Canadian Journal of Learning and Technology

Volume 28(2) Spring / printemps, 2002

Describing and Enhancing Collaboration at the Computer

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Abstract

Computer-based learning materials differ from classroom practice in that they seldom explicitly offer opportunities for collaboration. Despite this, students do collaborate, helping one another through the content and affordances of computer materials. But, in doing so, students meet with challenges. Paradoxically, these challenges can either inspire or discourage learning and second-language acquisition. This paper, based on research with twenty Hong Kong university students in a controlled experiment, evaluates challenges to collaboration at the computer as evidenced by discourse. The students were videotaped and their discourse transcribed and evaluated both qualitatively and quantitatively, according to a set of discourse markers created to describe collaborative, non-collaborative and ambiguous strategies. The paper begins by exploring the differences between collaboration and similar terms such as teamwork and cooperative learning then goes on to define collaboration in the context of computer-assisted learning. It ends by presenting practical suggestions for software designers, teachers and students to enhance collaboration at the computer.

Résumé

Les matériels d'apprentissage par ordinateur diffèrent des pratiques dans les classes en ce qu'ils offrent rarement des occasions explicites de collaboration. Les étudiants collaborent malgré tout, en s'aidant les uns les autres pour ce qui est du contenu et de la mise à disposition des matériels informatiques. Ce faisant, les étudiants se retrouvent toutefois face à des défis. Paradoxalement, ces défis peuvent soit inspirer, soit

décourager l'apprentissage et l'acquisition d'une seconde langue. Cet article, fondé sur une recherche menée auprès de vingt étudiants universitaires de Hong-Kong dans le cadre d'une expérience contrôlée, évalue les défis posés à la collaboration à l'ordinateur tels qu'ils se manifestent par le discours. Les étudiants ont été enregistrés sur vidéocassette et leur discours transcrit et évalué à la fois quantitativement et qualitativement, par rapport à une série de marqueurs de discours créés afin de décrire des stratégies de collaboration, de non-collaboration ou ambiguës. L'article commence par l'exploration des différences entre le terme collaboration et des termes connexes, tels que travail d'équipe et apprentissage coopératif, puis définit le terme collaboration dans le contexte de l'apprentissage assisté par ordinateur. Enfin, des suggestions sont présentées à l'intention des concepteurs de logiciels, des enseignants et des étudiants pour améliorer la collaboration à l'ordinateur.

Defining Collaboration

Before examining collaboration in a Computer-Assisted Language Learning (CALL) environment, it is necessary to define collaboration more generally. Collaboration and related terms have been used to encompass a wide range of ideas about learners working together. This presents problems, as researchers cannot properly examine the outcomes of collaboration if the scope of the term is not agreed upon beforehand. In discussing collaborative learning, Dillenbourg (1999) suggests:

When a word becomes fashionable - as is the case with "collaboration" - it is often used abusively for more or less anything. The problem with such an over-general usage is two-fold. First, it is nonsense to talk about the cognitive effects ("learning") of "collaborative" situations if any situation can be labeled "collaborative". Second, it is difficult to articulate the contributions of various authors who use the same word very differently (p. 1).

Collaboration in the classroom begins with an activity that facilitates real communication; for example, verbal, written or electronic discussion in the course of solving a problem. But a true collaborative activity also requires that two or more learners engage in discourse over the decisions associated with a task, discussing what is most important, discussing the sequence of discrete problems within the task and deciding how to approach solving the problems within the task. Collaboration essentially puts learners into a semi-autonomous situation in which they are faced with a task, question or problem and must use discourse to negotiate each participant's separate learning strategies and make joint decisions about what is (and is not) worth investigating and learning.

But in many cases, collaboration is not a clearly defined phenomenon beyond a sense of two or more individuals working together. Several authors and researchers have defined collaboration in contrast to other terms, such as cooperation,while others have listed aspects of collaboration that help to define its parameters. The following excerpts from Nunan (1992), Derycke, Smith and Hemery (1995), Gould (1996), O'Neil (1994), and Jacobs (1998) provide examples of a range of concerns about collaboration.

Promoting Awareness and Skill Development

Nunan (1992) notes that collaboration encourages both learner awareness and skill development:

- to learn about learning, to learn better

- to increase their awareness about language, and about self, and hence about learning

- to develop, as a result, metacommunicative as well as communicative skills

- to confront, and come to terms with, the conflicts between individual needs and group needs, both in social, procedural terms as well as linguistic, content terms

- to realize that content and method are inextricably linked

- to recognize the decision making tasks themselves as genuine communicative activities. (p. 3)

Nunan's focus here is on promoting the benefits of collaboration, suggesting that it supports a communicative approach to learning.

Achieving Pedagogical Objectives

Derycke, Smith and Hemery (1995) offer a justification for the use of collaborative learning:

…some of the highest pedagogical objectives can only be achieved by employing group learning activities such as group problem solving, games, case studies and exchanges with real experts. In all of these activities and skills, language is explored, exercised and developed in ways supported by collaboration at the computer. (p. 182)

What they add to Nunan's justification of collaboration is the argument that a collaborative approach can take place at the computer.

Improving Literacy

Gould (1996) ascribes some of the same advantages to collaboration as raised by Nunan (1992) and Derycke, Smith and Hemery (1995), but focuses on literacy:

Social activities integrated into the language arts processes can actually lead to better writing, reading and spelling (Graves, 1993), for the talking, sharing and listening that occur pull down the challenges to communication and enhance the child's literacy growth.(Amarel, 1987, p. 93)

Gould, writing of young children in a native language situation, is more likely to be concerned with literacy, but there is no reason to believe that the same benefits are not also available to older native speakers and second-language learners.

Promoting Language Acquisition

O'Neil (1994) uses the term teamwork for what may also be defined as collaboration, and suggests that such skills involve the complex production of language. These include adaptability, recognizing problems and responding appropriately; coordination, organizing team activities to complete a task on time; decision making, using available information to make decisions; interpersonal, interacting cooperatively with other team members; leadership,providing direction for the team; and communication, encouraging the overall exchange of clear and accurate information.

These same points are mirrored in a list presented by Jacobs (1998), which summarizes some of the above by offering ten potential advantages of group activities in language instruction:

- The quantity of learner speech can increase

- The variety of speech acts can increase

- There can be more individualization of instruction

- Anxiety can be reduced

- Motivation can increase

- Enjoyment can increase

- Independence can increase

- Social integration can increase

- Students can learn how to work with others

- Learning can increase.

Several of Jacobs' points are identical to the advantages Hoogeveen (1995) ascribes to multimedia learning. This is perhaps because the computer naturally invites collaboration through its various affordances, including the public nature of the display or screen (versus the relatively

private

nature of the textbook and sheet of writing paper). This is noted by Cazden (1988) who suggests:

There may be several reasons why placing computers in classrooms seems to result in increased collaboration among peers. One reason is a permanent feature of the technology: work in progress on the screen is public in a way that paper on a desk is not. Other reasons may be more temporary. Most classrooms today have one computer at most, and that makes it a scarce resource whose use can be doubled by asking children to work at terminals in pairs. Expertise in the new technology is also a scarce resource, and student experts can supplement the limited availability of the teacher. (p. 148).

Cazden would seem to outline a paradox: a limited number of computers might in some cases be preferable to a class set, as more limited access is likely to promote collaborative learning. Collectively, the ideas and concerns of the above authors point to a broad range of benefits of collaboration. But for collaboration to be successful, it may require a structure, although that structure may be facilitated through a computer interface rather than being imposed by a teacher.

Structuring Collaboration

One debate within collaboration studies is the degree to which a teacher should structure collaborative activities and offer skills training. Hamm (1992) suggests that the teacher must structure collaboration on computers through:

- assigning students to mixed-ability teams

- establishing positive interdependence

- teaching cooperative social skills

- insuring individual accountability

- helping groups process information. (p. 95)

Hamm (1992) goes on to suggest that an aim of successful collaboration is to promote feelings that "no one is successful unless everyone is successful" (p. 96). He suggests that this may occur through:

• Goal interdependence - stating clearly what each member of the group should know how to do upon completion of the task

• Task interdependence - clearly defining the group goal, and what the team should agree on or be able to produce

• Resource interdependence - specifying parameters, materials, the team's task

• Role interdependence - reviewing the individual roles for the group members; keyboarder, checker, reporter, summarizer, encourager, and so on. Set up the expectation that all are responsible for explaining how they came up with the answer. Explain the grading procedures, group credit as well as credit for how well each student performs his or her group job. (p. 96)

However, in the context of CALL, many of Hamm's suggestions are better left to the computer. For example, Susman (1998) argues:

Software can be designed to give some interaction support features. CBIs (Computer-Based Instruction materials) can support 1) reflection, 2) exploration of multiple perspectives, and 3) the integrated use of multiple resources. These supports can be accomplished by a note-taking section or frame and providing links to a variety of media presentations and sources (e.g., links on the World Wide Web). Rysavy and Sales suggest pauses in the materials that direct group members to interact on their understanding. They also suggest that CBI could remind students to monitor their performance. Even though CBIs cannot assure a cooperative environment, CBIs can help stimulate group processing by encouraging the group to analyze their progress and by teaching them how to effectively communicate. (p. 317)

CALL programs should also provide ways to make motivation implicit instead of explicit. It is certainly true that some learners (especially younger ones) may need training in the skills necessary for working in a group, but many of the advantages of collaboration are lost if learners lose their autonomy and the task becomes too teacher-centered and teacher-directed, adopting a behaviorist model of instruction.

In particular, Hamm's assignment of individual roles for each learner discourages the collaborative advantages of a learning activity. Learners are likely to be more concerned with fulfilling their individual roles and tasks rather than the overall process of socially engaging in a process of problem-solving through negotiation of meaning. Dillenbourg (1999) discusses the impact of forcing roles upon learners:

Negotiation can occur only if there is space for negotiation (Dillenbourg, Baker, Blaye & O'Malley, 1996), i.e. if something can actually be negotiated. Negotiation at the meta-communicative level can be inhibited by forcing partners to play well-defined roles (a growing trend in research in collaborative learning). (p. 15)

Dillenbourg (1999) expands on this by suggesting that trivial tasks similarly inhibit collaboration or deny the benefits of collaboration:

Negotiation at the task level can be inhibited in trivial tasks, in which there is nothing to disagree upon, and in which there is nothing to misunderstand. The boundary between misunderstanding and disagreement is shallow. If we do not understand each other, we cannot say that we properly agreed. (p.15)

In any case, from the point of the view of learners engaged in a learning task, a conversation is often about creating roles for each person. Richards and Schmidt (1983) explain:

Conversation is more than merely the exchange of information. When people take part in conversation, they bring to the conversational process shared assumptions and expectations about what conversation is, how conversation develops, and the sort of contribution they are each expected to make. (pp. 119-120)

If a teacher proceeds to make these assumptions and raises the corresponding expectations of roles for learners, the learners are deprived of the opportunities to develop appropriate conversational and negotiation skills. By extension, they may also be denied the attendant opportunities for language acquisition. The above concerns and ideas serve to explain features, parameters and advantages of collaborative activities, but none provide a definition or show the difference between collaboration , cooperation and other terms, such as teamwork .

Differences Between Collaboration and Other Terms

The difference between collaborative learning and cooperative learning is not well defined and both have many shades of meaning. Biggs and Moore (1993), for example, suggest cooperative learning is an activity set by the teacher while collaborative activities are ones spontaneously set up by the learners.Kohonen (1992) uses cooperative and collaborative interchangeably. Nunan (1992) defines collaboration as an activity in which learners have greater control over the design of their learning while he considers cooperative learning as merely a mode of instruction. Other authors, such as O'Neil (1994) avoid the use of cooperation or collaboration and use the term teamwork .

Dillenbourg, Baker, Blaye & O'Malley (1996) provide perhaps the clearest functional difference between cooperation and collaboration:

Cooperation and collaboration do not differ in terms of whether or not the task is distributed, but by virtue of the way in which it is divided; in cooperation the task is split (hierarchically) into independent subtasks; in collaboration cognitive processes may be (heterarchically) divided into intertwined layers. In cooperation, coordination is only required when assembling partial results, while collaboration is...a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem. (p. 189)

This difference between collaboration and cooperation is made plain in Hamm's earlier suggestion for teacher-imposed division of roles among learners in a group engaged in a common task. Such an imposed division places Hamm's suggestions within the definition of cooperation. This paper's definition of collaboration is based on what Dillenbourg, Baker, Blaye & O'Malley (1996) consider to be collaborative practices and situations, regardless of the terms used by other authors in describing pair or group learning. However, various authors' quoted texts retain their original choice of terms.

The Range of Collaboration and Call

CALL programs, or other computer programs that can be used to encourage language learning[1] , often address several of the cooperative, teamwork or collaborative skills mentioned above by various researchers. Adaptability(recognizing problems and responding appropriately) is found in various software programs that present learning as a quest. This is particularly appropriate in materials developed for younger learners in which a series of correct answers move one along a map or serve to save a creature in danger. This requires coordination and decision-making and interpersonal and communication skills. Such activities often work best with group members of different language and cultural backgrounds, such as in a mixed ESL classroom where English (however limited) is the only common language. In such situations, collaborative interpersonal skills such as consensus and queuing must be negotiated as well as the target content. However, the focus of the investigation in this paper is a different but commonly observed collaborative phenomenon: oral/aural collaborative language use among pairs or small groups of learners working at a single computer to complete a task or a series of tasks.

Some teachers worry that working at a computer can be a socially isolating experience for learners. However, as Crook (1994) states: "Yet when we examine actual classroom practice we find that, in certain significant respects, the computer has facilitated socially organized learning rather than inhibited it" (p. 121). A commonly observed collaborative phenomenon is pairs or small groups of learners working on their own outside of a class at a single computer to complete a task or a series of tasks. This type of collaboration is sometimes teacher-initiated but is more often learner-initiated. In some cases, such collaboration is a prelude to broader international communication or collaboration through email.

In collaborating, learners sometimes work together at one computer because of limited access to enough computers. But my own observations over the past eight years of learner use of computers in computer centers, computer lab areas and design studios[2] suggest learners commonly and naturally work together at the computer, despite an abundance of computers that would allow them to work individually. Argyle (1991) suggests three possible reasons, or motivations, for people to collaborate:

- For external rewards

- In order to form and further relationships

- In order to share activities they are involved in. (cited in McConnell, 1994, p. 13)

Argyle's external rewards suggest collaboration simply for extrinsically motivated reasons such as classroom marks. But Argyle's second and third reasons suggest more intrinsic motivations. These include the desire to offer assistance where one learner of the pair has already completed an assignment, to help with problems tangential to the assignments such as the operation of unfamiliar hardware/software or, less nobly, to simply plagiarize assignments.

Collaboration at the Computer as Evidenced by Discourse: An Investigation

In an investigation of collaboration at the computer (Beatty 2001), twenty subjects were asked to answer seven questions using the resources of a CD-ROM developed around the novel Frankenstein by Mary Shelley. The subjects were second-year students at City University of Hong Kong, who had a general level of computer literacy and keyboard skills, but were unfamiliar with the Frankenstein story. The students were paid HK$100 (about CAN$20) each and arranged themselves randomly in pairs on a sign-up sheet. Each pair was given an hour to answer the seven questions.

The seven questions (see Appendix 1) were intended to encourage both discourse and exploration of the learning materials on the CD-ROM, which included the annotated novel, source materials for the novel, art, poetry and video organized into 1,042 linked pages. Part of the research was to determine whether interface was a significant influence on collaboration. To this end, two interfaces were created. The interface designs followed ideas presented by Jonassen, Wilson, Wang, and Grabinger (1993) whose ideas are summarized in the following table:

Table 1. A summary of behaviorist and constructivist approaches to learning materials (after Jonassen, Wilson, Wang, and Grabinger 1993).

A behaviorist design…	A constructivist design…
• Eliminates extraneous information	• Supports natural complexity and content
• Simplifies for comprehensibility	• Avoids oversimplification
• Uses a convergent, task-analyzed model as a basis	• Presents multiple representations/perspectives
• Reconstructs/replicates knowledge	• Engages knowledge construction
• Abstracts instructional experiences	• Presents instruction in real-world contexts (authentic tasks)
• Focuses on acquiring skills	• Engages reflective practice
• Offers prescriptive sequences of instruction	• Offers open learning environments
• Supports individual learning and competition	• Supports collaboration

One interface featured a behaviorist model of instruction in which the questions and hints were easily accessible and plainly stated. The second interface used a game-like constructivist model in which the same seven questions and hints were organized into a game set in a surrealistic graveyard, complete with interactive graphical elements and sound effects, for example for fire and an atomic explosion. In keeping with the game metaphor in which points are lost when one requires extra resources, a variety of different screams were heard as a gentle punishment for clicking on the help and hints. Most of the hints were arranged as apples on a tree growing from a skeleton. Some apples were empty, without hints. Other hints were obtained by clicking items that identified themselves as interactive as one passed the mouse cursor over them. To increase the subjects' perception of the need for self-reliance, the warning "Every time you take an apple, you lose a bone" was added, although no actual score keeping was done.

Figure 1. The penultimate page of the constructivist interface.

Five of the pairs worked on the behaviorist interface while the other five worked on the constructivist interface. While the students worked, their keystrokes were recorded through the use of Lotus ScreenCam , which allowed for a replay of each one-hour session indicating exactly where the students had gone in exploring the interfaces and also successive revisions to their answers to the seven questions.

To collect the discourse, the subjects were also videotaped. The ten hours of videotape were transcribed indicating both what was said as well as paralinguistic actions, such as pointing at the screen. Analyzing the discourse involved transcription notations - writing out the utterances and describing the paralinguistic acts - and interpretive notations, deciding the motivations, or strategies, behind the utterances. The strategies, listed below, were developed after consideration of a set of strategies by Kumpulainen and Wray (1996). These are strategies learners use to engage in collaboration, strategies learners use to engage in or avoid collaboration and ambiguous strategies which may work either way, depending on the context or the respective attitudes of the speakers.

Ambiguous strategies are the most problematical in terms of strategy identification as both their intentions and effects may differ in any situation. For example, a learner might employ humor to dispel tension, but his or her interlocutor might perceive it either as an attempt to avoid the task or to engage in lateral thinking. The reverse might just as easily be true.

Strategies used to engage in collaboration:

• Determine participants' expertise: Determining expertise is classified as a collaborative strategy because it helps to clarify what each partner knows or does not know about a task. Learners who start off by determining expertise are better able to collaborate because they are better positioned to evaluate what they and the other person knows.

• Explain the text/task/ideas: Explaining the text, the task and the ideas in a collaborative situation helps provide opportunities for negotiation of meaning and create a common understanding. If learners in a collaborative situation do not arrive at a common understanding of the text, the task and the ideas behind what they are studying, they are likely to work at cross-purposes.

• Offer suggestions: Offering suggestions is often marked by the phrase . think. A suggestion differs from a judgment in that the former offers a qualification and invites comment, while a judgment is presented as a final word on a subject.

• Direct attention: Directing attention to text or images on the computer screen or to something else such as the keyboard or mouse is classified as a collaborative strategy because it is a strategy that tries to involve one's partner in some aspect of the program.

• Solicit suggestions/support: Soliciting suggestions and support are collaborative actions because they directly ask one's partner's involvement.

• Solicit clarification: Soliciting clarification occurs when one learner asks the other for more information on a statement. It is a collaborative strategy essential to joint negotiation of meaning.

• Signal interest in/show support of another's ideas: Signaling interest or showing support of another's ideas are collaborative strategies that allow the learners to indicate a common direction in what they are doing or discussing.

• Solicit support for or suggest actions : Soliciting support for or suggesting actions most often occur when one learner is navigating or about to navigate in the program. Soliciting support is typically marked

• by phrases such as, should we…, shall I… and so on and is collaborative because it gives the partner a chance to discuss the working process.

Social strategies learners use to avoid collaboration:

• Ignore the text/task: Ignoring the test or a task is a strategy used to avoid collaboration because it often marks a learner's preference for pursuing individualistic or competitive goals. In some cases, the task may be too difficult for the learner, but not to even try to solicit suggestions signals a failure to take advantage of the collaborative partner's skills and makes ignoring the task a sign of avoiding collaboration.

• Interrupt: Interrupting is a strategy that avoids collaboration because it signals that one learner does not value what the other learner wants to say. In some cases, interrupting may be seen as a supportive strategy if, for example, one interrupts to supply information one is struggling to recall or formulate, but such interruptions are usually signaled by a pause in the speech by the other speaker. In this investigation, such interruptions were classified as offering suggestions.

• Ignore ideas: Ignoring ideas signals that one learner does not value what the other learner wants to say and does not care to discuss it. An idea might be a suggested answer or a suggested action, such as directing attention to something on-screen.

• Offer judgments: Judgments are statements without qualifying phrases such as . think…. Sometimes a judgment is presented as a learner's simple statement of a fact, but it is often a strategy that avoids collaboration because judgments to not invite the collaborative partner to present opinions or negotiate

meaning.

Ambiguous strategies in collaboration:

• Offer humor: In addition to the above methods of engaging in and avoiding collaboration are the sometimes negative and sometimes positive aspects of humor. Humor can be used negatively as an avoidance strategy or positively as a way of soliciting lateral thinking, smoothing social relations and dispelling tension.

• Read aloud: Reading aloud may be a neutral strategy for holding space in the conversation while one learner reads what is on the screen or it may be a collaborative strategy for dictating or keeping the partner informed. As it is difficult to assess the first learner's intention and the second learner's perception, reading aloud is classified as an ambiguous strategy.

A Sample Episode from the Investigation

Learners are sometimes preoccupied with factors that have little or nothing to do with the task. These can include concerns about completing the task as a priority over completing it properly or successfully. In some cases, an unwillingness to enter into a task may be related to feelings of insecurity over one's expertise. The following episode is representative of the session involving Dominic, a generally conscientious and hard-working learner, and Eunice, an academically successful and intelligent learner but one who, nonetheless, balks at completing the tasks in the session. They are using the constructivist interface.

This episode begins with Dominic taking the lead through the program. He is at the keyboard and in control of the mouse. He and Eunice are looking at the Other Texts section, which features a review of Percy Shelley's review of Frankenstein.

Episode one

283a. Dominic: This is Perry (sic) Shelley's review of Frankenstein. And maybe it will tell us something [about]	DX (direct attention), ET (explain the text/task/ideas)
284. Eunice:((reading)) [Paradise lost].	IR (interrupt), II (ignore ideas) / RA (read aloud)
285. Dominic: ((reading)) ((inaudible)) …fall from grace. So it has something to do with the Bible, I think.	RA (read aloud), OS (offer suggestions)
286. Eunice:It makes me even more puzzled.	II (ignore ideas)
287. Dominic:Yes.	SI (signal interest)
288. Eunice: Uh..	–
289. Dominic: Let's take a look at Mary Shelley's Frankenstein. Oh. Sorry. Percy Shelley's Frankenstein ((reading the summary))… in wonder as we read it…	SA (solicit support for or suggest actions), RA (read aloud)
290. Eunice: ((laughs)) ((inaudible)) … isn't fun.	OH (offer humor), IT (Ignore the text/task)
291. Dominic: Yeah.	SI (signal interest)
292. Eunice: I have no interest in reading this.	IT (Ignore the text/task)
293. Dominic: Yes. But this is supposed to have something to do with	SI (signal interest), ET (explain the text/task/ideas)
294. Eunice: ((reading with sarcasm)) The elementary feelings of the human mind are exposed to will and those who are accustomed to reading will be the only person who can sympathize with	IT (Ignore the text/task)
295. Dominic: Interested in this…	DX (direct attention)
296. Eunice: This kind of comment is written in the way that human…	IT (Ignore the text/task)

297. Dominic: Can you page down…	SA (solicit support for or suggest actions)
298. Eunice: As difficult as possible as so much difficult words will make you feel puzzled.	IT (Ignore the text/task)
299. Dominic: Yeah ((reading)) who will not ((inaudible)) means.	SI (signal interest), RA
300. Eunice: I can find one or two or three new vocabularies in one line and this is not supposed to read by students like me. I no patient in reading it anymore. Shall we go back?	IT (Ignore the text/task), IT (Ignore the text/task), SA (solicit support for or suggest actions)
301. Dominic: But here, in the comment ((reading)) treat a person ill and he will become wicked. You know, like treat a person bad and he will become a bad person	DX (direct attention), RA (read aloud), OS (offer suggestions)
302. Eunice: ((reading)) required…. This is some kind of philos-, philosophy writing	IT (Ignore the text/task),
303. Dominic: Yeah. And I think that what Mary Shelley did change about the world is probably down, down there. ((reading in-audible murmuring)) He was an abortion and an anomaly and though his mind was such as its first impressions framed it, affectionate and full of moral sensibility… So probably initially Frankenstein was a good person. ((reading)) He had in the circumstances of his existence a that were so monstrous and uncommon that when blah blah blah. So then he become evil. Become bad. ((reading)) The… can we go further down. ((reading)) Instance… further down. Can we go down? Indeed. Mm. ((reading)) Can we go down ((pause)) ((reading)) We should ((pause)) Maybe sometime I'll read Frankenstein. Interesting.	SI (signal interest), OS (offer suggestions), RA (read aloud), OS (offer suggestions), RA (read aloud), OS (offer suggestions), RA (read aloud), SA (solicit support for or suggest actions), SI (signal interest), SA (solicit support for or suggest actions), RA (read aloud), IT (Ignore the text/task)
304. Eunice: I'm, I'm not interested. I'm not interested at all	II (ignore ideas), IT (Ignore the text/task)
305. Dominic: Can we answer the game now? Do we have enough information?	SA (solicit support for or suggest actions), SC (solicit clarification)
306. Eunice: Of course not.	OJ (offer judgment)

Eunice appears unwilling to enter into the questions and instead looks for ways of attacking the text and avoiding participation to the point of rudeness. She repeatedly expresses her puzzlement (lines 286, 298) and uses a sarcastic tone of voice (line 294) to register her contempt and boredom. Her statements in line 304, "I'm, I'm not interested. I'm not interested at all." leave no doubt as to her attitude.

This behavior seems somewhat feigned and was perhaps for the purpose of impressing Dominic with her rebellious attitude, but is also surprising, considering that she was aware (as were all subjects) that she was being paid HK$100 for participating in the one hour session. Eunice's conduct suggests that while the quasi-experiment might not have been a totally authentic task, it was at least authentic enough to make Eunice forget herself and relax into a natural behavior.

Eunice's attempts to denigrate the task (lines 286, 290, 292, 294, 296, 298, 300, 302) in the above episode are largely (and diplomatically) ignored by Dominic who takes the lead in addressing the questions and patiently working through the materials. Throughout, Dominic attempts to share what he has seen and understood (lines 283a, 285, 293, 301, 303).

Seaton (1993) writes "...knowledge emerges from a collaborative process of active dialogue among those who seek to know" (p. 51). However, the above episode is clearly a situation where despite the assignment of a task in which learners are encouraged to collaborate, one subject (i.e., Eunice) simply does not seek to know. Although Eunice exhibits moments of collaborative behavior, she generally maintains her bored and contemptuous attitude throughout the session.

In discussing guidelines for determining the locus of instructional control in CAI, Hannafin (1984) suggests older students perform more effectively under guided learner control while younger students perform best under lesson control. He goes on to say that more able students perform best under learner control while less able students perform best under lesson control. But the above episode raises the question of what happens when students of varying abilities are put together to work in a collaborative environment. Does the more motivated learner encourage or discourage or the less motivated one? Does the better learner encourage or discourage the poorer learner? In fact, both subjects in this session are good learners; it is simply that one of the subjects chooses to not be interested in the program and tasks.

In the case of the above episode with Dominic and Eunice, it may be that Eunice's negative attitude over self-perception of not being up to the task (especially seen in line 300) and poor motivation bring out better-than-usual behaviors in Dominic as he adopts, in the face of confrontation, a sympathetic, teacher-like nurturing role and explaining the question (ET) as seen in Lines 283a, 293 and offering a suggestion (OS) in line 301.

This supports the idea put forward that challenges to collaboration may promote different behaviors in different subjects. In another pairing, Eunice's negative attitude might have discouraged her collaborative partner to the extent that he or she might have become similarly demotivated. But in this case, Dominic rises to the challenge. Line 300 also suggests a missed opportunity for scaffolded learning and negotiation of meaning. Eunice identifies her inability to understand "three new vocabularies". Had Dominic challenged her on them, they might well have been able to work out the meanings from context.

Wegerif and Dawes (1998) suggest that a mixture of cooperation and conflict is the best way to promote interaction and note that such discourse is likely to include criticism, explanation, justification, clarification and elaboration. Implicitly, these are all ways in which one learner acknowledges the ideas or presence of another learner. However, as seen in the above episode, criticisms may be hostile and without any attempt to offer another idea or support. Such criticism is negative in that it deters participation. Wegerif and Dawes' other categories (explanations, justifications, clarifications and elaborations), are basically ways of engaging in collaboration by following McConnell's (1994) hypothesis that collaborative learning serves to make public those parts of our learning which are blind, hidden and unconscious. Therefore, other challenges are built on an unwillingness to offer explanations, justifications, clarifications and elaborations.

Based on the ideas elaborated above, four social challenges to discourse can be summarized as:

• an unwillingness to engage in the activity;

• an unwillingness to accept the collaborative nature of the activity (i.e. pursuing individual or competitive goals);

• an unwillingness to offer suggestions or explanations;

• an unwillingness to offer or accept justifications, clarifications, elaborations, criticism (i.e. groupthink) with supporting evidence or alternatives.

In addition to these social challenges, additional challenges can be summarized as:

- the complexity of the program's content;
- the navigability of the program's interface;
- the difficulty of program's model of instruction.

A examination of collaborative, non-collaborative and ambiguous strategies in terms of their frequency of use by students using the two interfaces (Beatty 2001) led to the creation of a model (see Appendix 2), focusing on challenges to collaboration with respect to behaviorist and constructivist interfaces.But although the strategies are useful for examining discourse at the computer, the findings of the investigation were inconclusive because, as discussed above, learners may treat various challenges in different ways; rising to them, or being discouraged by them. A consideration of the strategies and challenges leads to pedagogical implications for software development and classroom practice reflecting on what might be done to make collaboration at the computer more effective.

Pedagogical Implications for Software Development

Pedagogical implications for software development arise from perceptions of the technology in which learners need to navigate the interface, share control, use resources and address affordances. Affordances are the visual clues a software program gives to its use as well as what it is capable of doing in terms of both intended and unintended functions. An object can have both affordances and misaffordances. A misaffordance is something that distracts from an object's intended use, such as a software program's flashing words or pictures that distract from the purpose of reading. The design of computer-based learning materials has largely been taken out of the hands of educators. Instead, the costs involved in the creation of interactive educational software means that it is often designed on the basis of what engineers decide is possible and what marketing executives decide can be sold.

Affordances should be made clear: what a program can do and can offer a learner should be made clear to that learner through such devices as maps of the resources, clear menus of options, help buttons and easy navigation options. All affordances should be considered in order to minimize those misaffordances that simply distract the learner. In this investigation, subjects often seemed unaware of or unconcerned with of some of the resources that would have helped them complete the questions. A better software program could perhaps be more active in advertising its resources through timed prompts (i.e., prompts that appear after a certain time of keyboard and mouse inactivity) such as, Click here to go to a resource that might help you answer this/find out more about this topic.

Traditional materials tend to follow a set scope and sequence that lay down the paths and principles of learning and this is the general route followed by many learning materials that are, in some cases, adaptations of existing textbooks. However, a strength _ and sometimes a weakness _ of some computer-based materials is their lack of a clearly determined scope and sequence. Instead, they allow individual learners to pursue links that they perceive as being both useful and interesting. This ability to choose a path of learning means that a group of learners are not all constrained to learn the same materials in the same way, but may instead find new answers and solutions to questions and problems. A common example of this method of learning is a teacher-assigned task that asks learners to use resources on the World Wide Web (WWW). The WWW now consists of billions of individual pages that learners can enter using search engines and links. But learners using the WWW who lack clear direction can often become muddled, distracted and lost in the sea of information.

The same is true in some computer-based constructivist learning materials that present a wide range of resources, as did the learning materials for this investigation, Frankenstein Illuminated . For such materials to work, learners may need more guidance in the form of on-screen help that appears not just when asked, but when the learner appears to be stalled.

In terms of sharing control of the technology, a good interface would be one that prompted learners to share control. This is often done in game software that requires two or more users to register their names. These names can be used as prompts for computer-directed actions and turn taking. In an educational program, having learners' register would present opportunities for personalized prompts as simple as: (X student) has given this answer. (Y student) do you agree?

The above pedagogical implications for software development mostly concern perceptions of the technology, but the other three general perceptions of the learners, collaboration and priorities could also be addressed in similar fashion by including prompts that asked students about themselves, how they intended to approach the problems before them, and what priorities they had decided upon.

If a computer-based learning environment were to make use of the points outlined above, in particular the use of questions and prompts, a high degree of learner-centredness would be possible while, at the same time, guiding learners into good collaborative and learning practices. If nothing else, these suggestions warrant further research.

Pedagogical Implications for Classroom Practice

The pedagogical implications of this investigation for classroom practice are now considered, with particular concern for the teaching of language in collaborative contexts at the computer. Several teaching functions are now assumed by software learning packages. The degree to which they are effective depends upon the environment set aside for collaboration at the computer, the model of instruction for the software, learning, and working styles.

Continuing changes in computer hardware and software, different definitions of learning styles and broad definitions of what constitutes CALL, means that adapting software to different learning styles also needs to proceed along general lines. These general lines are phrased as recommendations and listed below.

Determining a Software Program's Model of Instruction

The subjects in this investigation were not aware of the model of instruction, nor would the names have made sense to them. However, from the point of view of the classroom teacher, knowing the model of instruction can help moderate his/her own and the learners' expectations of the type and organization of the tasks.

The model of learning featured in a particular CALL software package is seldom stated, and software packages sold as so-called learning games are often simply highly behaviorist tutorials. If CALL software packages are to be properly evaluated and matched with learning needs, they need to be classified by teachers. One way for teachers to do so is by collecting reviews of software from professional publications.

Another, more personalized, way to classify materials is through the creation of in-house reviews, similar to book reviews, which outline key aspects of the program. For example, one might evaluate where a program fits

into Chandler's (1984) Locus of Control(describing user vs. computer control of the interactions) and suggest how and why a learner might use particular software. In a school setting, these reviews might include the reviewer's name so that users might gauge the reviewer's opinion. In a classroom or self-access learning center, these reviews should be posted or otherwise made easily available. In these tasks, the teacher should take the role of the editor, having her learners engage in critical thinking about the learning materials they are using. This is a particularly important process to undertake when evaluating materials which claim to offer collaborative opportunities, but which simply offer shallow cooperative activities in which learners do not need to negotiate the meaning, the task or the process of finding answers.

Determining Individual Learning and Working Styles

One of the questions raised in this investigation was whether personality was a principal influence in determining the degree of collaboration. Personality can be divided into several areas such as learning style(s) but defining learners' learning styles can be difficult, time consuming and non-transferable across disciplines. For example, a learner who excels in the rote memorization of baseball statistics may not transfer such skills to mathematics or learning vocabulary. Nor may the skills be appropriate to all subjects and situations, such as the learning of creative writing or emergency procedures.

There is also the question of whether a learner's preferred learning style is the most appropriate for learning. Some learners may say they prefer learning passively through a lecture, but may actually learn better through a simulation. One way in which teachers unconsciously define learning styles is through publication of review phrases such as if you enjoyed this, you may like this. Learners should examine how they learn best, but they should also consider whether their present learning style is efficient and, if not, where it is in need of improvement.

In terms of facilitating collaboration at the computer, it appears that some subjects in this investigation's quasi-experiment were good at determining the collaborative process, others were not so good, and some simply failed to determine the working process altogether. There are arguments for and against strategies training. In some cases, it may be that defining the collaborative process down to the level of assigning roles for each learner defeated the benefits of collaboration _ the opportunities for negotiation of meaning.

However, it is apparent from this investigation that some degree of strategies training about the collaborative process could be useful both for learners and teachers. Such strategies training might include methods for addressing the individual perceptions. For example, strategies to help learners begin a task by explaining what they already know or do not know about the problem (determining the expertise) and deciding what they want to accomplish (determining goals and priorities).

Software Objectives

Explaining what skills each software package attempts to improve is an important task for teachers and learners. Dunkel (1991) asks teachers to consider which kinds of CALL lessons augment development of particular L2 skills such as reading and listening comprehension, oral proficiency, and knowledge of grammar. One way to do this on a more individual level is for teachers to brainstorm with learners what they think they need to learn in terms of language. This serves as a starting point for deciding the categories and sub-categories in which they may wish to have CALL interaction, and it can be used to make decisions on what kinds of

CALL software programs to include in a classroom as well as to create learner contracts for learning. An initial level of categories includes basic skills of reading, writing, speaking and listening as well as the more general category of computer literacy. Sub-categories might include micro-skills and vocabulary related to local and individual needs.

Language teachers generally aim to increase learner-centredness, or locus of control toward the user, in activities in which learners are involved in the curriculum and teaching/learning decision-making process. Posting a schemata or mental map of a learners' needs along with notes on the software packages that match each need is a good way to allow learners to organize their own learning. This can involve learners in the process, and make them more responsible for their learning, and, in doing so, increase intrinsic motivation.

Making Better Use of Existing Materials

In order for learners to learn, they need to reflect upon their learning in discussion with teachers and peers, in diaries and in reports. In this way, learners begin to examine learning materials and their strategies for approaching them, thus benefiting even when a CALL program does not meet their learning needs. When a CALL program is not suitable, learners and teachers might need to examine ways in which it can be adapted. In some cases, this might involve a learner drawing up a set of questions that will guide another user on how to use the program. The same is true of another possible activity, adding layers of tasks to materials to make them more challenging or more appropriate. For example, learners might create a treasure hunt for key words and concepts within an encyclopedia software program.

Conclusion

Research into computer-based collaboration has mostly focused on individual learners using computers to collaborate over distance with other learners. However, collaboration among pairs or small groups of learners working at a single computer is perhaps a more common phenomenon in the classroom, and is one worthy of further study. This paper aimed to present tools to aid in that study: discourse markers for describing collaborative, non-collaborative and ambiguous strategies as well as practical suggestions for software designers, teachers, and students to enhance collaboration at the computer.

Acknowledgements

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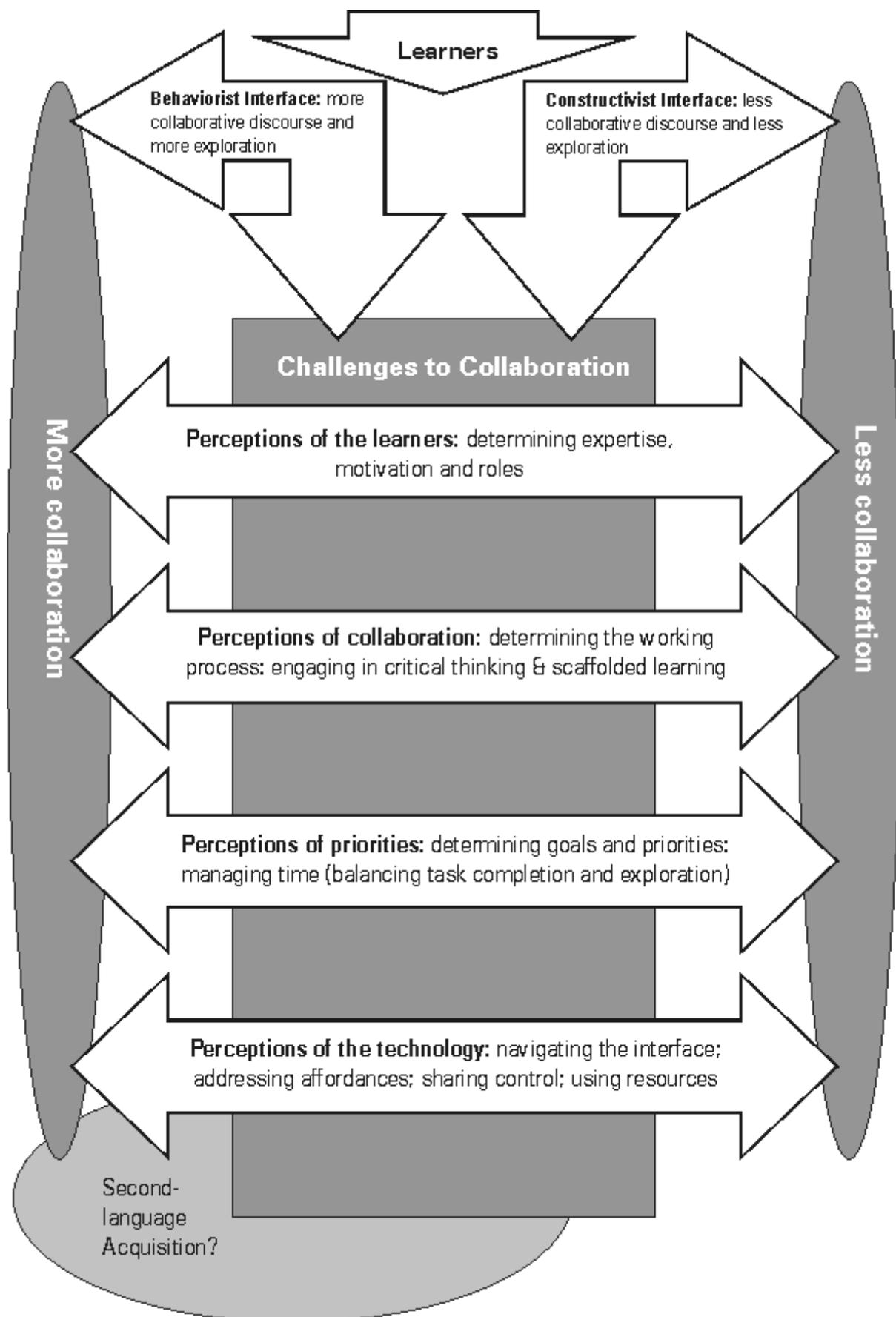
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Appendix 1: Seven Questions

Question 1. What was remarkable about Mary Shelley? Question 2. When Mary Shelley was born, her mother, Mary Wollstonecraft, contracted a form of blood poisoning and died ten days later. Shortly before Mary Shelley began writing Frankenstein , she gave birth to a daughter but the child died before being given a name. Around this same time, her half-sister Fanny Imlay and Percy Shelley's wife Harriet, (whom Mary and Percy had run away from), committed suicide. What is the relationship between these deaths and deaths in the novel? Question 3. When Mary Shelley was a child, the poet S. T. Coleridge came to visit her father William Godwin. Coleridge read his poem Rime of the Ancient Mariner to them. The poem influenced Frankenstein and part of the poem is included in the novel. How and why? Question 4. A metaphor is a comparison between two things. Look at the Art section. There are several portraits of Jacques Chirac. This is because at the time of the Frankenstein Mail Art exhibition, Chirac was the French leader when the French were experimenting with nuclear devices in the South Pacific. Is it fair to compare Chirac with Victor Frankenstein? Question 5. What final message would you write on Victor Frankenstein's gravestone that would summarize his life? Question 6. What final message would you write on the Creature's gravestone that would summarize his life? Question 7. Who is worse? Victor Frankenstein or the Creature he created? Why? Appendix 2.

A

model of collaboration at the computer

Learners

Behaviorist Interface: more collaborative discourse and more exploration

Constructivist Interface: less collaborative discourse and less exploration

More collaboration

Less collaboration

Challenges to Collaboration

Perceptions of the learners: determining expertise, motivation and roles

Perceptions of collaboration: determining the working process: engaging in critical thinking & scaffolded learning

Perceptions of priorities: determining goals and priorities: managing time (balancing task completion and exploration)

Perceptions of the technology: navigating the interface; addressing affordances; sharing control; using resources

Second-language Acquisition?

Endnotes

1. Many of the Sim games (Sim City etc.), for example, are not intended for language learning, but are ideal for that purpose.

2. For the past nine years, the author has taught university level desktop publishing, web design and computer-based English for Special Purposes courses.

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