for both teachers and learners (Hakkinen and Makitalo-Siegl, 2007). When a collaborative effort is conducted online, it is imperative that all of the group members understand the organisation of tasks and deadlines of the tasks, and pay attention to time management. These aspects must be explicitly articulated to ensure a positive interaction online. A clear time structure facilitates teacher regulation by providing the teacher with an easy way to follow a team's progress (Forsyth, 2010) and makes task distribution more salient, especially because deadlines define clear boundaries between two or more consecutive sub-tasks (Weller, 2002). Striking a balance between the extremes of giving too much time or too little time to completing a task is one of the most difficult issues that teachers face when managing a group, and there is no easy answer (Palloff and Pratt, 2005). Teachers need to know their students and to carefully monitor what is happening as a group progresses through various stages of the online learning process (Harrison, 1996). In general, teachers and students should learn how to use and allocate time more efficiently as group work progresses.

Moreover, the work/activities spread nearly evenly across the writing time set by the lecturers (from Week 1 to Week 8). This finding contradicts the data of Southavilay, Jasef and Calvo (2009), who reported that activities in online CW primarily occur close to the due date. This research also confirms the idea that the CW process is not linear (Lay and Karis, 1991; Lowry, Aaron and Rene, 2004; Lowry et al., 2005) and that the process is cyclic (Lowry et al., 2005; Speck, 2008). This fact emphasises the statement that online CW is a complex process (Lay and Karis, 1991; Vilalon et al., 2008). Therefore, online CW needs scaffolds to help or guide the learner to a higher level of both collaborative processes and individual learning outcomes (Sherin, Reiser and Edelson, 2004; Tabak, 2004).

In this investigation, the aim was to study relationships between writing phases and revision patterns during online CW. First, there were two groups that began the works with brainstorming ideas. These groups were the only groups that basically finished the CW task within the specified time frame. The written result of the brainstorming helped the groups to structure the contents of the CW project and to determine whether the initial idea was still developable during the writing process.

Although micro structural changes (C7) accounted for the smallest proportion of revisions performed by the groups, these changes clearly contributed to the overall time needed to complete the CW project. It took one additional week for Group I and three additional weeks for Group III to complete the micro structural changes.

Once a group completed C6, the time and effort dedicated to each writing phases was nearly the same. It seems that C6 was linked with C5, meaning that the group also became more critical and aware of the writing content because the group members reread the revision that they had made and deleted content that they thought was not suitable or was not in agreement with the new topic/outlines.

In this experimental exercise, all participating groups performed a CW project. An introduction to and guidance on CW were provided within the first week of the class. However, the introduction and guidance could not guarantee equal and high-level collaboration within the teams, and there was also considerable variation between the teams.



Despite the apparently similar instructional support, the quality of collaborative activities in the different groups varied considerably (Arvaja and Hamailen, 2009). This research suggests that a high activity level is not always an indication of good collaboration. Group II suffered from an over rider, whereas Group I took over the jobs and responsibilities of the free rider without trying to effectively involve the free rider in the CW project. Based on the contributions to the writing phases made by each group member, it was clear that the brainstorming and outlining processes were merely conducted by particular group members, whereas the rest of the group basically expanded the ideas without trying to fill in gaps in the ideas.

### **Conclusions and Future Work**

The work presented in this study is a work in progress. The results show that there was a relationship between writing phases and revisions. This relationship can be used to help lecturers to determine the right scaffold and feedback for a group, so that a CW task can be completed within the given time frame and that groups can benefit and learn from the idea of CW and collaborative learning skills.

Furthermore, the data also show that the groups had to perform many revisions before they produced a final draft. It is therefore important to make revision a significant intellectual activity that allows time for ideas to ripen and for knowledge to grow. When new knowledge is an element of the writing situation for the writer, revision may proceed roughly. The process of revision can involve at least three types of knowledge: knowledge about the topic under consideration; knowledge about the audience; and, knowledge about the plans and the pattern of development, for example (Nevgi, Virtanen and Niemi, 2006). All three types require critical thinking, which is usually placed at the upper end of cognitive development scales and is associated with such intellectual features as suspending judgement, reflecting on alternatives, decentring, and relativising (Rourke and Anderson, 2004). These findings suggest that topical knowledge and revision belong together. More specifically, there should be well-defined and intellectually stimulating content and revision should be performed as part of the process of understanding the content. Lastly, the findings also suggest that teachers should treat these revisions as a series of rehearsals rather than as separate entities and, whenever

possible, should attend to and comment on macrostructural changes from draft to draft. This process may take a long time, but as writers, the students begin to recognise that writing and learning truly belong together.

This preliminary work gives the researcher direction for the next step of her/his work. The challenge was to design a script that could equally engage students in CW. It might be useful to combine the knowledge of both students' self-regulation (Tynjala, 1998), and of the collaborative script (Tabak, 2004).

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## APPENDICES

**Table 1** Coding scheme for writing stages (Lowry et al., 2005)

Activities	Code	Definition	Activities
Brainstorming	B	Developing new ideas for a paper draft.	Listing the possible ideas and section.
Outlining	O	Creating a high-level direction in which the document will be going, including major sections and subsections.	Organising ideas and sections.
Drafting	D	Writing the initial incomplete text of a document (this is typically synonymous with the term writing, but the term drafting is used to convey incompleteness in the writing). This is also synonymous with composing.	Adding ideas, section, paragraphs, sentences, word.
Reviewing	R1	Having a participant or an editor read and annotate document draft sections for content, grammar, and style improvements.	Reading the draft and make comments/suggestions on how to improve the documents.
Revising	R2	Responding to review comments by making changes in the draft that reflect the review comments. Revising is used over editing to distinguish this activity more clearly from copyediting and from the editorial process of reviewing.	Deletion of information (deleting ideas, section, etc.) Creation of immediacy (changing voice, adding quotes, etc.) Subordination of information (reorganising, deleting and substituting ideas, section, etc.)
Editing	E	The process of making final changes that are universally administered to a document to make a document more consistent (such as copy edits, grammar, logic), usually made by one person charged with this responsibility.	Improve the prosody (changing sentence, clause, phrase, words). Improve the vocabulary (changing words, adding metaphor, alliteration). Correction of grammar and mechanics.

**Table 2** Coding scheme for revision (Based on Boriartsky, 1985)

Activities	Code	Purpose	Activities
Correction of grammar and mechanics	C1	Making the piece grammatically and mechanically appropriate for the audience and purpose.	Correcting: grammar, graphic representation, punctuation, word usage, and format.
Reordering	C2	Organizing the information in some logical arrangements to communicate the message.	Reorganizing: ideas, sections, paragraphs, sentences and words.
Consolidation	C3	Subordinating secondary information so it does not interfere with the main part of the message.	Reorganizing/deleting/substituting: ideas, sections, paragraphs, sentences, words.
Distributing text	C4	Emphasizing information to communicate the message.	Reorganising/adding/substituting ideas, sections, paragraphs, sentences, words.
Expansion of the information	C5	Providing sufficient information in relation to the purpose and the audience.	Adding ideas, sections, paragraphs, sentences, words.
Deletion of the information	C6	Eliminating excessive information in relation to the purpose and the audience.	Deleting ideas, sections, paragraphs, sentences, words.
Start again		Changing the ideas and information presented in the document in total.	Erase the whole text and rewrite the text from the scratch.
Micro structure changes	C7	Achieving coherence between the whole piece and its various parts to communicate the message.	Create transitions between ideas, sections, paragraphs, sentences, words.
		Developing a form that is effective and consistent with the purpose and audience.	Changing tones, angle, voice, point of view, person, style