

The Effect of Peer Collaboration and Collaborative Learning on Self-Efficacy and Persistence in a Learner-Paced Continuous Intake Model

Bruno Poellhuber, Martine Chomienne, and Thierry Karsenti

Abstract

In an attempt to find ways to improve persistence rates in its distance courses, the Cegep@distance introduced different forms of collaboration (peer interaction and collaborative learning activities) in selected courses. A mixed methodology was used to understand the effects of these interventions, relying on a quasi-experimental design for the evaluation of the effects of peer interaction. The objective of the study was to understand the impact of peer interaction and collaborative learning on student self-efficacy beliefs and persistence in a distance education context. The level of peer contacts remained very low. Persistence rates were in favour of the control group, but confounding variables were found related to academic background. A qualitative analysis of the interviews in the collaborative learning activities group showed that the learners related the course materials and tutoring to their motivation (self-efficacy and interest) and that some of them evaluated peer interaction positively.

Résumé

Pour tenter d'améliorer les taux de persévérance dans les cours à distance, le Cegep@distance a mis en place différentes formes de collaboration (activités d'interaction entre pairs et d'apprentissage collaboratif) dans certains cours. Une méthodologie mixte a été utilisée pour comprendre les effets de ces interventions, se fiant notamment à un design quasi-expérimental pour évaluer les effets des interactions entre pairs. L'objectif de l'étude était de comprendre l'impact des interactions entre pairs et de l'apprentissage collaboratif sur le sentiment d'auto-efficacité des étudiants et sur leur persévérance dans un contexte d'éducation à distance. Les taux de persévérance ont été plus élevés pour le groupe témoin, mais des variables confondantes ont été trouvées en lien avec les antécédents scolaires. Une analyse qualitative des entrevues dans la condition activités d'apprentissage collaboratives a montré que les apprenants reliaient le matériel de cours et l'encadrement à leur motivation (sentiment d'auto-efficacité et intérêt) et que certains d'entre eux évaluaient positivement les interactions entre pairs.

Introduction

The drop-out rate has long been a concern in distance education and it remains problematic in the context of open and distance learning. This study intends to evaluate and understand the effects of different forms of collaboration on self-efficacy and persistence in the context of learner-paced distance courses.

Context

Distance education has long been associated with high drop-out rates. In fact, this problem is the biggest drawback facing this form of education. Distance education drop-out rates reportedly vary between 30% and 68% (Pithers & Twyford, 2000), much higher than that observed in traditional classroom settings. Recently, Quebec's educational legislation was changed to enhance institutional accountability for student achievement. As part of a global movement towards improving the performance of Quebec's education system, the changes renewed interest in looking for ways to lower drop-out rates in distance education settings. The Cegep@distance is a type of junior college, unique to the province of Quebec, which corresponds roughly to grades 12 and 13 in the rest of Canada and in some other countries such as USA. It is the largest junior-college distance education institution in Quebec (Canada), offering postsecondary distance courses to Quebec students. At the Cegep@distance, many students definitely face achievement problems that cause them to drop out. In 2004, for all distance courses taken at the Cegep@distance, the drop out rate rate was 33 %, within the range cited by Pithers & Twiford (2000). Drop out in distance education courses is not only an issue in Quebec, but one that distance educators face around the world (Carr, 2000; Elliot, Friedman, & Briller, 2005).

Dropping out of a distance course has negative consequences for the student, the institution, and society. Incompletion or failure of a first distance course may prevent students from taking other distance courses (Moore & Kearsley, 1996). It may also have a negative impact on the student's self-esteem and self-confidence. From an institutional point of view, it may be considered a sign of inefficiency (cost of training, loss of students, lowering of success rates). Finding ways to help students persevere in their courses seems to be the best way to improve achievement in distance education courses.

Historically, distance education institutions have always tried to use emerging technologies to reach and communicate with learners: postal service, radio, television, satellite, audioconferences, etc. In recent years, the introduction of information and communication technology (ICT) has created new ways for students and tutors to communicate and interact.

The communication potential of ICT was quickly identified by traditional distance education institutions: the new communication media would facilitate contacts between tutors and students and among students, breaking the sense of isolation experienced by some distance learners and helping to sustain their motivation. This in turn would lead to diminished drop-out rates – or so it was hoped.

But for many distance education institutions, these hopes were not realized. At the *Cegep@distance*, for example, telephone communications were replaced with Internet communications in some courses. To date, this measure has not proved to be successful. The success rate in traditional correspondence courses (53.7%) is similar to that of courses that rely on electronic communication for student support (50.4%) and online courses (47.1 %) (*Cegep@distance*, internal statistics for the year 2004).

Furthermore, drop-out rates remain a major problem not only in traditional distance courses, but also in e-learning (Owston, 2000). It is often difficult to obtain clear data regarding completion or drop-out rates and equally difficult to interpret this data (Glikman, 2002), but there is some talk of high drop-out rates being the “e-learning taboo” (Moshinski, 2000).

The explosion of ICT has fuelled the rapid growth of e-learning offerings, leading to the birth of various online teaching and learning models. While self-paced, individualized learning is still used in many online courses, several institutions offer courses based on a socio-constructivist paradigm. These courses use a cooperative or collaborative learning approach. Students learn by interacting with their peers and restructure their prior learning by adding new information to it. While some statistics indicate that high drop-out rates still pose a challenge for online education, some online courses founded on cooperative or collaborative learning models show marked improvements in retention rates compared to what is traditionally observed in distance education settings (Hiltz, Coppola, Rotter, Turoff, & Benbunan-Fich, 2000; Mayadas, 1997; Harasim, 1999).

Research Questions and Objective

This research is part of a larger study that seeks to answer the following research questions: What are the factors that affect students’ evolving motivation and persistence in distance education? Could individual tutoring and peer collaboration positively influence motivation and persistence in these courses? The specific objective pertaining to the part of the study presented here is to understand the impact of peer interaction and collaborative learning on student self-efficacy beliefs and persistence in a distance education context.

Conceptual Framework

The distance education community has been concerned about high drop-out rates for a number of years, and this problem is quite well documented. In a distance course setting, dropping out occurs fairly early, often within a period of two to three months after registration (Blay, 1994; Gibson, 1996). A significant percentage of students do not even submit their first assignment (Rekkedal, 1993), which suggests a lack of engagement.

Many variables have been linked to persistence or drop-out rates in distance education. According to Bourdages and Delmotte (2001), these variables may be classified as follows: institutional variables (courses and learner support characteristics), environment variables (time constraints, life changes, social environment, etc.), demographic variables (gender, age, employment status, academic background, etc.) and individual characteristics (cognitive characteristics, time management, motivation, etc.).

Learner motivation has been identified as playing a key role in the process leading to either persistence or dropping out. Parker (1999) demonstrated the existence of a link between persistence and internal locus of control. Motivation may also decline when learners feel isolated. Hence, according to Abrahamson (1998), communication in distance education should aim to alleviate the sense of isolation experienced by distance learners and sustain their motivation.

The role of learner motivation has gained recognition in several different aspects of academic achievement. Recent motivational research shows multiple links between cognitive or academic achievement and motivational factors (Linnenbrink & Pintrich, 2002; Pintrich, 1999). In online and distance education courses, self-efficacy has been related to different aspects of performance (Wang & Newlin, 2002; Jourdan, 2003; Joo, Bong & Choi, 2000; Taplin, Yum, Jegede, Fan, & Chan, 2001). In an effort to synthesize and integrate many recent developments in the sociocognitive views of motivation, Pintrich proposed an expectation and value model (Pintrich, Smith, Garcia & McKeachie, 1991; Pintrich, 2003). The expectations component of the model is composed of self-efficacy and control beliefs. Self-efficacy may be the most useful motivational construct to have been developed in recent years. It has been consistently and repeatedly related to many aspects of achievement and performance (Linnenbrink & Pintrich, 2003; Graham & Wiener, 1996). It is defined as "people's judgments of their capability to organize and execute courses of action required to attain designate types of performances" (Bandura, 1986: 391). This motivational construct is also related to self-regulation behaviors (Pintrich, 1999). In his definition of self-regulated learning,

Pintrich (1999) outlined three categories of strategies: cognitive, metacognitive, and resource management. Reviewing results from a few recent studies, Pintrich (1999) asserted that “the findings for self-efficacy showed very positive relations between self-efficacy and self-regulated learning for both middle school and college students” (p. 465).

Research has shown that in distance education, dropping out is a complex process that brings a large number of variables into play (Morgan & Tam, 1999; Bourdages & Delmotte, 2001). In addition to initial motivation, however, the factors that seem to be the most influential belong to two categories: academic background (prior academic results, prior failures with the course, experience with distance courses) and socio-demographic variables (gender, hours worked). These have to be taken into account in research on drop-out or persistence.

In regular education settings, Tinto (1987) proposed an influent model of the process leading to either persistence or dropping out at the college level. His model emphasizes the importance of the social and academic integration processes. More recently, recognizing that a significant portion of today’s college first-year and sophomore population no longer live on campus, he stressed the importance of collaborative learning activities in classes in order to facilitate both academic and social integration.

Tinto’s model was developed to explain the process by which students quit college, in order to implement actions to improve student retention (Tinto, 1993). But it is not clear whether this model, built for the institutional level, is valid at the course level. Furthermore, it was developed for a clientele who spend most of their time on campus, and is not thought to be directly transferable to the distance education context, which often involves older students in a very different social environment (Sweet, 1986).

Taking this into account, Kember (1989) adapted Tinto’s model to distance learning, stressing the importance of the social integration process. His definition of the social integration process, however, refers to the learners’ ability to integrate the requirements of distance learning into other aspects of their social life. Interaction with distance learning peers is one aspect of this process. But Kember’s model, developed to apply to mature students in distance education, also attempts to explain persistence and drop-out rates at the institutional level.

Neither models seem to accurately portray persistence at the course level in a distance education or even e-learning context. Distance study offerings are multiplying and the students taking these courses are quite heterogenous (Gilbert, 2000). The mature students taking distance or online courses for qualification purposes represent only a portion of the students taking these courses. Many are full-time students registered in

another institution that choose to take one or two distance courses. Furthermore, there is a diversity of profiles within these two broad categories. The social and academic environments of these different types of learners are very different, suggesting that their social and academic integration processes might also be quite different. Nevertheless, both Tinto and Kember stress the importance of the social integration process, however it may differ in light of the students' social environment.

While the importance of social interaction in the learning process has long been recognized, especially in face-to-face settings (Vygotsky, 1978), it is just slowly being acknowledged by many distance education institutions that have traditionally relied on a learner-paced individual learning model. "Researchers have found that when a sense of learning community is established, distance learners exhibit desired outcomes, such as high retention, greater motivation, increased satisfaction and better performance" (Lee, 2002: 66).

Educators have been using a variety of cooperative and collaborative learning models emerging from diverse theoretical perspectives for many years (Johnson, Johnson & Smith, 1998). In their meta-analysis of 305 published studies, Johnson et al. (1998) found that cooperative learning at the college level influences academic performance (size effect of 0.49), quality of peer relations (size effect of 0.69) and adaptation to college life. Tinto (1999) deemed it a means for achieving better persistence at the college level. In distance learning settings, the retention rates of online courses based on cooperative or collaborative activities have been generally better than those usually observed in distance education settings that do not implement these types of activities (Harrasim, 1999; Hiltz et al., 2000; Mayadas, 1997).

Collaborative activities might improve some distance learners' social integration process and possibly sustain their motivation, which would lead to higher involvement in course work and, ultimately, to persistence. This study intends to measure and understand the effects of collaborative activities on persistence and motivation in distance learning courses.

Although some distinctions can be made between cooperative and collaborative learning activities, both are characterized by learner interdependence in attaining learning objectives (Henri & Lundgren-Cayroll, 2001). Although they differ in their degree of structure (Henri & Lundgren-Cayroll, 2001), both collaborative and cooperative learning activities are organized and structured.

The level of peer collaboration varies along a continuum. At the lower end, there may be no form of collaboration. The beginning of collaboration involves peer interaction. As part of the support system for distance education courses, peer interaction is a form of learner support where students are invited to communicate with other students registered

in the same course. These contacts are left to the students' initiative. They take place in the absence of the tutor or other representatives of the institution. (Gagné, Deschênes, Bourdages, Bilodeau & Dallaire, 2002).

Method

This research used a mixed methodological approach, relying on both quantitative and qualitative data. According to different authors, this pragmatic strategy allows a deeper understanding of a studied phenomenon (Moss, 1996; Karsenti & Savoie-Zajc, 2000), and the complementarities of strengths and weaknesses of both approaches may enrich and reinforce the results (Petter & Gallivan, 2004; Johnson & Onwuegbuzie, 2004).

A quasi-experimental design was used to compare the self-efficacy and persistence measures of groups where peer interaction was encouraged through computer-mediated conferences (CMC) to other groups taking a correspondence version of the same courses (without peer interaction), tutored by the same teachers. It was hypothesized that the introduction of collaborative activities would facilitate student contact, enhancing peer-learning and help-seeking strategies, as well as boosting the students' motivation in a way that would improve their persistence in the selected courses.

The mixed approach we chose permitted different types of triangulation of results, including triangulation between quantitative and qualitative results. The interviews offered an alternative way to consider the effects of the intervention in small groups.

Measures and Analysis

The measures consisted of two questionnaires with closed and open-ended questions, individual semi-structured phone interviews, a tutors' group interview and data from the Cegep@distance information systems.

Questionnaires

Student self-efficacy was measured by an adapted Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991), used for self-efficacy in a particular course or discipline, and by the DSES (Distance Study Self-efficacy Scale), an instrument we developed to measure student self-efficacy in the requirements specific to distance learning (Poellhuber, 2007). The MSLQ was translated into French and some of the terms were adapted to the distance learning context (for example, teacher was replaced with "tutor"). The MSLQ adaptation was validated with 512 respondents, revealing a Cronbach's Alpha of 0.93 for the self-efficacy subscale. The DSES is composed of seven Likert-type items that pertain

to self-efficacy in the ability to maintain the discipline and commitment required for distance learning (Poellhuber, 2007). The Cronbach's Alpha is 0.93 for this scale. This questionnaire was completed twice: at the time of registration and after completion of the final assignment. The first questionnaire also asked about some demographic variables (occupation, hours worked, etc.).

The second questionnaire contained questions on the number of contacts with peers and tutors as well as open-ended questions on the effect of these contacts and on the events related to variations in their motivation. The variables pertaining to each student's academic background and measures of persistence were retrieved from the Cegep@distance information systems.

Interviews

Semi-structured individual phone interviews were conducted with 22 students in the three online courses. Of these, eight were in the philosophy course with the compulsory collaborative activities, six were in the French course and nine were in the accounting course. All the individual phone interviews were conducted after the completion of the final assignment, and some of them after the completion of the final exam.

We also conducted a group interview with the tutors responsible for the courses selected for the study and a complementary phone interview with the philosophy tutor to enrich the data and clarify the nature of his interventions.

Qualitative Analysis

All interviews were taped and transcribed. Initially both researchers, using an in vivo coding approach to remain close to the interviewee's discourse, coded them manually. The researchers then agreed on a coding grid and one researcher coded all the materials using Atlas-ti software. Then followed a synthesis phase in which each researcher independently identified the categories linked to the research objectives. A high degree of convergence was observed. Following the recommendations of Miles & Huberman (2003), the researchers then proceeded to thematize and hierarchize the codes, seeking a better fit with the theoretical framework where possible and allowing new categories to emerge. In a final phase, a grounded theory approach (Glaser & Strauss, 1967) was used to schematize a causal relations network.

Experiment Design

The courses selected for this research were available both in a correspondence version and in a partially or totally online version. The Cegep@distance learning model is learner-paced individualized learning, with registrations accepted on a continuous basis. There is no group pacing; learners move forward at their own rate with progressive learning materials and the help of an assigned tutor.

Experimental Treatment 1: Collaborative Learning Activities

The Internet course with added collaborative activities was compared to the correspondence version of the same course, supervised by the same tutors, using different persistence indicators: withdrawal rates, first assignment submission rates, and course completion. However, only 12 students registered for this course, preventing any significant statistical analysis.

Experimental Treatment 2: Peer Interaction

While the collaborative learning activities were compulsory in the redesigned philosophy course, they were optional in the other courses. Students were encouraged by their tutors to participate in asynchronous course discussion forums, but this participation was not graded. In the initial welcoming message sent to them through the Learning Management System (LMS) by their tutors, students were invited to join a dedicated forum. After that first stage, when tutors received questions from the students, they either invited them to post their question on the discussion forum or decided to transfer the question to the forum themselves. The tutors also encouraged students to answer questions asked by other students. To accommodate the continuous entry model used at the Cegep@distance and allow students with different rhythms to collaborate, a number of computer conferences were held to reflect the course structure, typically anchored in the preparation of each homework assignment.

Participants

The subjects were all students registered in the chosen courses with the chosen tutors between March 31, 2004, and November 29, 2004 (n = 308). However, this study took place in the context of a larger study involving 1,372 students. For the study reported here Table 1 shows the Subjects that participated in each Treatment and Control Group.

Table 1. Subjects

Course	Format	Treatment	Subjects	Interviews
Philosophy	Collaborative activities	Treatment 1	12	8
Philosophy	Correspondence	Control 1	42	
French and Accounting	Peer interaction	Treatment 2	126	15
French and Accounting	Correspondence	Control 2	128	
TOTAL			308	22

Note. In the correspondence format, there was no interaction between students.

Procedure

In order to find ways to improve completion rates for distance courses, the Cegep@distance conducted a two-year action-research study that involved the implementation of a series of measures intended to improve student persistence. One of these was the implementation of different types of peer collaboration activities in three courses, delivered partially or totally online. It was hoped that the collaboration would help to create a sense of community that would sustain student motivation and support their commitment to the course and their persistence. Collaborative activities were introduced in one online philosophy course, which was redesigned so that these collaborative activities became part of the course structure. Graded assessments took these activities into account. In two other online courses (French and accounting), a lighter type of peer collaboration was introduced. Students were encouraged to participate in CMCs that were introduced by the tutors as the students moved through the course, thus becoming part of the learners' support system rather than an integral part of the course design and the course materials. Peer collaboration was proposed rather than imposed, optional rather than mandatory. The students were free to participate or not.

In the first stage of the project, tutors were trained to encourage students to take part in these CMCs and to adopt a facilitator role. Their training was based on Salmon's five-stage model of learning and teaching in an online environment (2000), as well as on Henri and Lundgren's collaborative learning model (2000). The second stage of the project,

which involved implementing collaborative activities and other measures to improve course persistence (tutoring), began in April 2004.

Results

After presenting the response rates for the two questionnaires (Table 2), we will present qualitative results that may help us understand the effects of the collaborative learning activities condition. To evaluate the effects of peer interaction (treatment 1), we will then present a quantitative analysis of the differences between the peer interaction condition (treatment 2) and the no-interaction condition (control 2).

Collaborative Learning Activities (Treatment 1)

Due to the small number of subjects in this condition, we decided to essentially rely on the interviews to understand the effects of the introduction of collaborative learning activities. Of the ten students who remained registered after twelve weeks, eight agreed to be interviewed. Of these, seven persisted to the end and passed the course. The small number of students registered in that condition and the fact they are self-selected introduce a bias.

The analysis and categorization of the interview transcripts indicate that the factors that contributed to favourable motivational dispositions were the course materials and the individual tutoring. All but one student appreciated the course material quality, deeming it well done, engaging and interesting, which suggests a positive impact on perceived task difficulty and self-efficacy, as well as interest:

It was well presented and the explanations were clear (excerpt, interview 2)

It was more interesting (excerpt interview 3)

Table 2. Response Rates for the Questionnaires

Course	Format	Treatment	Sub's	Q1 (n)	Q1 (%)	Q2 (n)	Q2 (%)
Philosophy	Online	Treatment 1	12	12	100.0%	8	66.7 %
Philosophy	Corres- -pondence	Control 1	42	13	31.0%	8	61.5%
	Online	Treatment 2	126	63	50.0%	20	31.8%
	Corres- pondence	Control 2	128	56	43.8%	32	57.1%

The tutor support was rated positively and mentioned frequently in association with motivational dispositions. Students appreciated the short turn-around time for tutor responses to their questions. There was no specific measure of turn-around time in the study; “short” is a perceptual measure, but in some cases receiving an answer in 24 to 48 hours was considered a long delay.

The tutor was always there for us when we had questions. (excerpt, interview 2)

They also appreciated the quality of the answers.

I also found that the tutor provided good answers to my questions. (excerpt, interview 8)

Students perceived that the tutor was available for them if they needed help. For the students, the rapidity and quality of the tutor’s answers seemed to promote comprehension and thus self-efficacy.

It was that the tutor answered my questions quickly and I understood right away (excerpt interview1).

The tutor’s perceived availability seemed to promote confidence, which we consider closely related to self-efficacy. These categories emerged from the interview transcript analysis and were also confirmed by the content analysis of the answers to the open-ended questions in the second questionnaire.

The LMS communication facilities were used to enhance student and tutor contacts rather than for collaborative activities. Peer interaction appears to have played a minor role in the students’ motivation, but a certain degree of contact and collaboration was achieved.

We talked to each other, but it was mostly forums. We didn’t really do our assignments as a team (excerpt interview1).

In this experimental condition, many students did actually appreciate the contact with their peers.

She said she had been able to discuss with the other students, and that it was interesting, and that she saw things that she wouldn’t have thought of on her own. Sometimes I asked the others questions (excerpt interview1).

Furthermore, when carried out, the collaborative learning activities were positively rated.

Logistical problems arising from the small number of participants and the individual learner-paced model (as opposed to a group-paced model) prevented the collaborative learning activities from taking place as planned. In some cases, the student was interested in collaborating but

unable to do so because of logistical difficulties. While a low number of students registered in the course featuring the collaborative learning activities, they entered the course at different points in time and there were not enough students to permit collaboration on group projects.

I would have liked to interact with the others...but it was just impossible (excerpt interview 3).

In many cases, the planned interaction in collaborative learning activities took place with the tutor rather than with peers. So, in fact, the collaborative learning aspect of the course was mostly experienced through the tutor, thus making for an enhanced tutoring approach with increased peer-to-peer and peer-to-tutor interaction, rather than a true collaborative learning condition.

Peer Interaction (Treatment 2)

Students in the peer interaction condition (treatment 2) were compared to students in the no-interaction condition (control 2) on persistence and self-efficacy measures, as well as on the number of occurrences of peer contact. A qualitative analysis of the interviews conducted with students in the study is presented elsewhere (Poellhuber, 2007). This analysis focused on the evolution of the students' motivation in the course and on the paths that led to persistence or drop-out. More specifically, the analysis showed that most students encountered difficulties at some point in the course, even those with a favourable academic background. The difficulties were of different types: comprehension, time management and personal being the most frequently cited categories. If left unresolved, these difficulties were associated with a decrease in motivation and engagement in the course. Students who turned to resources in their environment for support (tutor, peers, or members of their social network) seemed to overcome these difficulties, but students who ended up dropping out of the course tended to remain isolated, trying to resolve their difficulties by themselves, and not resorting to their tutor, peers or social network for help. Tutor contact was often mentioned in association with an increase in self-efficacy.

Group Profiles

The groups were compared using the variables traditionally shown to be good predictors of academic success in online or regular courses: academic background (prior experience in distance courses, prior college academic grades, prior failures in the course taken) and gender, which is consistently related to course persistence and success at the college level in Quebec (Terrill & Ducharme, 1994) and at the Cegep@distance. The

treatment and control groups did not differ in terms of prior experience in courses at the Cegep@distance: overall, for 76.0 % of them, the course in question was their first distance course at the Cegep@distance.

Further differences were found between the two groups. Compared to the correspondence courses, the online courses (treatment 2) attracted more students (50%) who had previously failed the course than did the correspondence version (24.8%). Furthermore, nearly half of this 50 % (30 out of 61) had previously failed the course two or more times, a significant difference; $\chi^2 (1 \text{ df}) = 17,814, p=.000$.

Motivational Dispositions

Self-efficacy (First Administration of the Questionnaire)

Groups were also compared by initial self-efficacy measures on the MSLQ subscale and the DSES, as shown in Table 3. There was no significant difference in initial self-efficacy between the groups, but the students of the control group anticipated a better final grade (mean = 79.8) than the treatment group (mean = 74.7, $p = 0.001$).

Persistence

Differences between the peer interaction (treatment 2) and no-interaction (control 2) conditions concerning withdrawal rates were not significant. The average withdrawal rate for these two groups was 15.7%. Of the 254 students in the Treatment 2 and the Control 2 conditions, 214 remained registered after twelve weeks.

As shown in Table 4, contrary to our expectations, the first assignment completion rate was significantly higher in the non-collaborative condition (Control 2: 92.7%) than in the collaborative one (Treatment 2: 78.1%) ($p = .003$ for Pearson χ^2). The same finding was also true for the second assignment completion rate and for course persistence. Course persistence was defined as completion of all required assignments and taking the final exam, regardless of the pass or fail verdict for the course.

Table 3. Self Efficacy Measures by Treatment

Format	Treatment	MSLQ	DLSES	Anticipated Grade
Online (collaborative)	Treatment 2	41.5	37.5	74.7
Correspondence	Control 2	44.0	40.0	79.8 *** ^a

a. $F(1, 108) = 12,689, p = 0.001$

Table 4. Persistence Measures by Treatment

Format	Treatment	Subjects	Assign1	Assign2	Persistence
Online	Treatment 2	105	78.1%	61.9%	49.5%
Correspondence	Control 2	107	92.5%** _a	76.6%* _b	72.0%** _c

a. $\chi^2 (1 df) = 8.883, p = .003$

b. $\chi^2 (1 df) = 5.409, p = .020$

c. $\chi^2 (1 df) = 11.201, p = .001$

Self-efficacy (Second Administration of the Questionnaire)

There was no difference between the groups in terms of self-efficacy changes as measured by the second questionnaire.

Peer Contacts

As shown in Table 5, fifty students answered the question pertaining to the number of peer contacts in the second questionnaire. No statistical analysis was performed because two cells would have an expected value under $n = 5$ using a Chi-square test (Siegel & Castellan, 1988). However, it can be noted that the peer contact level in the “treatment” groups was very low, and that some peer contacts were taking place in the correspondence format of the course, which is somewhat surprising since the students have no formal means to contact peers. Analysis of the individual interview transcripts confirmed that in this condition, the level of peer contact was low. Most students consulted the computer conferences, especially at the early stage of the course. Although a few of them reported they felt part of a group or a class, peer contact did not play an important role in student motivational dispositions.

Table 5. Reported Peer Contacts by Treatment

Format	Treatment	n	Peer contacts
Online	Treatment 2	19	4 (21.0%)
Correspondence	Control 2	31	2 (6.4%)
TOTAL		50	

Data from the Tutor Group Interview

The tutors commented on the way the students used the LMS. According to them, the number of contacts between students and tutors in the targeted groups exceeded that generally observed in other Cegep@distance online courses. The level of activity in the computer-mediated conferences was also higher. But the tutors observed that the students' communications were essentially directed at tutors rather than at other students and consisted mainly of questions concerning the subject matter. Students rarely answered other students' questions, even when encouraged to do so.

Discussion

The objective of this study was to understand the impact of peer interaction and collaborative learning on student self-efficacy beliefs and persistence in a distance education context. Regarding the link between peer interaction and persistence, all persistence measures (assignment rates and course persistence) were found to be higher in the no-interaction condition (correspondence courses) than in the peer interaction condition (online courses). But it seems that these differences can be attributed to differences between groups rather than to the absence of effect of peer collaboration.

The online courses seem to attract more students with a less favourable academic background: a history of failure or repeated failures in the course, and a lower anticipated course grade. For these people, choosing an online course may have been a way of trying an alternative approach to the course.

Additional analysis shows that the differences may be due to significant differences between the sub-group profiles registered for the French and the accounting course. Accounting students have a better academic background (higher R-scores, lower previous failure rates), they anticipate a better grade, and they differ from the French students on a variety of sociodemographic variables. The proportion of women is higher, the students are older, and a larger proportion of them are registered full-time at the Cegep@distance rather than another Quebec college. All these differences are significant. Globally, all of these variables have been found to be related to persistence in another part of the study.

The differences between the online peer contact condition experimental group and the correspondence control group might be attributed to differences in student profiles in the two courses (in favour of the accounting course), and accentuated by a high number of subjects in the online version (n = 94) of the French course and in the correspondence version of the accounting course (n = 97).

Since the peer collaboration was at quite a low level, it is difficult to draw a conclusion about its effects. Different factors might explain this low level of collaboration. The tutors recruited for this study reported having been very busy with the time-consuming task of following up on student activities related to tutoring interventions. This may have left them with little time to facilitate the discussion forums, even though this has been identified as critical in the literature and they had received training on this subject.

Being separated in time and place, the students may not have had the opportunity to develop a sufficient feeling of proximity or social presence to collaborate with their peers. Social presence draws its origins from media theory (Short, Williams & Christie, 1976) and has been defined more recently as “the degree to which a person is perceived as a ‘real person’ in mediated communication” (Gunawardena & Zittle, 1997: 9). In the “community of inquiry” model, social presence is defined as “the ability of participants in a community of inquiry to project themselves socially and emotionally as ‘real’ people (i.e., their full personality)” (Garrison, Anderson, & Archer, 2000). Here, social presence is seen as a prerequisite for peer collaboration. In this study, there may have been insufficient attention to the development of the social aspect of collaboration for social presence to develop.

Although many students did sign in to the discussion forums as requested, discussions rarely occurred between students. The activity design may have been deficient. Instead of asking the students to simply log in, perhaps tutors should have asked them to ask questions of other students and answer questions that were asked, or to find other students with common interests.

The low registration rate in the collaborative learning version of the philosophy course indicates that collaborative activities may not be appealing to Cegep@distance students. This is confirmed by the low peer contact rate that was observed in the peer contact condition. Many students may prefer more individualized ways of learning. Students who register at Cegep@distance, especially those with prior experience with its course format, may not be very interested in collaborating with peers. It is not in the culture of the institution, and it may not be in their culture either. Peer collaboration may not be suitable for all students. It does seem to help persistence, however, and in other contexts, many students choose to collaborate with peers. At the Norwegian Knowledge Institute, 55% of self-paced students choose some aspect of collaboration in their studies (Shaunnessy, 2007). The technology chosen to support collaboration may not have been adequate. In the case cited (Shaunnessy, 2007), a very specific technological development was made to encourage peer collaboration.

New social software could offer interesting characteristics that would facilitate peer collaboration.

Overall, the level of collaboration was lower than expected in both experimental conditions. The CMCs were used more for tutor-student communication than for peer interaction, and the collaborative learning condition became more an enhanced-tutoring and peer-interaction condition. Qualitative data analysis reveals that in this condition, peer interaction took place and was appreciated by most students.

Conclusion

In this research, we wanted to understand the impact of peer interaction and collaborative learning on student self-efficacy beliefs and persistence, using a mixed methodological approach. Persistence was higher in the no-interaction group than in the peer interaction condition, but significant group differences were found in a number of confounding variables. The context of the study and institution's tutor assignment policy did not allow for a random assignment of students to the different experimental conditions. To reinforce the methodological design of the study, a larger number of subjects in the online collaboration condition would be needed, as well as the means to better control confounding variables. The non-persisters responded marginally to the second questionnaire, which introduces some biases. A qualitative approach was used to understand the effects of collaborative learning, which, in fact, became an enhanced tutoring and peer interaction condition. From a qualitative point of view, the student-tutor interactions stimulated student self-efficacy.

Recommendations

The introduction of collaborative learning in an institution centred on a self-paced, individualized learning model is neither easy nor popular. While some students are interested in peer collaboration and take advantage of it, many others are either not interested in collaboration or not accustomed to the culture of collaboration. In fact, some authors found that collaboration could be seen as a culture shock for many students used to traditional teaching. There are institutional, logistical, and individual barriers to collaboration in an institution where self-paced learning is the norm. In order to create significant peer interaction, it might be necessary to form groups, an initiative that runs counter to the flexibility at the core of the learner-paced model, or at least find ways to enable and promote peer collaboration.

One avenue compatible with the learner-paced model would consist of the use of technological tools to facilitate and promote peer interaction, in an approach where collaboration is optional rather than mandatory

(Paulsen, 1993; Anderson, Annand, & Wark, 2005). If peers can be made more readily and easily available to each other through technology, a certain proportion of students might take advantage of it, hopefully those with the fewest available support resources in their environment.

This research demonstrates that there are challenges in using CMCs for peer interaction in self-paced learning environments. It is increasingly clear, however, that individual and collective peer-tutor interactions have potential in this context. While tutors are accustomed to rely essentially on individual tutoring, they could advantageously use these collective interactions to enhance tutoring.

Future Research

Further research is required on student desire to collaborate or openness to collaboration, and on the effect of these dispositions on learning and persistence. Finding ways to facilitate peer collaboration within the self-paced model while resolving logistical difficulties remains a worthwhile challenge, from both a practical and a research perspective. Emerging technologies such as social software and Web videoconferencing might offer promising avenues to accomplish this.

Research with a larger number of subjects and better controlled conditions would be needed. Research is also needed on the links between the different support resources (cognitive support from tutors, peers, and the social environment) available to students, their way of using them, and the links between them. Finally, research should try to identify forms of peer collaboration that are helpful from a motivational perspective and compatible with learner needs and preferences in a learner-paced learning model.

References

- Abrahamson, C. E. (1998). Issues in interactive communication in distance education. *College Students Journal*, 32(1), 33-43.
- Anderson, T., Annand, D., & Wark, N. (2005). The search for learning community in learner paced distance education. *Australasian Journal of Educational Technology*, 21(2), 222-241.
- Poellhuber, B., Chomienne, M., & Karsenti, T. (In Press). *L'effet du tutorat individuel sur le sentiment d'auto-efficacité et la persévérance dans les formations ouvertes et à distance*.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. NY: Prentice Hall.
- Blay, T. (1994). How to reactivate drop-outs. *Epistologodaktika: The European journal of distance education*, 1, 40-48.
- Bourdages, L., & Delmotte, C. (2001). La persistance aux études universitaires à distance [Electronic Version]. *Journal of Distance Education/Revue de l'enseignement à distance*, 16(2). Retrieved 15/08/2006 from <http://cade.athabascau.ca/vol16.2/bourdages-delmotte.html>.

- Carr, S. (2000). As distance education comes of age, the challenge is keeping the students. *The Chronicle of Higher Education*, 46(23), A39-A41.
- Elliot, N., Friedman, R., & Briller, V. (2005). Irony and asynchronicity: Interpreting withdrawal rates in e-learning courses. In P. Kommers & G. Richards (Eds.), *World Conference on Educational Multimedia, Hypermedia and Telecommunications 2005* (459-465). Montreal, Canada: AACE.
- Gagné, P., Deschênes, A.-J., Bourdages, L., Bilodeau, H., & Dallaire, S. (2002). Les activités d'apprentissage et d'encadrement dans des cours universitaires à distance : Le point de vue des apprenants. *Journal of Distance Education/Revue de l'enseignement à distance*, 17(1), 25-56 [Electronic Version]. Retrieved 15/10/2006 from : <http://cade.athabasca.ca/vol16.1/deschenesetal.html>.
- Garrison, R., Anderson, T., & Archer, W. (2000). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education. *The Internet and Higher Education*, 2(2-3), 87-105.
- Gibson, C. C. (1996). Toward an understanding of academic self-concept in distance education. *American Journal of Distance Education*, 10(1), 23-36.
- Gilbert, W. A. (2000). *Retention in distance education telecourses and perceptions of faculty contact: A comparison of traditional and nontraditional community college students*. Unpublished Ph.D., Talahassee, FL: Florida State University.
- Glaser, B., & Strauss, A. L. (1967). *The discovery of grounded theory*. Chicago: Aldline.
- Glikman, V. (2002). *Des cours par correspondance au "e-learning"*. Paris: Presses Universitaires de France.
- Graham, S., & Weiner, B. (1996). Theories and principles of motivation. In D. D. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 63-84). New York: Simon & Schuster Macmillan.
- Gunawardena, C. N., & Zittle, F. (1997). Social Presence as a Predictor of Satisfaction within a Computer Mediated Conferencing Environment. *American Journal of Distance Education*, 11(3), 8-25.
- Harrasim, L. (1999). *What are we learning about teaching and learning online: An anlysis of the Virtual-U field trials* [Electronic Version]. Réseau des centres d'excellence en téléapprentissage. Retrieved 12/01/2002 from http://www.telelearn.ca/g_access/news/vufieldtrials.pdf.
- Henri, F., & Lundgren-Cayrol, K. (2001). *Apprentissage collaboratif à distance*. Sainte-Foy (Québec): Presses de l'Université du Québec.
- Hiltz, R. H., Coppola, N., Rotter, N., Turoff, M., & Benbunan-Fich, R. (2000). *Measuring the importance of collaborative learning for the effectiveness of ALN: A multi-measure, multi-method approach* [Electronic Version]. *Journal of Asynchronous Learning Networks*, 4(2). Retrieved 02/10/2006 from http://www.sloan-c.org/publications/jaln/v4n2/v4n2_hiltz.asp.
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Cooperative learning returns to college: What evidence is there that it works? *Change*, 30(4), 26-35.
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.
- Joo, Y.-J., Bong, M., & Choi, H.-J. (2000). Self-efficacy for self-regulated learning, academic self-efficacy, and internet self-efficacy in web-based instruction. *Educational Technology Research and Development*, 48(2), 5-17.
- Jourdan, L. F. (2003). Differences in predictors of online and classroom performance. *Paper presented at the Selected papers from the 14th International conference on college teaching and learning*.
- Karsenti, T., & Savoie-Zajc, L. (2000). *Introduction à la recherche en éducation*. Sherbrooke: Université de Sherbrooke, Faculté d'éducation, Éditions du CRP.

- Kember, D. (1989). A longitudinal-process model of drop-out from distance education. *Journal of Higher Education*, 60(3), 278-301.
- Lee, C. Y. (2002). *The impact of self-efficacy and task value on satisfaction and performance in a Web-based course*. Unpublished Ph.D., University of Central Florida, Orlando, Florida.
- Linnenbrink, E. A., & Pintrich, P. R. (2002). Motivation as an enabler for academic success. *School Psychology Review*, 31(3), 313-327.
- Linnenbrink, E. A., & Pintrich, P. R. (2003). The role of self-efficacy beliefs in student engagement and learning in the classroom. *Reading and Writing Quarterly: Overcoming Learning Difficulties*, 19(2), 119-137.
- Mayadas, A. F. (1997). Asynchronous learning networks: A Sloan foundation perspective [Electronic Version]. *Journal of Asynchronous Learning Networks*, 1. Retrieved 20/08/2006 from http://www.sloan-c.org/publications/jaln/v1n1/v1n1_mayadas.asp.
- Miles, M. B., & Huberman, A. M. (2003). *Analyse des données qualitatives* (2nd ed.). Paris: Université de Boeck.
- Moore, M., & Kearsley, G. (1996). *Distance education: A system view*. Belmont, CA: Wadsworth.
- Morgan, C. K., & Tam, M. (1999). Unravelling the complexities of distance education student attrition. *Distance Education*, 20(1), 96-108.
- Moshinskie, J. (2000). How to keep e-learners from e-scaping [Electronic Version]. *White paper #1, E-lite Think Tank*. Retrieved 15/06/2003 from [http://hsb.baylor.edu/html/moshinsk/ELITE/eLITE1 - Motivate.doc](http://hsb.baylor.edu/html/moshinsk/ELITE/eLITE1-Motivate.doc).
- Moss, P. A. (1996). Enlarging the dialogue in educational measurement: Voices from interpretive research traditions. *Educational Researcher*, 25(1), 20-28, 43.
- Owston, R. D. (2000). A meta-evaluation of six cases studies of web-based learning [Electronic Version]. *Paper presented at the AERA meeting*. Retrieved 28/09/2003 from http://eduserv.edu.yorku.ca/~ron_owston/aera2000.html.
- Parker, A. (1999). A study of variables that predict dropout from distance education. *International Journal of Educational Technology*, 1(2), 1-10.
- Paulsen. (1993). The hexagon of cooperative freedom: A distance education theory attuned to computer conferencing [Electronic Version]. *Deosnews*, 3(2). Retrieved 14/05/2005 from <http://www.nettskolen.com/forskning/21/hexagon.html>.
- Petter, S. C., & Gallivan, M. J. (2004). Toward a framework for classifying and guiding mixed method research in information systems. *Paper presented at the 37th Hawaii International Conference on System Sciences*.
- Pintrich, P.R. (2003). Motivation and Classroom Learning. In W.M. Reynolds and G.E. Miller (Eds), *Handbook of psychology, vol 7: Educational psychology*. Hoboken, N.J.: John Wiley & Sons. 103-122.
- Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research*, 31, 459-470.
- Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. (1991). *A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ)*. Ann Arbor: The University of Michigan.
- Pithers, B., & Twyford, K. (2000). The effect of telephone contact as a means of student support in distance education. *Australian and New Zealand Journal of Vocational Education Research*, 8(2), 91-109.
- Poellhuber, B. (2007). *Les effets de l'encadrement et de la collaboration sur la motivation et la persévérance dans les formations ouvertes et à distance (FOAD) soutenues par les TIC*. Unpublished Ph.D. Université de Montréal: Montréal.
- Rekkedal, T. (1993). Practice related research in large scale distance education. *Paper presented at the Umea conference*.

- Salmon, G. (2000). *E-moderating: The key to teaching and learning online*. London: Kogan Page.
- Shaunessy, M. (2007, April 25 2007). An Interview with Morten Flate Paulsen: Focusing on His Theory of Cooperative Freedom. In *Online Education*. *EdNews*. Retrieved Aug. 2007 from <http://www.ednews.org/articles/10626/1/An-Interview-with-Morten-Flate-Paulsen-Focusing-on-His-Theory-of-Cooperative-Freedom-in-Online-Education/Page1.html>
- Siegel, S., & Catellan, J. (1988). *Statistics for the behavioral sciences*. McGraw Hill.
- Sweet, R. (1986). Student dropout in distance education: An application of Tinto's model. *Distance Education*, 7(2), 201-213.
- Taplin, M., Yum, J. C. K., Jegede, O., Fan, R. Y. K., & Chan, M. S.-c. (2001). Help-seeking strategies used by high-achieving and low-achieving distance education students. *Journal of Distance Education/Revue de l'enseignement à distance*, 16(1), 56-69, [Electronic Version]. Retrieved 15/10/2006 from: <http://cade.athabascau.ca/vol16.1/taplin.html>.
- Terrill, R., & Ducharme, R. (1994). *Passage secondaire-collégial: Caractéristiques étudiantes et rendement scolaire* (Deuxième édition ed.): SRAM.
- Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago: The University of Chicago Press.
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2e édition ed.). Chicago: The University of Chicago Press.
- Tinto, V. (1999). *Taking retention seriously: Rethinking the first year of college*. *NACADA Journal*, 19(2), 5-9.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge MA: Harvard University Press.
- Wang, A. Y., & Newlin, M. H. (2002). Predictors of web-student performance: The role of self-efficacy and reasons for taking an on-line class. *Computers in Human Behavior*, 18, 151-163.

Bruno Poellhuber M.Ps., Ph.D. is a Professor in collegial pedagogy at the University of Montreal. He worked as a pedagogical advisor in the Quebec CEGEP network for 15 years, at Cegep@distance and elsewhere. His current research activities and interests focus on different uses of ICT in education, persistence in open and distance learning, social software and pedagogical innovation models. E-mail: bruno.poellhuber@umontreal.ca

Martine Chomienne is a senior instructional designer and researcher at Cegep@distance. She received her PhD in education from Concordia University, in 1987. Her more recent research interests focused on online tutoring to enhance peer collaboration and socioconstructivism approach to learning. E-mail: chomiennema@sofad.qc.ca

Thierry Karsenti, M.A., M.Ed., Ph.D. is Director of the Centre de recherche interuniversitaire sur la formation et la profession enseignante (CRIFPE). Besides holding the Canada Research Chair in ICT in Education, he is also a Full Professor at the University of Montreal. His research interests lie in the areas of integration of new technologies into education, educational practices for teachers, open and distance learning, and motivation techniques. E-mail: thierry.karsenti@umontreal.ca
