Introducing Engineering Students to Intellectual Teamwork:
The Teaching and Practice of Peer Feedback in the Professional Communication Classroom

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A rich discussion of collaboration as integral to writing in academia and the workplace has been on-going for some time among writing instructors and researchers (e.g. Bruffee, 1984; Dias and Paré, 2000; Ede & Lunsford, 1992; McGroarty & Zhu, 1997; Thralls, 1992; Reither & Vipond, 1989). The outcomes of this discussion have convinced some writing instructors to promote peer feedback as one of the forms of collaborative writing in the classroom (e. g., Perry & Collins, 1998; Schriver, 1993; Sitko, 1993;Villamil & De Guerrero, 1998). In this paper we report on the preliminary stages of a longitudinal study of the role and place of peer feedback in the development of students' writing.

The site of our research is a mandatory undergraduate communication course that we teach to engineering students at a Canadian University. In this course the student to instructor ratio often reaches 130 to 1, where students are divided into sections of 25-30, and where one instructor teaches 4-5 sections. This high number of students is of particular concern in a communication course, in which students need to continuously practise written and oral communication strategies by interacting with each other and their instructors. The major goal of this course is to facilitate the acquisition of domain-specific communication strategies[1] necessary for students to successfully communicate in engineering, both in writing and orally. To help students to acquire these domain-specific communication strategies and, therefore, to

meet the goals of the course, and to facilitate student learning in large classes, it is necessary to develop an effective pedagogical approach. The present study stems from our attempt to develop such a theoretically sound and practical pedagogical approach. In the attempt to develop such a pedagogical approach and because of the high number of students enrolled in the communication course and the communicative nature of the course, we considered it appropriate to look to the social theories of writing.

Research into academic and workplace writing practices suggests that "competence is a necessary but not a sufficient condition for success . . . writers must be 'able to work together.' They must, in short, be able to collaborate" (Ede & Lunsford, 1992, p. 66). Contemporary theories of language and, in particular, Bakhtin's (1986) theory of the communication chain "provide a solid vantage point from which to begin to explore the sense in which collaboration is present in both individually and jointly authored texts" (Thralls, 1992, p.65). Therefore, to facilitate student acquisition of domain-specific communication strategies writing instructors should help students to realize that collaboration, as Thralls suggests, is integral to all writing and not unique to co-authorships. Instructors need to provide an environment that is conducive to "social engagement in intellectual pursuits" (Bruffee, 1984, p. 652) and promote the understanding that all writing is collaborative because all writing is social (Ede & Lunsford, 1992, p. 15).

In our communication course students are working on engineering projects of their own choice[2]. They have to complete tasks that require them to manipulate existing information and, sometimes, to produce new information. Students are then asked to communicate this information through written documents. We feel that, because of the social nature of writing, it is necessary to involve students in collaborative writing, that is, to introduce them to one of the types of intellectual teamwork. As Galegher and Kraut suggest, "The concept of intellectual teamwork embraces information intensive work of many kinds . . .. The central image underlying . . . [intellectual teamwork] is one of individuals working together to produce or manipulate information . . ." (Galegher & Kraut, 1990, p.1). And so, to ensure that our pedagogical approach involves students in genuine intellectual teamwork (Galegher, Kraut, & Egido, 1990) in the class-

room, we need to create an environment that would stimulate student intellectual collaboration. That is, we need to introduce a social dimension in our classroom.

Teachers of writing were attempting to introduce a social dimension in the writing classroom as early as the 1960s (Moffet, 1968). An example of such a pedagogical approach developed when the writing process movement was gaining momentum in the 1980s is the teacher/student conference that became an integral component of the "process-conference approach" (Graves, 1984, p. 70). The process-conference approach involved the instructor working "with the student through a series of drafts, giving guidance appropriate to the stage through which the writer is passing. By putting ideas on paper the student first discovers what he or she knows and then is guided through repeated drafts that amplify and clarify until the topic is fully expressed" (p. 70). The emphasis here is on the instructor guiding the student where the instructor is both the authority and the sole audience.

Moffet (1968), however, notes that it is classmates -- as peers -- who are a natural audience for a student. Students who are provided with the opportunity to habitually respond to and coach each other get insights about their peers' writing, about their own writing, and about the needs of their readers (Moffet, 1968). By working in small groups, students start relying on their peers as reviewers and may be able to overcome communication problems caused by egocentricity, that is, by a writer's inability to look at her writing from a reader's perspective (Elbow, 1973; Herrington & Cadman, 1991; Sargent, 1997). The role of the instructor, then, becomes "to teach . . . students how to teach each other" (Moffet, 1968, p. 196). This understanding of the role of the instructor reinforced our belief that it was necessary to teach students how to interact in their small groups so they could learn how to collaborate (Elbow & Belanoff, 1989).

Our continued search for studies that focused on peer feedback provided us with a large body of literature (e. g., Beason, 1993; Dale, 1994; Elbow, 1973; Elbow & Belanoff, 1989; Freedman, 1992; Herrington & Cadman, 1991; McGroarty & Zhu, 1997; Perry & Collins, 1998; Sargent, 1997; Schriver, 1993; Sitko, 1993; Smith, 1997; Villamil & De Guerrero, 1998). From this literature, we learned that in the majority of studies peer feedback was provided orally, whereas in our classroom, the focus was on written feedback

(e. g., McGroarty & Zhu, 1997; Sitko, 1993; Villamil & De Guerrero, 1998). We also learned that even though peer conferencing was widely practised in the writing classroom, the instructor often remained the audience for resulting drafts and the final product. That is, in addition to the (mostly) oral feedback provided by peers, it was the instructor who continued to read and respond to student drafts.

Only a few studies that we were able to locate explored in depth the practice of teaching students how to use small groups to learn how to write and use peer feedback (Elbow & Belanoff, 1989; Herrington & Cadman, 1991; Sargent, 1997; Sitko, 1993; Schriver, 1993). To our knowledge, peer feedback that results from teaching students how to use each other as intellectual teamwork facilitators (cf. Sargent, 1997) in the writing classroom has received very little attention. More attention has been paid to revisions (Sitko, 1993; Schriver, 1993; Herrington & Cadman, 1991) than to the quality of the peer feedback that results from teaching feedback strategies.

Because information on the effectiveness of teaching peer feedback strategies and on the quality of resulting peer feedback was limited, we decided to conduct our own research as we were developing and implementing our pedagogical approach. In this paper, we present a brief description of our research site, i. e., the engineering communication course we teach; a description and analysis of our first, and unsatisfactory, attempt to introduce peer feedback as a strategy for intellectual teamwork; the design of a new approach to teaching peer feedback; a description of two research studies into the effects of teaching peer feedback in an engineering communication class; and the analysis and interpretation of the results of the studies.

Research Site

In our engineering communication course, we ask students to choose subject matter covered in the engineering courses they are taking concurrently with our course and to use this subject matter as topics for their communication course projects[3]. In our course, students are required to write documents typical of any engineering project: a formal letter, a project proposal, a progress report, and a completion report. Students are asked to produce multiple drafts of each document, obtain written comments (feedback) from their peers on these drafts, and use this

feedback to revise their work before submitting it to the instructor. Hence, each document produced by each individual student author is a result of collaboration between a number of peer reviewers and that author. By asking our students to participate in the peer feedback process, we hope that such collaboration will promote intellectual teamwork among peers, which will allow for continuous practice necessary for the acquisition of domain-specific communication strategies. In addition, we believe that by creating this opportunity to collaborate, we encourage students to be more self-reliant and thus less dependent on the instructor (cf. Herrington & Cadman, 1991; Sargent, 1997).

Introducing Peer Feedback as a Strategy for Intellectual Teamwork

When we first started teaching the communication course in 1997, our approach to using peer feedback as a strategy to improve writing was to introduce students to document types characteristic of engineering; explain the potential benefits of peer feedback; and provide students with instructor-designed forms to use as a means of conveying their feedback to classmates (Fig. 1). We chose to use feedback forms as they are often used in composition (e.g. Freedman, 1992) and technical communication classes (e. g. Covington & Keedy, 1979). The questions on the forms (Fig. 1) were intended to help students focus their feedback on content, organization, format, and language use in the draft document under review. We asked students to read each other's drafts; write their comments on the forms; and return the draft documents and the completed feedback forms to the writers. We hoped that participation in the course and regular exposure to samples of engineering documents would allow students to be able to address pertinent issues related to the questions asked on the forms.

On review of completed forms and subsequently revised student drafts, we discovered that students' feedback was often generic and shallow, and not helpful for revision. For example, in response to questions related to the appropriateness of content in the document, reviewers would often write, "Content is good," "clear," or "confusing," without providing any explanations or justification. Such feedback led us to believe that the questions on the forms were too broad (e.g. Organization: Is it logical? What is good about it? What could be improved? (See Fig. 1)). In addition, we observed that the

Assignment 1: Letter to Instructor

Content (MAIN QUESTION: Does it include all information requested by the instructor?)	
What is good about it?	What could be improved?
Organization (Is it logical?)	
What is good about it?	What could be improved?
Format (Does it have an appropriate layout?)	
What is good about it?	What could be improved?
Language (Is it accurate?)	
What is good about it?	What could be improved?

Figure 1: Feedback Form.

authors of drafts were experiencing difficulties trying to connect feedback written on the forms to specific parts of their drafts. This observation lead us to conclude that feedback would be more accessible to authors if written directly on the drafts as opposed to the forms which were physically separate from the drafts.

Given these observations, we determined that participation in the classroom and exposure to sample documents was insufficient to help students to use peer feedback as a strategy to improve their writing. It was unrealistic to expect students to collaborate productively simply because they were put into groups and given a task to work on together (cf. Elbow & Belanoff, 1989; Sargent, 1997; Schriver, 1993; Sitko, 1993). To maximize the effectiveness of collaboration among peers -- and, therefore, to enhance the process of student acquisition of domain-specific communication strategies -- instructors must "create and

maintain a demanding academic environment that makes collaboration – social engagement in intellectual pursuits – a genuine part of students' educational development" (Bruffee, 1984, p. 652). It became clear to us that we had to modify our pedagogical approach.

The Design of a New Pedagogical Approach to Teaching Peer Feedback

In designing a new pedagogical approach we began by trying to address the problems that came to light in our first attempt to teach peer feedback. First, to address the problem of "broad" questions we reconsidered the purpose of the feedback form and redesigned it so that it served as a guideline and geared students' attention to more concrete problems in drafts. As Elbow and Belanoff (1989) say, "you can't really take charge of the feedback process if you haven't learned enough kinds of feedback to ask for " (p. 2, italics in the original). For example, the revised form contains questions such as "Does the writer provide enough information to justify the choice of the engineering course? Does the writer provide all the information about the [engineering] course that the instructor has requested?" (Fig. 2).

Second, to help authors to connect peer feedback to specific problems in their drafts we moved away from the "fill in the blanks" form. We instructed reviewers to write their feedback directly on the drafts, addressing issues identified in the guideline.

Third, to ensure that student collaboration was productive we decided to teach students how to use small groups to learn how to write and use peer feedback effectively. This approach is grounded in the work of Vygotsky (1978) and Rogoff (1990) that showed that in collaboration with experts and peers, learners are often able to achieve goals they are unable to achieve on their own. We hoped that by promoting peer feedback in small groups we would be able to encourage students to draw on each other's resources; form "a community of status equals: peers" (Bruffee, 1984, p. 643), and rely less on the instructor's feedback (cf. Sargent, 1997). Because all students in our course come from different years and different departments of the Faculty of Engineering, they share some common discipline-specific knowledge, and they all "start with different degrees of knowledge or hold different perspectives" (Hughes & Greenhough, 1995, p. 535). In addi-

1. Is there a clear sense of audience in the letter? How do you know who the intended reader of the letter is?
2. Is it clear that this is a letter of response? How does the writer make it clear?
3. Does the writer identify the selected engineering course?
4. Does the writer provide enough information to justify the choice of the engineering course?
5. Does the writer provide all the information about the course that the instructor has requested?
6. Does the letter follow conventions for formal letter writing:
   a. Is the order of the addresses correct?
   b. Does the receiver's address provide enough information for the letter to be delivered to the receiver?
   c. Does the sender's address provide enough information so that the receiver's response can reach the sender?
   d. Is there an appropriate
      - date?
      - salutation?
      - complimentary close?
      - signature block?
      - end notation(s)?
   e. Does the letter meet all the format requirements outlined in the Instructor's letter of request and the course outline?
7. Is the language of the letter formal and grammatically correct?

Figure 2: Checklist for Feedback on the Letter to Instructor.

tion, as Herrington and Cadman (1991) observe, "reviewing another's draft [moves] students from passive roles of receivers and demonstrators of knowledge to more active roles in shaping their own ways of thinking and writing" (p. 196). In other words, students working in peer feedback groups can serve as intellectual teamwork facilitators (cf. Rogoff, 1990) for one another by drawing on shared knowledge and benefiting from various perspectives represented in their groups.

As we were developing and implementing our new pedagogical approach, we decided to complement our incidental classroom observations by formal research. Our intention was

to collect information on students' attitudes toward peer feedback and to analyze the effect of teaching peer feedback on the quality of comments students wrote on each other's drafts.

Two Studies

Our research[4] included two distinct but complementary studies. In the first study we elicited student perceptions of peer feedback at the same time as we were introducing students to our new pedagogical approach. We designed feedback questionnaires to gain access to students' perceptions of and concerns about peer feedback (Appendices A and B). The information we gained as a result of the analysis of the feedback questionnaires guided us as we were implementing the new approach. In this paper, we call this study the "Feedback Questionnaire Study."

In the second study, we collected all drafts of course assignments with peer feedback produced by a small group of students. The drafts and final copies of the assignments were analyzed at the end of the term to determine whether the quality and nature of peer feedback had changed over the term. We call this study the "Peer Feedback Study."

Research Methodology

The following sub-sections of the paper present the methodologies of the Feedback Questionnaire Study and Peer Feedback Study.

Methodology: Feedback Questionnaire Study

The participants of this twelve-week (one term) study were twenty undergraduate students from different departments and streams of the Engineering Faculty enrolled in the mandatory communication course. The majority of participants were first- and second year students with some third- and forth-year students as part of the group.

In this study, we collected and analyzed students' responses to two feedback questionnaires (Appendices A and B). On the first day of the course, without any discussion of peer feedback, we administered the first feedback questionnaire (see Appendix A). The reason we administered it on the first day of classes was to collect information about students' understanding of and attitudes towards peer feedback as based on their prior experiences and not as influenced by our teach-

ing. At the mid-term point (after six weeks of teaching), we administered the second questionnaire (see Appendix B) and then analyzed student responses to the questionnaires to identify concerns about peer feedback at different points in the term, compare them, and modify our pedagogical approach to accommodate them. In our analysis of student responses to the feedback questionnaires, we focused on categories of common student concerns that emerged from the close reading of all questionnaires in the sample.

Methodology: Peer Feedback Study

In this study, we selected a small group of four students from the original group of twenty. We collected and analyzed peer feedback written on drafts of all four course assignments[5] over the term to assess whether the quality of the feedback changed (cf. McGroarty & Zhu, 1997). Our analysis of these data was conducted at the end of the course. At the end of the term, we compared and analyzed the peer feedback to determine whether its nature and quality had changed over twelve weeks.

Analysis and Interpretation

This section provides the analysis and interpretation of the results of both studies.

Analysis and Interpretation:
Feedback Questionnaire Study

The analysis of student responses to the first feedback questionnaire revealed that students had five main concerns about peer feedback. First, students were concerned with their peers' attitudes toward giving feedback. They thought that peers would not take the feedback process seriously (cf. Freedman, 1992). Students also felt that peers might be unclear about their responsibilities and role as reviewers. Second, students questioned the competence of peers to give feedback. They did not think peers would know what elements of writing to address in feedback. Third, students voiced a concern for the need for practice in giving feedback. Fourth, students expressed a need for the instructor's voice. They saw the instructor as the expert and the person marking the assignments and, therefore, felt that they needed instructor feedback in addition to peer feedback. Finally, students indicated

a need for combined written and oral feedback. They thought that each process by itself was incomplete.

As a result of this analysis, we developed a series of pedagogical responses. We responded to the concern about peers' attitudes toward giving feedback by conducting in-class discussions of the roles and responsibilities of peers, trying to instill in our students a sense of responsibility to each other.

To respond to the concern about competence of peers to give feedback, we provided students with guidelines in the form of questions (what we called "checklists") to help student reviewers to identify and address problematic areas in peers' writing (See Fig. 2 for a guideline for the first assignment, Letter to Instructor). "Checklists" were accompanied by oral instructions to ensure that reviewers would focus their feedback on the identified areas and would write their feedback directly on drafts. We also conducted in-class training sessions where small groups of students would examine samples of draft documents written by students enrolled in the communication course in previous terms[6] and provide feedback on them using the "checklists." Students and instructors would then compare and discuss in plenary the feedback provided by different reviewers.

To satisfy the students' need for practice in giving feedback, we established "prescribed" feedback groups based on the results of a diagnostic exercise conducted on the first day of classes (Artemeva, 2001a, 2001b) and instructor's observations of the class dynamics (cf. Sargent, 1997). In these prescribed groups each student received feedback from two or three peer reviewers. The groups were given class time to comment on each other's drafts. In addition to time provided in the classroom, we encouraged students to use an Internet-based electronic course newsgroup where students could publish drafts and exchange peer feedback[7]. Students were also encouraged to use personal e-mail to exchange feedback on drafts.

To respond to the need for the instructor's voice in feedback, we offered students oral feedback on drafts in class and during office hours and when possible, we provided written feedback by email or through the electronic newsgroup.

We responded to the students' need for combined written and oral feedback by providing in-class feedback sessions, in which feedback written by reviewers on other students' drafts was followed by an oral discussion between the writer and the reviewer.

Analysis of the second questionnaire showed us that at the mid-term point students had three main concerns. The first concern was related to the prescribed feedback groups. Some students felt that their mandatory groups did not function well because of bad interpersonal dynamics, and they wanted to use other classmates for feedback. The second concern expressed by students was related to their confidence level. They questioned their ability to provide useful feedback to classmates. Finally, students indicated that they were not sure if they were using peer feedback optimally.

As a result of the analysis of the second questionnaire we developed another series of pedagogical responses. To respond to the concern about prescribed feedback groups, we allowed students to solicit feedback from classmates outside of their prescribed groups, after they had had six weeks of practice in those groups. We hoped that by having an opportunity to choose their own feedback partners and form their own feedback groups students would be encouraged to collaborate more effectively.

We considered the students' concern about their abilities to give feedback natural given that they had only been working as peer reviewers for about six weeks and responded to this concern by providing more in-class opportunities for continued practice.

Finally, to respond to students' concerns about the optimal use of feedback, we reinforced the importance of an oral discussion in support of the written feedback. We hoped that discussion between the reviewer and the writer would allow for clarification and negotiation of the written feedback and thus enhance the writer's confidence when using the feedback.

In summary, the comparison of responses to the first and second questionnaires indicated that students' concerns were fewer in number at the mid-term point and were quite different in nature. The analysis of responses to the questionnaires suggested that students felt more comfortable with the practice of peer feedback by the mid-term point, which might indicate that our pedagogical responses to students' concerns expressed at the beginning of the term were fairly effective. This analysis also led us to think that by the mid-term point students had started "to buy into" the strategies we had exposed them to and had started seeing peers as possible intellectual teamwork facilitators.

Analysis and Interpretation:
Peer Feedback Study

As explained above, in the middle of the term students were given an opportunity to solicit feedback from classmates outside of their prescribed groups. Although some students decided to solicit feedback outside of their original prescribed feedback groups, others preferred to remain with their original feedback partners. The four student participants in the Peer Feedback Study chose to remain with their original feedback partners.

After reading and comparing all the feedback written by the four students over the term, we defined our unit of analysis as a meaningful instance of feedback. A meaningful instance of feedback might be presented in the form of a single word, a phrase, a complete sentence or a passage. For example, the comment "Double space" addresses a problem of format (spacing) and is presented in the form of a phrase. The comment "Look at spacing in text, I don't know if you're required to follow it" also addresses a problem of format (spacing) but is presented in the form of a sentence. Each of these comments would be counted as a separate meaningful instance of feedback addressing the same problem, that is the problem of format.

Once we had defined our unit of analysis and compared feedback on all the drafts, we were able to group meaningful instances of feedback under the following categories: local context, content, organization, language, format, writing process, advice, and evaluation (for rules of inclusion for meaningful instances of feedback in each category, see Fig. 3).

When studying peer feedback written on drafts of each of the four assignments, we counted how often the meaningful instances of feedback belonging to each identified category occurred per assignment, or, in other words, we calculated the frequency of the occurrence of instances of feedback in each category. Figure 4 demonstrates the change of the relative number of instances of peer feedback in each category from assignment to assignment.

Thus, Figure 4 demonstrates that in their comments on drafts of the first assignment (a formal letter to the instructor), students focused on issues of format, language, and local context, while issues of content and organization received less attention. Given that the assignment sheet (" Instructor's Letter of Request," see Appendix C) asked students to present
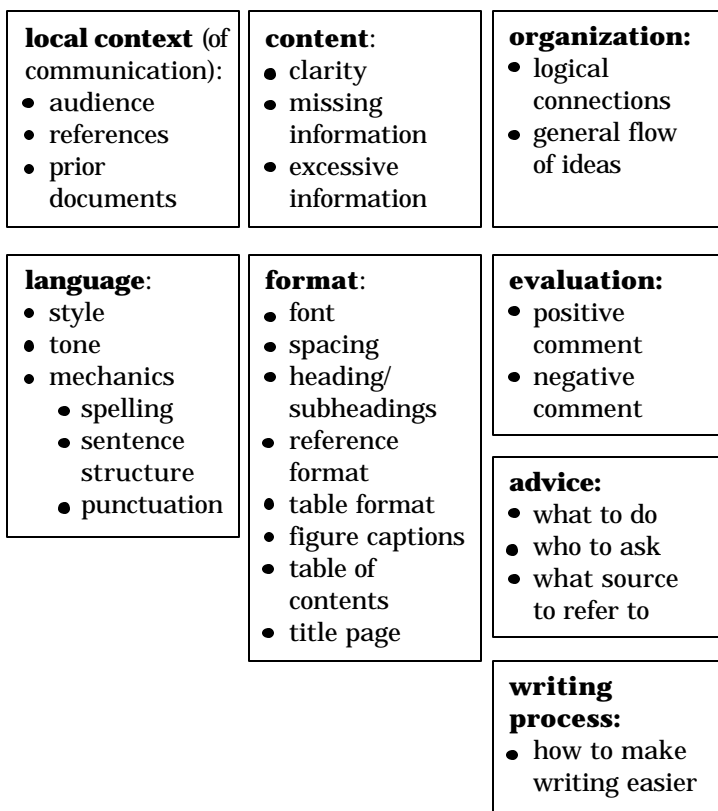
local context (of communication):
- audience
- references
- prior documents

content:
- clarity
- missing information
- excessive information

organization:
- logical connections
- general flow of ideas

language:
- style
- tone
- mechanics
  - spelling
  - sentence structure
  - punctuation

format:
- font
- spacing
- heading/ subheadings
- reference format
- table format
- figure captions
- table of contents
- title page

evaluation:
- positive comment
- negative comment

advice:
- what to do
- who to ask
- what source to refer to

writing process:
- how to make writing easier

Figure 3: Categories of Peer Feedback and Abbreviated Rules of Inclusion.

specific information pertinent to their projects and modeled an order in which this information could be presented, we hoped that students might attend to these issues in their feedback. In addition, no meaningful instances of feedback providing advice, evaluating the document, or commenting on the process of writing were found on drafts of the first assignment.

On the other hand, our analysis of peer feedback written on drafts of the last assignment (a completion report) showed that compared to assignment one, issues of local context and format received much less attention at the end of the term, while content, organization, and language were addressed more often. In addition, the new categories of advice, evaluation, and writing process appeared in student feedback as the term progressed (Fig. 4).

Assignment 1 – Letter to Instructor
Assignment 2 – Project Proposal
Assignment 3 – Progress Report
Assignment 4 – Completion report

Figure 4 : % Meaningful Instances of Peer Feedback vs. Categories of Peer Feedback on Each Assignment

The analysis of the frequency of meaningful instances of feedback in each category, therefore, showed that over the term there was a shift in the focus of peer feedback (Fig. 4). The focus of feedback shifted from issues of local context and format on the first assignments (e. g., "signature missing;" "refer to instructor's letter" [local context]; "Double space;" "Look at spacing in text, I don't know if you're required to follow it" [format]) to issues of organization and evaluation on later assignments (e. g., "Might flow better if background were moved in front of purpose" [organization]; "Good problem statement, too long though" [evaluation]). This shift in focus to issues of organization reflects a growing student awareness of the readers' need to be "guided" through writ-

ten technical documents. The appearance of feedback in which students evaluate each other's work suggests the growing level of confidence and comfort in peer interaction. This growing level of comfort may be a result of students working together in feedback groups. Students get to know each other and each other's writing, which leads to more relevant and profound feedback, which could result in more substantial revisions.

The changes we observed in the focus of peer feedback differed from the results of the majority of previously published studies we are familiar with. Most of the studies demonstrated that students' comments focused mostly on spelling, punctuation, and sentence structure and did not focus on organization or provide evaluative commentary (e.g. Beason, 1993; Freedman, 1992; McGroarty and Zhu, 1997). In our study, students also commented on language issues in their feedback on all four assignments; however, they provided a significant amount of feedback that addressed a variety of other issues (Fig. 4). This difference may be an outcome of our pedagogical approach of teaching students how to use small groups to learn how to provide peer feedback and of practising this process with them (cf. Herrington & Cadman, 1991; Sargent, 1997). This difference may also be a result of providing reviewers with guidelines in the form of questions ("checklists") to help student reviewers to identify and address problematic areas in peers' writing.

In addition to the findings presented above, we discovered that the four students in the small feedback group we studied were developing their own strategies in providing feedback to each other. These strategies were developed in addition to those taught and practised in the classroom. One of the strategies developed and used by students was to provide an end commentary to summarize and clarify feedback written throughout the draft[8].

The following is an example of one such end commentary provided by one group member on a draft of the completion report, in which another group member evaluated materials that could be used as firewalls in cars:

> Your last 2 sections are confusing!! In 5 you say that aluminum and steel are good but then in 6 you say steel is the best. Maybe you should combine 5 & 6. I assume that you are saying which material is best in the conclusion. You might add a section on what

real firewalls in cars are made out of. I don't know if you have info on that, just a suggestion. Also make sure that with everything that you say you relate it back to your purpose. I found that in section 3 you were just listing off properties of metals, and not saying a lot on how those properties related to firewalls. Maybe at the first of section 3 you could list off what properties are needed in firewall material and then say how each metal meets or fails those needs. I hope this is helpful, thank you for editing my report!!

We believe that the development of the "end commentary" strategy on the part of the group is indicative of students adopting the role of intellectual teamwork facilitators for one another. As a result of their group work students seemed to develop a sense of responsibility to each other and for each other's writing and became better collaborators (cf. Sargent, 1997). They began to take responsibility for each other's writing product, thus realizing that writing is a social rather than individual endeavor, and developed a strategy that worked for them.

The results of our analysis of peer feedback in one feedback group over the term allowed us to conclude that the nature of students' feedback did change. The analysis also allowed us to see that students were taking their own initiative in developing feedback strategies. The fact that students began to evaluate peers' work and came up with their own feedback strategies as the term progressed indicated the growing levels of competence and confidence in peer interactions in feedback groups.

Conclusion

The purpose of this paper is to describe and discuss an effective pedagogical response to a problem of teaching domain-specific communication strategies in classes with high enrollment. High enrollment is of particular concern in communication courses, in which students need to continuously interact with each other and their instructors to acquire and improve communication strategies. The high student-to-instructor ratios make it necessary to develop a pedagogical approach that is conducive to effective collaboration among peers and, therefore, facilitates intellectual teamwork. The communication course for engineering students we discuss

in this paper has a student-to-instructor ratio that often reaches 130 to 1. The pedagogical approach developed in response to the course problems was to teach students how to write and use peer feedback effectively in order to improve their writing.

The two studies reported in this paper were undertaken as part of a longitudinal research project into the role and place of peer feedback in an engineering communication classroom. The Feedback Questionnaire Study was conducted to help us fine-tune our new pedagogical approach so that it met the needs of students. The Peer Feedback Study was conducted to assess whether the nature and quality of peer feedback, in the context of the new pedagogical approach, changed over the term.

The results of our study demonstrate that most students' perceptions of peer feedback changed significantly over the term. Our research also shows that the nature of peer feedback changed: for example, the focus of peer feedback shifted from issues of local context and format to organization and evaluation. The shift in focus to organization seems to demonstrate a growing student awareness of the readers' need to be guided through written technical documents. The appearance of feedback in which students evaluated each other's work reflected students' increased confidence as reviewers. In other words, the students felt more comfortable in their role as intellectual teamwork facilitators. As students worked in small peer feedback groups, they got to know each other and each other's writing, and their feedback became more profound and potentially more useful for revisions. This increased comfort level within feedback groups led to more collaboration and reliance on each other, which, in turn, led to less reliance on the instructor. The growing level of confidence in and comfort with the peer feedback process was reflected in students' changing perceptions of the process.

The results of our study demonstrated that our pedagogical approach was effective in helping students produce more sophisticated and relevant feedback. These results could be viewed as indicative of the beginning of understanding on the part of students that writing is truly a social intellectual pursuit.

When looking at feedback to assess the changes in its nature over a term and analyzing the second set of questionnaires to identify changes in students' concerns about peer

feedback, we became aware of problems related to the interpretation and use of peer feedback. In this research, we did not explore the effect of peer feedback on revision. In other words we did not analyze students' revisions made in response to peer feedback in order to learn if writers were interpreting and using feedback optimally. Further research is needed to understand how students interpret peer feedback and whether they use it optimally in revising their draft assignments.

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Endnotes

[1]The term *domain-specific communication* strategies encompasses communication strategies acquired and used both in a disciplinary classroom and in the workplace within one's profession.

[2]For a detailed discussion of the course, its philosophy and theoretical foundation, and description of assignments, see Artemeva, Logie & St. Martin (1999).

[3]In this paper, we present only a brief description of the engineering communication course we teach at a Canadian University. For a detailed discussion of the course, its philosophy and theoretical foundation, and the actual assignments, see Artemeva, Logie & St. Martin (1999).

[4] The longitudinal study was approved by the University ethics committee in 1998, and all participants gave informed consent.

[5] A formal letter, a proposal, a progress report, and a completion report.

[6]Only assignments supplied by those students from previous terms who gave a formal permission to use their work in our classes (with all personal identifying information substituted by fictional names) are used as samples.

[7]The computing service at the university automatically creates an electronic course newsgroup for each undergraduate and graduate course. The newsgroups are used in conjunction with common newsreader programs such as Netscape Newsreader or Outlook Express or with an internally set up university network (for a more detailed discussion of the use of electronic course newsgroups in the communication course, see Artemeva, Logie & St. Martin [1999] and Artemeva [2000]).

[8] It is important to note that the instructor who taught the four students in this study did not practise this strategy.

Acknowledgements

Appendix A
First Feedback Questionnaire

General Information:
The purposes of this questionnaire are 1) to obtain your thought on "feedback" and 2) to get you thinking about feedback. Please complete the questions below in the space provided.

Questions:
1. What do you think "feedback" is?

2. What do you see as the purpose of feedback?

3. Have you received oral or written feedback on school assignments?   Oral _____   Written _____

4. What do you like best – oral feedback or written feedback? Why?

5. Have you had any problems with written feedback on assignments? Explain.

6. Is peer feedback useful? Why? Why not?

7. How do you think feedback could be made more useful for students?

Appendix B
Second Feedback Questionnaire

General:
Now that you have been working in "feedback groups" for several weeks, please complete the following questionnaire.

Questionnaire:
1.   How do you feel about "prescribed" feedback groups? Please provide both positive and negative comments if possible.

2.   How do you use the feedback you receive from your peers?

3.   What do you see as the value of feedback? Please explain.

4.   Do you find feedback difficult to give? Why? Why not?

5.   Do you find feedback difficult to accept? Understand? Why? Why not?

6.   How has feedback influenced the way you write? Please explain.

Appendix C.
Assignment sheet for the assignment "Letter to Instructor."

School of Linguistics and Applied Language Studies
Carleton University
1125 Colonel By Drive
Ottawa, ON
Canada
K1S 5B6

September 24, 1998
Faculty of Engineering
Carleton University
1125 Colonel By Drive
Ottawa, ON
Canada
K1S 5B6
Dear Engineering Student:
Please inform me about the details of the Engineering course you have selected as the focus of your work in the communication course. I am specifically interested in the title of the course, course number, your professor's name, number of labs/problem analysis sessions (if there are any), course assignments, exams/tests, and any additional details you are able to present.

Since your response will be considered as a formal assignment, please follow one of the letter formats presented in class or in the textbook. After you have written the first draft of the letter in class, you will be asked to discuss it with your classmates and exchange comments. You will need to consider all the comments and revise your draft at home.

After the necessary number of revisions, edit the letter and submit it to me in the next class along with all the drafts and comments. Please do not exceed the required maximum number of words (125). This number does not include the sender's and receiver's addresses, date, salutation, complimentary close, signature block and end notations.

If there are any questions you would like to clarify, please do not hesitate to contact me at nartemev@ccs.carleton.ca or by calling 520-2600 ext. 7452.

Sincerely,

[instructor's signature]

Natasha Artemeva
23.100 Instructor