PERCEIVED COLLECTIVE EFFICACY, SUBJECTIVE WELL-BEING AND TASK PERFORMANCE AMONG ELECTRONIC WORK GROUPS
An Experimental Study

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This study investigates the effects of e-groups on well-being and performance, using a collective approach and an objective performance indicator. Furthermore, it includes collective efficacy as a moderator and negative (anxiety) as well as positive (engagement) well-being. A lab experiment with an interval of 3 weeks was performed among 140 students who were randomly distributed across 18 groups using a chat-internet program and 10 groups working face to face. Half the groups performed under time pressure. Results confirm the moderating role of perceived collective efficacy on well-being and task performance. All groups working under time pressure and low in collective efficacy show an increase in collective anxiety. Chat-internet groups under time pressure show an increase in collective engagement but only when they feel high in collective efficacy. Finally, task performance was poorer in chat groups, working under time pressure, and with low levels of collective efficacy than in the other groups.

Keywords: electronic groups; collective efficacy; subjective well-being; task performance; collective engagement

SMALL GROUP RESEARCH, Vol. 34 No. 1, February 2003 43-73
DOI: 10.1177/1046496402239577

Two major changes may be observed in today's organizations. Information and communication technologies (ICTs) are rapidly implemented and employees are working in groups rather than individually. Modern ICTs include shared computer-based databases; electronic mail and Intranets; the Internet; computer-supported cooperative work (CSCW); group communication support systems (GCSS); and video-mediated communication systems (Hollingshead, McGrath, & O'Connor, 1993; Symon, 2000). These technologies produce changes in how individuals communicate with each other. For instance, the technological system that we are focusing on in this study modifies within-group communication. We use a "chat-internet" system that synchronically links group members who do not have to meet face to face and may be at different places. This new way to organize the work (i.e., so-called electronic work groups or e-groups) may have negative or positive effects on users' subjective well-being and task performance. For example, although such technologies may make collaboration between dispersed group members more convenient, electronic groups are also exposed to job demands such as time pressure.

Typically, research on e-groups is cross-sectional and nonexperimental so that no causal inferences can be made. Furthermore, research designs are relatively simple, for instance, without considering individual moderator effects. This study investigates the moderating role of perceived collective efficacy between group communication systems (GCSs) (i.e., chat vs. face to face) and time pressure on collective well-being (i.e., anxiety and engagement) and task performance. On a more general level, we attempt to bridge the gap between two research traditions on group communication support systems and job stress, respectively.

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PERCEIVED COLLECTIVE EFFICACY

People differ in beliefs about their competence and success in different domains of their life. Bandura (1997, 1999, 2001) called these cognitions "self-efficacy," which are "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Bandura's (1999) social cognitive theory assumes that the individual's beliefs in his or her own coping efficacy determines how much strain is experienced when demanding situations occur. For instance, research on job burnout shows the potential moderating effect of self-efficacy as a buffering variable (Leithwood, Menzies, Jantzi, & Leithwood, 1996; Rabinowitz, Kushnir, & Ribak, 1996; Salanova, Grau, Cifre, & Llorens, 2000; Salanova, Peiró, & Schaufeli, 2002; Van Yperen, 1998).

Recent developments in self-efficacy research call attention to the degree of specificity of self-efficacy and perceived collective efficacy (Bandura, 1999, 2001; Eden & Zuk, 1995; Gist & Mitchell, 1992; Lent & Hackett, 1987). It seems that more robust results are obtained when domain-specific rather than general measures of self-efficacy are used (Bandura, 1997; Brouwers & Tomic, 2000; Maibach & Murphy, 1995; Salanova et al., 2000, 2002). The reason is that self-efficacy beliefs are domain specific; a person's self-efficacy belief is likely to differ depending on the activity to which it is related (Bandura, 1997, 1999). Regarding the "collective" nature of efficacy beliefs, social cognitive theory recently extended the conception of human agency to collective agency. Perceived collective efficacy is defined as a group's shared belief in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainment (Bandura, 1997). As Bandura (1999) stressed, group performance is the product of interactive and coordinated dynamics of its members. Therefore, perceived collective efficacy is not simply the sum of the efficacy beliefs of individual members. Rather, it is an emergent group-level property. Although individual and collective efficacy differ in their unit of agency, both efficacy beliefs serve similar functions and operate through similar processes (Bandura, 2001). For example,

research has shown that the stronger the belief people hold about their collective capabilities, the more the group achieves. It was found that a strong collective sense of efficacy fosters high group effort and task performance (Bandura, 1993; Gibson, 1995; Hodges & Carron, 1992; Little & Madigan, 1994; Prussia & Kinicki, 1996; Sampson, Raudenbush, & Earls, 1997). Additionally, similar to the individual-level efficacy beliefs, group-level efficacy beliefs may buffer occupational stress by providing group members with social support when dealing, for instance, with new technological systems and/or when under time pressure (Cohen & Wills, 1985; Gore, 1987). Also, perceived collective efficacy may have a buffering effect by providing group members with the means necessary to actually reduce job demands (Beehr, 1995; Jex & Bliese, 1999). Moreover, similar to individual self-efficacy, a strong sense of perceived collective efficacy may boost collective well-being as well as group task performance (Jex & Bliese, 1999; Schaubroeck, Lam, & Xie, 2000).

In the current study, we use a collective domain-specific measure of perceived efficacy (i.e., specific to group task) that is supposed to moderate between the GCS time pressure on collective well-being and group task performance.

SUBJECTIVE WELL-BEING

Research on effects of technology on well-being and job stress is abundant; however, it is mainly focused at the individual level (i.e., user's reactions). Initially, research results were mixed; negative (i.e., computer anxiety) as well as positive (i.e., satisfaction) consequences of technology use were observed (Chua, Chen, & Wong, 1999; Igbaria & Chakrabarti, 1990; Jones & Wall, 1990; Kay, 1990; Todman & Monaghan, 1994). It became clear that two variables were moderating these mixed results: the user's technology experience and the psychosocial factors.

Hollingshead et al. (1993) developed the "change model" to stress the role played by the technology experience to explain the adaptation to new technology. When a group uses some new technology (i.e., chat), this change is likely to affect group task performance, the interaction process, and the members' psychological reactions. During change, the group needs to devote extra time to solving technical problems and interpersonal conflicts. Hence, compared to familiar face-to-face groups that do have to deal with any change, e-groups will spend much more time mastering problems and conflicts in their first meetings. Indeed, as predicted by their model, e-groups (i.e., groups using e-mail) reported significantly lower satisfaction with the task and performed significantly less well in the first two meetings, compared to face-to-face groups. However, during the next several weeks, no differences were observed between the two media. Also, anxiety is related to technology experience. Results show that computer anxiety decreases when users have more experience with computers (Chua et al., 1999).

In addition, research shows no main effect of technology on subjective well-being; instead, a moderating effect is observed of psychosocial factors, such as the positive attitudes toward technology (Korunka & Vitouch, 1999; Leso & Peck, 1992; Salanova & Schaufeli, 2000) and self-efficacy beliefs (Salanova et al., 2000, 2002). In other words, when users experience high levels of self-efficacy, negative effects of technology on well-being do not occur. For instance, Salanova and Schaufeli (2000) found that the mere experience with technology (i.e., time using new technology and the frequency of its use) is not directly related with levels of burnout but is mediated by the appraisal of this experience.

So far, research on the impact of ICT is almost exclusively focused on its negative effects (i.e., job stress). Instead of looking exclusively to the negative pole, researchers in the broader area of job stress recently extended their interest to the positive pole of workers' well-being. This development reflects an emerging trend toward a "positive psychology" that focuses on human strengths and optimal functioning rather than on weaknesses and malfunctioning (Seligman & Csikszentmihalyi, 2000; Sheldon & King, 2001). For instance, recently, engagement has been identified as the opposite pole of burnout (Maslach, Schaufeli, & Leiter, 2001). It is defined as a "positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption" (Schaufeli,

Salanova, González-Romá, & Bakker, 2002, p. 74). Vigor is characterized by high levels of energy and mental resilience while working, the willingness to invest effort in one's work, and persistence even in the face of difficulties. Dedication is characterized by a sense of significance, enthusiasm, inspiration, pride, challenge, and absorption and refers to being fully concentrated and engrossed in one's work, whereby time passes quickly and one has difficulties with detaching oneself from work. The present study focuses on both negative (i.e., collective anxiety) and positive (i.e., collective engagement) aspects of collective well-being in work groups.

TASK PERFORMANCE

According to the richness of information theory and task-media fit theory (Daft & Lengel, 1986; McGrath & Hollingshead, 1993), different technologies permit different information cues (e.g., verbal, auditory, nonverbal, etc.) to be transmitted. Also, different kinds of tasks (e.g., idea generation, intellective, decision making) require different information cues. For instance, in negotiation tasks, the nonverbal cues are very important for the output of the negotiation, and computer-based systems are limited in their ability to transmit these cues. This means that the effectiveness of a communication medium for a given task depends on the degree to which there is a fit between the richness of information that can be transmitted via that system and the information richness requirements of that given task. In this study, we used intellective tasks. These tasks require group members to find a demonstrably correct answer (Laughlin & Ellis, 1986). According to the task-media fit theory, the best technology system for such tasks is an audio-video system (no e-mail or face-to-face interaction). Unfortunately, research has shown mixed results that only partially support the assumption of the task-media fit theory. For example, Hollingshead et al. (1993) found that groups working face to face performed significantly better than e-groups for intellective tasks and only over time did these media differences disappear for later meetings on intellective tasks. Only in the first meetings were there significant differences on task performance. These results suggest that it is the

newness of the medium (i.e., technology system) and not the type of task that led to poorer task performance for computer groups in the first meetings. As far as we know, there are no studies about the moderating role that variables such as perceived collective efficacy may play in the relationship between ICTs and task performance. According to empirical research based on social cognitive theory, it is expected that perceived collective efficacy plays such a moderating role.

On the other hand, despite the obvious importance of the effect of time pressure on the functioning of work groups, it has only scarcely been researched (e.g., Svenson & Maule, 1993). Traditionally, time pressure is considered a job demand with negative consequences on work and individual well-being (Garst, Frese, & Molenaar, 2000). Results about the relationship between time pressure and task performance are mixed. A positive linear relationship is observed; namely, the more time pressure, the better the group's performance (McCann, Baranski, Thompson, & Pigeau, 2000). But a negative lineal relationship is observed as well; the more time pressure, the poorer the group's performance (Davis, 1969; Karau & Kelly, 1992; Kelly & McGrath, 1985; Yukl, Malone, Hayslip, & Pamin, 1976). In addition, other studies show a curvilinear relationship, that is, high and low time pressure are associated with poor performance (Isenberg, 1981) or no significant relationship at all (Kelly & Karau, 1993; Sethi, 2000). Not surprisingly, research has shown that the relationship between time pressure and group performance is moderated by variables such as type of group task (i.e., innovative, intellective, and negotiation task), technology system (i.e., face to face, e-mail, and videoconferencing), and individual characteristics (i.e., personality) (Davis, 1969; Gracia, Arcos, & Caballer, 2000; Heaton & Krublanski, 1991; Hollingshead et al., 1993). For instance, in intellective tasks, the time pressure is negatively associated with task performance (Davis, 1969; Gracia et al., 2000). And groups working with e-mail had a significantly poorer performance compared to face-to-face and videoconferencing groups when under time pressure (Gracia et al., 2000). As far as we know, there are no studies about the moderating role of perceived collective efficacy between time pressure and task performance in

groups working with different communication systems (i.e., electronic and face-to-face groups). According to Bandura's (1999) social cognitive theory, it is expected that perceived collective efficacy will moderate this relationship.

OBJECTIVE AND HYPOTHESES

This study explores the moderating role of perceived collective efficacy between GCS and time pressure on collective well-being (i.e., anxiety and engagement) and task performance. More particularly, we expect the following:

Subjective Well-Being

Hypothesis 1a: An interaction effect of GCS by perceived collective efficacy on collective well-being (anxiety and engagement). The combination of a chat system and low levels of perceived collective efficacy will lead to an increase in collective anxiety and a decrease in collective engagement.

Hypothesis 1b: An interaction effect of time pressure (time pressure vs. no time pressure) by perceived collective efficacy on collective well-being. The combination of time pressure and low levels of perceived collective efficacy will lead to an increase of collective anxiety and a decrease of collective engagement.

Hypothesis 1c: An interaction effect of GCS × Time Pressure × Perceived Collective Efficacy on collective well-being. The combination of a chat system, time pressure, and low levels of perceived collective efficacy will lead to an increase of collective anxiety and a decrease of collective engagement.

Task Performance

Hypothesis 2a: An interaction effect of GCS by perceived collective efficacy on task performance. The combination of a chat system and low levels of perceived collective efficacy will lead to the poorer task performance.

Hypothesis 2b: An interaction effect of Time Pressure × Perceived Collective Efficacy on task performance. The combination of time pressure and low levels of perceived collective efficacy will lead to the poorer task performance.

Hypothesis 2c: An interaction effect of GCS × Time Pressure × Perceived Collective Efficacy on task performance. The combination of a chat system, time pressure, and low levels of perceived collective efficacy will lead to the poorer task performance.

METHOD

PARTICIPANTS, DESIGN, AND PROCEDURE

One hundred forty students of psychology at University Jaume I, Spain, were randomly distributed to the study's 2 (chat vs. face to face) × 2 (time pressure vs. no time pressure) × 2 (Time 1 vs. Time 2) repeated measures longitudinal design. The last factor (time) was treated within subjects. The participation was voluntary and the experimental sessions were run in 28 groups of 5 students. Their mean age was 23.7 years ($SD = 3.09$); 128 females (91.6%) and 12 males (8.4%) were included.

The experimental manipulation of GCS as the first independent factor was performed randomly. Eighteen groups performed the tasks using a chat communication system, and 10 groups performed the tasks using a face to face communication system. The experimental sessions for chat groups were performed in a test-room with an Intranet linking five workstations at which the chat-internet miRC32 groupware was installed. Each member could only interact with another group member using the computer. The other groups (i.e., face to face) performed the same tasks as the chat groups but they did not use any electronic system to interact; instead, they interacted directly.

To vary time pressure (the second independent factor), half of the groups in each condition (chat vs. face to face) were performing the task without time pressure, whereas the remaining groups performed the task under time pressure. The procedure to induce time pressure was the following. First, half of the groups performed the task without time pressure. Second, the experimenters measured the total time spent to solve the task and then calculated the average time that groups used to solve the task correctly. Third, they deleted

the best and the worst time, so they got two times—one time for chat groups and another time for face to face groups. These times were considered deadlines for the rest of the groups that afterward were working in the condition time pressure.

All groups met during two experimental sessions performing the same tasks but with different GCSs and with and without time pressure. Because in the chat groups students had to work with a computer, they received short instructions and training about the workstation and the chat system.

The first task was an idea generation task. This task was also used as a training task. Participants had to come up with a slogan to promote the house sale in a specific area. The task was performed twice: individually and in a group. The individual task consisted of formulating three slogans without interacting with any other group member. Afterward, participants communicated with each other (using chat or face to face interaction) and groups discussed the five best slogans.

After 3 weeks, the same groups met again in the second experimental session. This time, groups performed an intellective task: to associate the name, surname, and job of four employees from a company. Each member had partial and complementary instructions to solve the task so that all information should be brought together in the group to be able to solve the task correctly. To avoid communication between groups about the right solution to the task, the experimenters varied the names, surnames, and jobs of the intellective task in each group. A small fee was promised for the best performance of two groups (i.e., the chat groups and face to face groups).

After finishing each task, participants filled out a questionnaire (see next section).

MEASURES

Perceived collective efficacy was measured with four items of the Generalized Self-Efficacy assessment by Schwarzer (1999; see also Scholz, Gutiérrez-Doña, Sud, & Schwarzer, 2002). In this study, the scale was slightly adapted for use in work groups (i.e., collective efficacy). For instance, instead of "I can solve most problems if I invest the necessary effort," the wording was changed to "My group can solve difficult tasks if we invest the necessary effort" (see Appendix A). The items ranged from 1 (*never*) to 5 (*most of the time*). The α coefficient of perceived collective efficacy was .77 at Time 1 and .88 at Time 2.

Collective anxiety was assessed with the Anxiety-Contentment scale developed by Warr (1990). In the original scale, high scores indicate levels of job-related anxiety. Respondents are asked to think of the past few weeks and indicate the extent to which they felt tense, uneasy, worried, calm, contented, and relaxed. Scores ranged from 1 (*never*) to 6 (*all the time*). Scores on the last three emotions are reversed. In the current study, the scale also was slightly adapted for use in work groups (i.e., collective anxiety). For instance, instead of "During the past few weeks *I felt* tense," it became "During the task *my group* felt tense." The α coefficient was .80 at both times (i.e., Time 1 and Time 2), thus meeting the criterion of .70 (Nunnaly & Bernstein, 1994).

Collective engagement was assessed with the Engagement Questionnaire (24-item version) by Schaufeli et al. (2002) that also was slightly adapted for use in work groups (i.e., collective engagement). For instance, instead of "When I'm working, I forget everything around me," the wording became "When my group was working, we forgot everything else around us" (see Appendix B). Collective engagement consists of 18 items, ranging from 1 (*never*) to 5 (*most of the time*). They are scored on three scales: Vigor (seven items; e.g., "During the task, my group felt full of energy"); Dedication (four items; e.g., "My group felt enthusiastic about the task"), and Absorption (seven items; e.g., "Time was flying when my group was working"). We did not include five items from the original questionnaire, because the adaptation to the collective scales was difficult (i.e., "When I get up in the morning, I feel like going to work"). The α coefficients for collective vigor were .76 at Time 1 and .80 in Time 2. The α coefficients for collective dedication were .75 at Time 1 and .78 in Time 2. After removing one item (i.e., "My group was proud of the task"), the initial α coefficient of

collective absorption was substantively increased to .70 (Time 1) and .80 (Time 2).

Task performance was measured at Time 2 when groups performed an intellective task. The task performed at Time 1 was used as a training method. Groups had to associate the name, surname, and job for four employees in a company. This variable ranged from 0 (no right answers), 1 (only one name-surname-job fitted), 2 (two names-surnames-job fitted), 3 (three—and as exclusion four—names-surnames-job fitted).

RESULTS

To test if participants in the experiment differed on previous use of chat-internet, a chi-square test was carried out that compared participants' previous experience with chatting in both conditions (chat vs. face to face). Results indicated that both groups do not differ significantly on previous chat software use, $\chi^2 = 0.22$, $df = 1$; $p = .70$. Therefore, it was decided to use the entire sample for testing our hypotheses. Next, descriptive statistics were computed. Table 1 shows mean values, standard deviations, and intercorrelations of all scales used in this study.

As expected, the three collective engagement scales are positively interrelated, and they are also positively related to perceived collective efficacy. Results are similar for Time 1 and Time 2, but at Time 2, correlations with self-efficacy are slightly higher. Furthermore, collective anxiety is negatively related to perceived collective efficacy and to the three collective engagement scales (except collective absorption at Time 1 and collective vigor at Time 2). Task performance is positively related with perceived collective efficacy and with collective dedication and negatively related with collective anxiety in Time 1. A similar pattern was observed at Time 2, except that in addition, task performance was positively related to collective vigor.

TABLE 1: Means, Standard Deviations, and Zero-Order Correlations ($N = 140$)

	M		SD								
Variables	*Time 1*	*Time 2*	*Time 1*	*Time 2*	*1*	*2*	*3*	*4*	*5*	*6*
1. Collective efficacy	4.24	4.30	.47	.62	(.43)	-.46	.56	.70	.55	.25
2. Collective anxiety	2.34	2.60	.76	.95	-.24	(.58)	*ns*	-.50	-.33	-.23
3. Collective vigor	3.85	3.82	.55	.60	.37	-.17*	(.43)	.77	.74	.22
4. Collective dedication	4.14	4.11	.53	.67	.43	-.21*	.78	(.43)	.72	.27
5. Collective absorption	3.90	3.75	.50	.61	.40	*ns*	.76	.74	(.44)	*ns*
6. Task performance (Time 2)		2.23		.94	.27	-.27	*ns*	.25	*ns*	—

NOTE: Below the diagonal (Time 1) and above the diagonal (Time 2). Between parentheses correlations Time 1-Time 2.
*$p < .05$. All remaining correlations are significant at the $p < .001$ level.

HYPOTHESIS TESTING (subjective well-being)

Perceived collective efficacy at Time 1 (and not in Time 2) was used as the moderating variable in all analyses because it refers by definition to future group outcomes.

To test Hypotheses 1a, 1b, and 1c concerning the combined effects of the GCS, time pressure, and perceived collective efficacy on well-being, a repeated measurement MANOVA was carried out with three between-group variables (chat/face to face, time pressure/no time pressure, levels of perceived collective efficacy) and one within-group variable (Time 1/Time 2). Collective anxiety, collective vigor, collective dedication, and collective absorption were used as dependent variables. Multivariate results (Wilks's lambda) show a significant two-way interaction effect of Time Pressure × Perceived Collective Efficacy, $F(4, 126) = 2.56$, $p = .04$, and a significant three-way interaction effect of GCS × Time Pressure × Perceived Collective Efficacy, $F(4, 126) = 2.11$, $p = .05$. Subsequent univariate tests show a significant two-way interaction effect of Time Pressure × Perceived Collective Efficacy on collective anxiety, $F(1, 131) = 2.82$, $p = .05$ (see Figure 1). No significant effects were observed on the three dimensions of collective engagement.

As can be seen from Figure 1, groups with low perceived collective efficacy that are under time pressure show an increase of collective anxiety over time ($M = 3.0$ at Time 1 vs. $M = 3.5$ at Time 2). In addition, groups reporting low levels of perceived collective efficacy (with time pressure and without time pressure) showed the highest levels of collective anxiety at both Time 1 and Time 2.

Moreover, a significant three-way interaction effect was observed of GCS × Time Pressure × Perceived Collective Efficacy (see Table 2). Subsequent univariate tests show significant effects on collective vigor, $F(1, 131) = 2.94$, $p = .05$, and close to .05 on collective dedication, $F(1, 131) = 2.47$, $p = .07$, but not on collective anxiety and collective absorption. The significant interaction effect on collective vigor is graphically represented in Figure 2 for high and low levels of perceived collective efficacy.

When we compare both graphs, groups with high collective efficacy clearly show higher levels of collective vigor than groups with

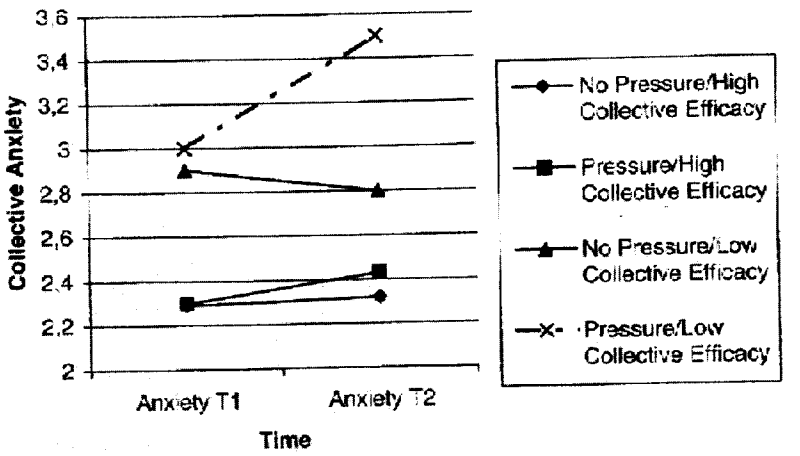

Figure 1: Within-Subjects Effect: Time Pressure × Perceived Collective Efficacy on Collective Anxiety ($N = 140$)

low collective efficacy. However, the patterns of changes from Time 1 to Time 2 are different between groups, depending on GCS and time pressure. Whereas groups working without time pressure decreased on collective vigor (independently of GCS and collective efficacy) groups working under time pressure show different patterns of change depending on the GCS used and the levels of collective efficacy. That is, groups working face to face showed an increase of collective vigor from Time 1 to Time 2 when collective efficacy was high ($M = 4.09$ at Time 1 vs. $M = 4.28$ at Time 2) but also when collective efficacy was low ($M = 3.0$ at Time 1 vs. $M = 3.61$ at Time 2). However, whereas chat groups working under time pressure show an increase in collective vigor from Time 1 to Time 2 ($M = 3.87$ at Time 1 vs. $M = 4.34$ at Time 2) when collective efficacy is high, they show a small decrease in collective vigor from Time 1 to Time 2 ($M = 3.7$ at Time 1 vs. $M = 3.6$ at Time 2) when collective efficacy is low. Hence, working with a chat system under time pressure increases the levels of collective vigor but only when groups feel highly efficacious. A similar pattern of results was observed for collective dedication (see Figure 3).

TABLE 2: Multivariate Analysis of Variance (MANOVA) With Repeated Measures Time 1-Time 2 (N = 140)

	Multivariate Test (Wilks's Lambda)		Univariate Test							
			Collective Anxiety		*Collective Vigor*		*Collective Dedication*		*Collective Absorption*	
Within-Subjects Test	F	p	F	p	F	p	F	p	F	p
Time	0.81	.51	0.01	.99	1.81	.18	1.31	.25	2.81	.09
Group communication system (GCS)	0.67	.61	1.21	.27	1.65	.20	1.54	.21	2.11	.14
Time pressure	**2.37**	**.05**	2.21	.10	0.06	.94	0.80	.37	1.41	.23
Collective efficacy	0.92	.45	0.07	.78	1.73	.19	1.20	.27	3.58	.06
GCS × Time Pressure	1.87	.12	0.98	.32	2.84	.09	2.35	.12	0.09	.75
GCS × Collective Efficacy	0.43	.78	1.01	.31	0.61	.43	0.65	.41	1.25	.26
Time Pressure × Collective Efficacy	**2.56**	**.04**	**2.81**	**.05**	0.01	.98	0.81	.36	1.50	.22
GCS × Time Pressure × Collective Efficacy	**2.11**	**.05**	1.56	.21	**2.94**	**.05**	**2.47**	**.07**	0.10	.75

NOTE: Significant effects are printed in bold numerals.

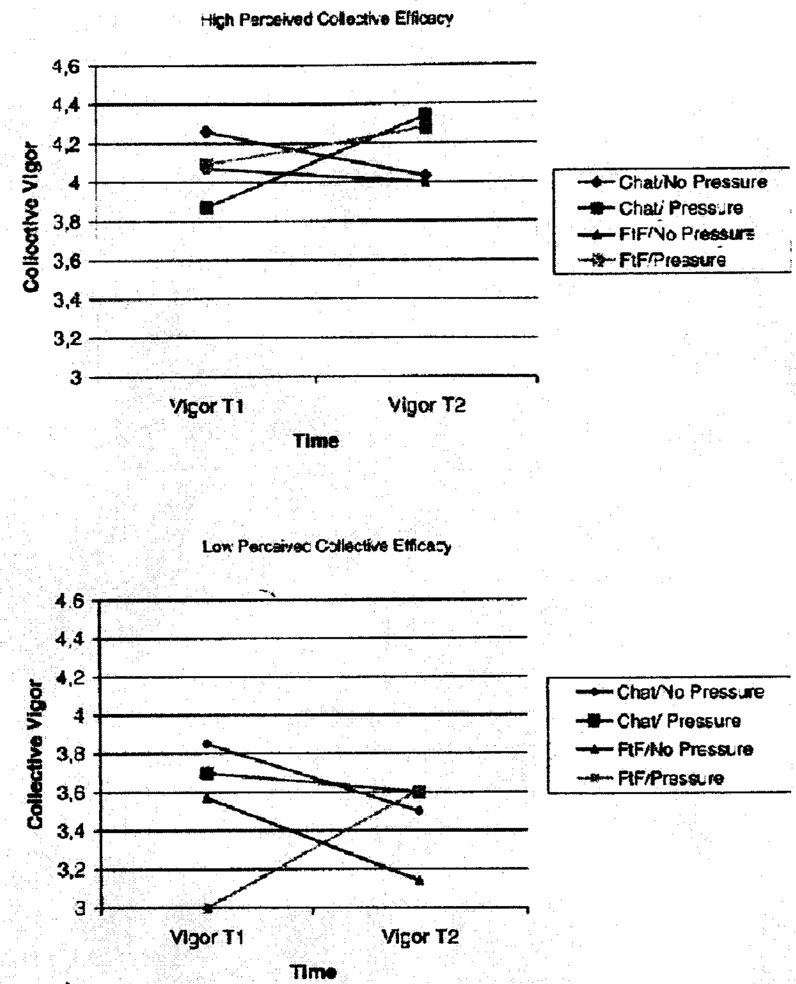

Figure 2: Within-Subjects Effect: Group Communication System × Time Pressure × Perceived Collective Efficacy on Collective Vigor (N = 140)
NOTE: FtF = face to face communication system.

Groups working under time pressure also show different patterns of change on collective dedication depending on GCS used and the level of perceived collective efficacy. Groups working face to face show an increase of collective dedication from Time 1 to Time 2. As with collective vigor, this holds for groups with high

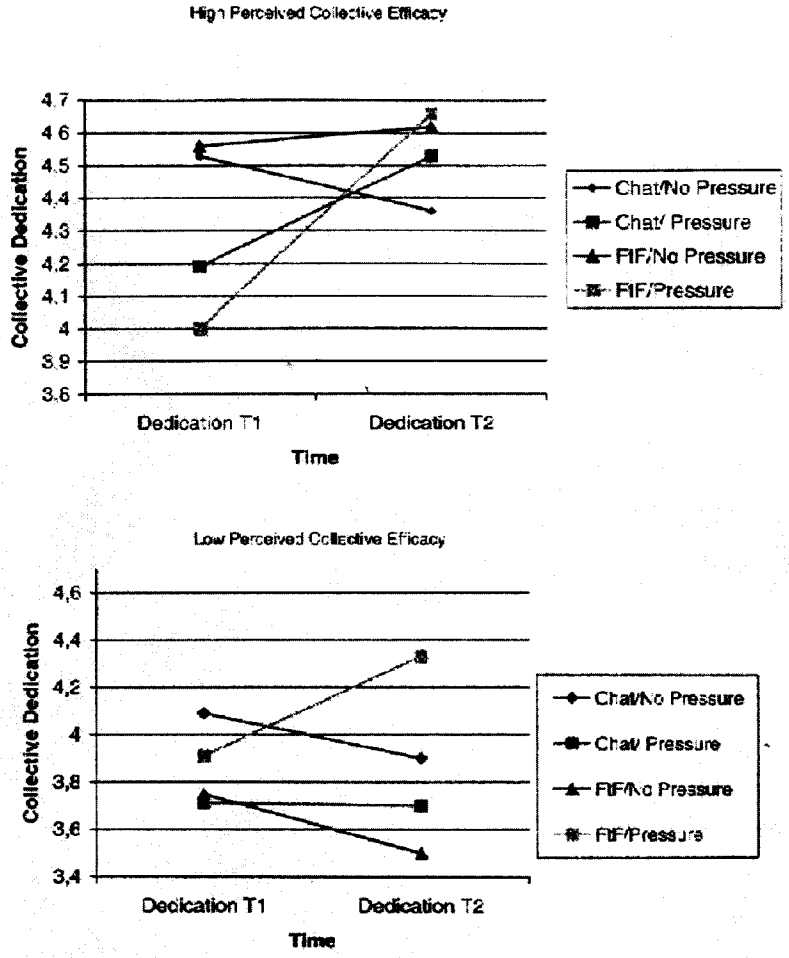

Figure 3: Within-Subject Effect: Group Communication System × Pressure × Perceived Collective Efficacy on Collective Dedication (N = 140)

NOTE: FtF = face to face communication system.

collective efficacy (M = 4.0 at Time 1 vs. M = 4.66 at Time 2) as well as for groups low in collective efficacy (M = 3.91 at Time 1 vs. M = 4.33 at Time 2). However, the pattern is also different for groups working with chat under time pressure. Although these groups show an over time increase on collective dedication from Time 1 to Time 2 (M = 4.19 at Time 1 vs. M = 4.53 at Time 2) when collective efficacy is high, they show a small over time decrease on collective dedication from Time 1 to Time 2 (M = 3.71 at Time 1 vs. M = 3.70 at Time 2) when collective efficacy is low. Thus, working with chat under time pressure increases levels of collective dedication but only when groups feel highly efficacious. So far, these results are similar to collective vigor. However, compared with collective vigor, the pattern of results in groups working without time pressure is different for collective dedication. Whereas face-to-face groups show high levels of collective dedication when collective efficacy is high, with even a little over time increase from Time 1 to Time 2 (M = 4.56 at Time 1 vs. M = 4.62 at Time 2), they show low collective dedication when collective efficacy is low, with an over time decrease from Time 1 to Time 2 (M = 3.75 at Time 1 vs. M = 3.5 at Time 2). Thus, working face to face without time pressure decreases levels of collective dedication but only when groups feel low in collective efficacy.

To sum up, Hypothesis 1a was not supported because no two-way interaction effect of GCS and perceived collective efficacy was found. Regarding Hypothesis 1b, it was supported for collective anxiety but not for collective engagement. The combination of time pressure and low levels of perceived collective efficacy leads to the strongest increase of collective anxiety over time. Hypothesis 1c was partially supported because the multivariate test was significant, but the direction of results was unexpected. However, an interesting pattern of results emerged regarding the moderating role of perceived collective efficacy. These results will be discussed later.

Finally, we found another unexpected result, namely, an over time multivariate main effect of time pressure, $F(4, 126) = 2.37$, $p = .05$. However, subsequent univariate testing revealed no significant differences on any dimensions of collective well-being.

HYPOTHESIS TESTING (task performance)

To test Hypotheses 2a, 2b, and 2c, we analyzed the average on task performance at Time 2 using a 2 (chat vs. face to face) × 2 (time pressure vs. no time pressure) ANOVA (see Table 3).

TABLE 3: Univariate Analysis of Variance (ANOVA) ($N = 140$)

	Task Performance	
	F	p
Group communication system (GCS)	1.74	.19
Time pressure	**3.41**	**.04**
Collective efficacy	2.12	.14
GCS × Time Pressure	1.07	.25
GCS × Collective Efficacy	1.05	.30
Time Pressure × Perceived Collective Efficacy	2.21	.13
GCS × Time Pressure × Collective Efficacy	**2.91**	**.05**

NOTE: Multiple $R = .51$; $R^2 = .2$. Significant effects are printed in bold numerals.

We found a three-way interaction effect of GCS × Time Pressure × Perceived Collective Efficacy on task performance, $F(1, 134) = 2.91, p = .05$. This significant interaction effect is graphically represented in Figure 4.

As we expected (Hypothesis 2c), the combination of Chat System × Time Pressure × Low Level of Perceived Collective Efficacy leads to poorer task performance ($M = 1.15$) compared with all other groups working under pressure: chat/high perceived collective efficacy ($M = 2.0$), face-to-face/low perceived collective efficacy ($M = 2.33$), and face-to-face/high perceived collective efficacy ($M = 3.0$). Working under pressure leads to the best performance when groups are working face to face with high levels of perceived collective efficacy. In this case, time pressure seems to improve task performance. On the other hand, working without time pressure brings leads to good performance when groups interact face-to-face and experience low levels of perceived collective efficacy. The best performance was achieved by face-to-face groups working *under* time pressure with high levels of perceived collective efficacy ($M = 3.0$) and face-to-face groups working *without* time pressure with low levels of perceived collective efficacy ($M = 3.0$).

To sum up, Hypotheses 2a and 2b were not supported and 2c was supported. Finally, against expectations, there was a significant main effect of time pressure on task performance, $F(1, 134) = 3.41$, $p = .04$. Groups working without time pressure performed significantly better ($M = 2.6$) than groups working under time pressure ($M = 1.8$).

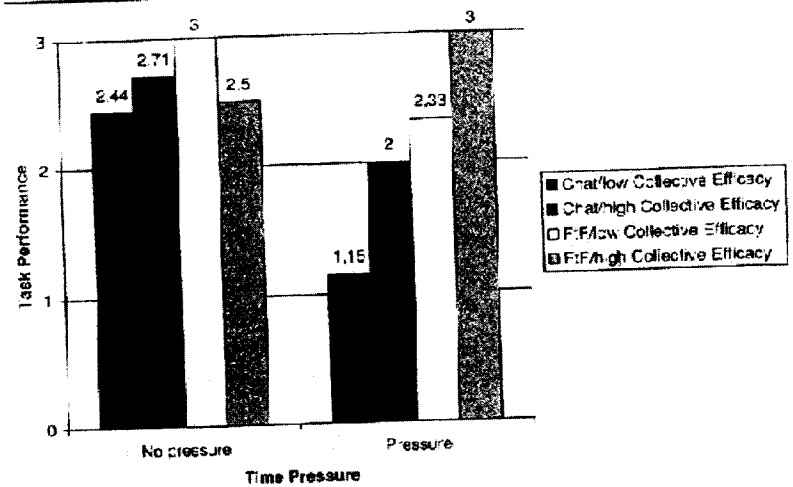

Figure 4: Interaction Effect Group Communication System × Pressure × Perceived Collective Efficacy on Task Performance ($N = 140$)

NOTE: FtF = face to face communication system.

DISCUSSION

This study explored the moderating role that perceived collective efficacy plays in the relationship between GCSs (i.e., chat/face-to-face systems) and time pressure on collective subjective well-being (i.e., anxiety and engagement) and task performance. Two sets of similar hypotheses were tested for each outcome: well-being and performance. Our results corroborated the potential moderating effect of perceived collective efficacy, thus confirming the main assumptions of the current experimental study. So far, high levels of perceived collective efficacy buffered the negative effects of chat use and time pressure on collective well-being and task performance. This result is confirming the basic assumption of the social cognitive theory because collective confidence in the group's future efficacy determines levels of collective well-being and task performance. In the current study, collective self-efficacy clearly acts as a moderator in the relationship between demands (i.e., using chat technology and working under time pressure) and subjective well-being and task performance.

THEORETICAL IMPLICATIONS

The theoretical relevance of our findings is fourfold. First, our results illustrate the robustness of perceived collective efficacy as a moderator variable. More specifically, it appeared that collective efficacy measured at Time 1 affected subjective well-being and task performance at Time 2, but a similar effect of collective efficacy measured at Time 2 was not observed. This confirms the future orientation of perceived collective efficacy, as was formulated in Bandura's (1999) social cognitive theory. However, the effects on subjective well-being were different depending on the nature of the dimension of subjective well-being (i.e., negative or positive). Regarding the negative dimension (i.e., collective anxiety), we found an interaction effect of time pressure and perceived collective efficacy but no effects on collective engagement. On the other hand, the three-way interaction effect of GCS, time pressure, and perceived collective efficacy was exclusively found for the positive dimensions of subjective well-being (i.e., collective engagement). Furthermore, the pattern of results obtained was different depending on the collective engagement dimension under study. For example, in e-groups working under pressure, levels of collective vigor and dedication developed differently across time depending on the level of perceived collective efficacy. That is, in the case of collective engagement, perceived collective efficacy buffers the effects of time pressure on collective vigor and dedication. However, we did not find any significant interaction effects with collective absorption. As a matter of fact, compared to both other dimensions of engagement, this dimension showed a slightly different pattern of results in other studies as well (see Schaufeli et al., 2002).

Second, our research extends current models of e-groups on users' reactions and task performance. Specifically, our results may expand the Model of Change as formulated by Hollingshead et al. (1993) by taking into account the influence of other variables (i.e., time pressure and perceived collective efficacy) in the relationship between ICTs on group outcomes. According to this model, it is expected that during the first meetings, e-groups will have a poorer performance compared to groups working face to face (i.e., the novelty effect of new technology). However, in the current study at Time 2, no significant difference was observed on subjective well-being and task performance between e-groups and face to face (i.e., no main effects of GCSs were found). Only when more variables in the model (i.e., time pressure and perceived collective efficacy) are taken into account, differences were found between e-groups and face-to-face groups on subjective well-being and task performance. Future research on this topic would include these variables as well, in order to understand the complex dynamics involved in these relationships.

Third, our research contributes to the literature on time pressure as a powerful demanding factor in work groups. The current study confirms the detrimental effects of time pressure on work groups. A main effect of time pressure on task performance was found. Groups working under time pressure performed their task less well compared to groups working without time pressure. Similar results were found in other studies (see Davis, 1969; Karau & Kelly, 1992; Kelly & McGrath, 1985; Yukl et al., 1976). However, e-groups working under time pressure do perform worse and feel less well only when we take into account perceived collective efficacy. This means that e-groups and face-to-face groups do not differ significantly on task performance and subjective well-being, when taking only time pressure into account. Different results were found by Gracia et al. (2000), who observed a two-way interaction effect of technology system and time pressure on the performance of an intellective task. However, they used other technology systems in their study, such as e-mail and videoconferencing and not a chat system. Future studies must confirm current results using chat systems and even other GCSs (i.e., computer-supported cooperative work groupware).

Finally, an interesting pattern emerges when we take into account psychological moderator variables (i.e., perceived collective efficacy) on task performance. As with subjective well-being, we found a three-way interaction effect of GCS × Time Pressure × Perceived Collective Efficacy on task performance. As expected, the e-groups working under time pressure and feeling less collectively self-efficacious performed their task less well than the remaining

groups. On the other hand, the best-performing groups working under time pressure were for face-to-face groups feeling highly efficacious. Time pressure seems to be a powerful obstacle for a good group performance that also contributes to more collective anxiety. But time pressure is especially an obstacle for e-groups' performance when groups shared negative collective beliefs about themselves.

PRACTICAL IMPLICATIONS

Research suggests some advantages when implementing GCSs in the workplace; for example, these synchronous electronic systems make groups work with more flexibility and autonomy. However, we should keep in mind some troubles as well. A main conclusion of this study is that introducing new GCSs may have detrimental effects on collective anxiety and task performance, especially when groups are working under time pressure with low levels of perceived collective efficacy. On the other hand, in the same condition (e-groups working under pressure), high levels of perceived collective efficacy increase collective engagement (i.e., collective vigor and dedication). Time pressure could be not only a powerful job demand but also a challenge for groups feeling highly efficacious. However, our results may picture a positive scenario as well (i.e., to increase perceived collective efficacy) because they point in the direction of buffering the negative effects of time pressure, especially when new GCSs are being implemented at the workplace. Remember that effects were observed of Time 1 perceived collective efficacy on Time 2 outcomes (collective well-being and task performance). It follows that organizations that plan to implement new GCSs should use strategies to increase perceived collective efficacy *before* the implementation of these technologies.

For instance, efficacy beliefs training is one of the strategies that might be used by companies when faced with the need to make changes, specifically those related to the implementation of new communication systems, to control potential job demands (Salanova, Cifre, & Martin, 1999). During the first stages of training, it is possible to enhance perceived collective efficacy. To

achieve this aim, training should include a variety of components that are consistent with theoretical cues for self-efficacy building (Bandura, 1997, 1999). These include role-plays to provide experiences of success using the new GCS (enactive mastery), models of performance (vicarious experiences), coaching and encouragement (verbal persuasion), and reduction of the emotional threats of rejection (managing physiological states). According to Bandura (1999), the most authentic and influential source to increase efficacy beliefs is fostering "mastery experiences." This can be achieved by tackling problems regarding the new GCS in successive, attainable steps. Whereas successes build a robust belief in one's self-efficacy, failures undermine it, especially in earlier phases of training. Therefore, to get resilient self-efficacy, it requires experiences in overcoming obstacles through perseverant effort. In a similar way, if members see other groups succeed by sustained effort, they come to believe that they also have the capability to success (vicarious experiences). Social persuasion seeks to persuade members that they have what it takes to succeed, and so they exert more effort and are more perseverant if they have self-doubts when obstacles arise. Finally, groups also rely on their physical and emotional states to evaluate their own capabilities to use new GCSs. Negative emotions such as tension and anxiety are signs of personal deficiency. In this case, it would be adequate to enhance the member's physical condition, reduce his or her negative emotional states, and correct misinterpretations of somatic sources of information.

LIMITATIONS AND FUTURE RESEARCH

In the current experimental study, we used a longitudinal design with self-report (i.e., collective anxiety, collective engagement, and perceived collective efficacy) and objective measures (i.e., task performance) to test the main hypothesis. However, although we kept the main factors in this laboratory experimental study under control, there are limitations. For example, we used participants who are not real employees in real organizations. Also, it is important to keep in mind that there were 28 groups in the study. Therefore, we had enough power to detect only the largest effects, and non-

significant effects may reflect a lack of statistical power. Additionally, participants were mainly young females. So far, results obtained in this study must be tested in future research, with real employees working in real organizations, with other kinds of GCSs (e.g., CSCW) and including participants with different gender and from different age groups.

APPENDIX A
Perceived Collective Efficacy Scale

1. I feel confident about the capability of my group to perform the tasks very well.
2. My group is able to solve difficult tasks if we invest the necessary effort.
3. I feel confident that my group will be able to manage effectively unexpected troubles.
4. My group is totally competent to solve the task.

APPENDIX B
Collective Engagement Scales

Collective Vigor

1. During the task, my group felt full of energy.
2. My group could continue working for very long periods at a time.
3. My group kept on working, even when things did not go well.
4. Hard work was not much of an effort for my group.
5. My group felt very resilient during the task.
6. My group felt strong and vigorous during the task.
7. When the task was finished, my group had quite some energy left for other activities.

Collective Dedication

1. My group was involved in the task.
2. My group felt enthusiastic about the task.
3. My group liked doing the task.
4. My group felt very motivated to a good job.

Collective Absorption

1. When my group was working, we forgot everything else around us.
2. My group took new perspectives.
3. My group was immersed in the task.
4. Time was flying when my group was working.
5. My group felt happy when we were engrossed in the task.
6. It was difficult for the group to detach from the task.
7. My group got "carried away" by the task.

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