When Collective- and Self-Efficacy Affect Team Performance: The Role of Task Interdependence

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ABSTRACT

The study examined task interdependence as a structural factor, which influences the emergence of collective-efficacy versus self-efficacy as a team level construct. It tested for the differential effects of self- and collective-efficacy on team performance, and the effects of initial perceptions of self- and collective-efficacy and record of past performance on the development of their subsequent perceptions. Results of a laboratory study demonstrated that collective-efficacy solidified as a meaningful team construct and influenced team performance only when a highly interdependent task required team members to closely interact and coordinate their efforts. Under conditions of low task interdependence, collective-efficacy had no basis from which to emerge as a higher-level team characteristic and no significance in what is, in essence, individual performances. In contrast, self-efficacy emerged as a meaningful construct that explained individual performance under low task interdependence conditions.

Key words: collective-efficacy, task interdependence, teams performance

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Introduction

The growing complexity of organizations and tasks has resulted in many jobs being designed for teams. Teams are two or more individuals who work together toward the accomplishment of a common goal in organizations (Hackman, 1990). The level of interaction among team members is determined by, among other factors, task interdependence. The latter helps determine whether the team becomes one integrated unit that is more than the sum of its parts, or simply remains an aggregation of individuals loosely linked together. Thus, interdependence among team members is crucial for the understanding of the reasons for the emergence of team level phenomena. Constructs as collective-efficacy originate in individual team members, and through team processes of social interaction and mutual task experience, they converge into shared team level constructs (Kozlowski & Klein, 2000). Shared beliefs about the team transform collective-efficacy into a team level construct.

The objectives of the present study are threefold: first, to examine task interdependence as a structural factor, which influences the emergence of collective-efficacy versus self-efficacy as a team level construct; second, to test for the differential effects of self- and collective-efficacy on team performance; and third, to test the effects of initial perceptions of self- and collective-efficacy and records of past performance on the development of their subsequent perceptions.

Self- and Collective-efficacy

Self-efficacy reflects an individual's beliefs in his/her own capabilities to pursue a course of action to meet given situational demands (Bandura, 1997). Numerous studies have examined the antecedents and behavioral consequences of self-efficacy in work organizations, particularly with regard to individual tasks (for reviews see Bandura, 1997; Gist & Mitchell, 1992; Locke & Latham, 2002; Stajkovic & Luthans, 1998). However, the meaning of self-efficacy may be questioned in highly

interactive tasks. Here all team members jointly work toward a collective outcome, and individual actions often cannot be distinguished from each other. In this case, group performance is affected not only by the individuals' capabilities and efforts, but also by the nature of the relationships among the group members, and by group processes, as for example, the needed levels of coordination and collaboration. Furthermore, when the team's task requires high interdependence among the team members, they have the opportunity to develop shared mental models and to use this shared knowledge to guide their behavior (Cannon-Bowers & Salas, 2001).

While working on tasks that require high levels of interaction among team members, individual perceptions of self-efficacy may not be sufficient to explain group performance because these perceptions do not reflect members' judgments of team processes that are crucial for team performance (Shamir, 1990; Weldon & Weingart, 1993). The meaning of efficacy necessarily changes when the focus shifts from individual competence to group competence. Therefore, collective-efficacy has been suggested as a meaningful parallel on the group level to the concept of self-efficacy on the individual level. This change occurs in two steps (Chan, 1998); first, individuals shift their reference from the individual to the group level when they evaluate team-efficacy. Second, the agreement among all team members elevates the construct itself to the group level. Thus, collective-efficacy reflects the shared beliefs of the group members in their group's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to produce given levels of attainments on a specific task (Gibson, 2003). Collective-efficacy influences what people choose to do as a group, how much effort they put into the group's objectives, and their persistence when group efforts fail to produce results (Bandura, 1997).

According to the multilevel theory (Klein & Kozlowski, 2000), groups as aggregations of individuals take one of two forms: a simple summation of the lower level units regardless of the variance among group members; or an aggregation justified by a consensus among group members. In

the latter case, the group is a consequence of the emergence of bottom-up processes, where lower level properties surface to form collective phenomena (Chan, 1998). According to this alternative, collective-efficacy is not simply the sum of the individual perceptions of self-efficacy. Rather, the group as a higher-level entity focuses on the team members' shared perceptions of their team's efficacy, or collective-efficacy. Collective-efficacy is an emergent group level property that reflects the way team members perceive their team reality or "what *we* think of us" (Mischel & Northcraft, 1997), and consequently, influences team performance (Bandura, 2000; Bar-Tal, 1989). This approach speaks of top-down effects that specify the influence of higher-level factors on lower levels of the system (Kozlowski & Klein, 2000). One of these higher-level factors is, for example, the organization's structure, which through top-down processes affects the team processes and perceptions.

The research investigating the relationship between self- and collective-efficacy is relatively limited (De Cremer & Oosterweged, 2000; Feltz & Lirgg, 1998; Parker, 1994; Spink, 1990; Seijts, Latham & Whyte, 2000). Collective-efficacy differs from self-efficacy because it is a group level, as opposed to an individual level, construct and it is meaningful at the group, rather than at the individual, level of analysis.

We theorize that the emergence of a group level construct such as collective-efficacy depends on the structure in which the group operates. Task interdependence is a structural factor, and thus, is a key factor in understanding the differences between self- and collective-efficacy; the level of interdependence among team members influences the emergence of collective-efficacy as a meaningful and distinct construct.

Task Interdependence

Task interdependence affects the nature of team processes because it shapes the links among the different roles in the team, and the coordination requirements from the team members (Kozlowski, Gully, Nason, & Smith, 1999). Interdependence exists when each individual's outcome is affected by

the actions of others (Johnson & Johnson, 1989). The level of task interdependence can be measured in two categories: outcomes, which pertain to the level of mutual goals and rewards, and means, which refer to the actions required to achieve the group goals (Deutsch, 1949). The level of task interdependence varies on a continuum from low to high. The lowest level of interdependence is when each team member makes a contribution to the team output without the need for direct interaction with other team members. In such cases, team performance is measured as the sum of individual performances. On the other side of the spectrum, when tasks are highly interdependent, team members must interact with each other to perform the team task, and the individual contributions cannot be separated out (Saavedra et al., 1993). Under this type of high interdependence, the team members commonly have different roles, skills, and resources, and they perform their parts of the task in a flexible order. Team performance requires mutual interactions and coordination among team members, and the final output cannot be obtained unless all team members interactively collaborate on task completion (Wageman, 1995).

Therefore, the nature of a team task, in particular, the level of task interdependence, shapes its underlying social and psychological processes such as team members' perceptions of collective-efficacy (Gibson, 1999; Feltz & Lirgg, 1998). Collective-efficacy, in turn, affects team performance (McGrath, 1984; Saavedra, Earley & Van Dyne, 1993; Stewart & Barrick, 2000; Tjosvold, 1986). This group level phenomenon is different than individual level characteristics that shape perceptions of self-efficacy.

Previous research on collective-efficacy has mainly been conducted under the conditions of highly interdependent tasks. These tasks consisted, for example, of sport teams (Feltz et al., 1988; Zaccaro et al., 1994); an idea generation task where participants had to come up with a new idea following a group discussion (Pescosolido, 2003); an interdependent muscular endurance task in which participants together had to hold a heavy ball above their heads (Bray, 2004); and a business simulation

in which five managers had to interact as a group for two hours (Gibson, 2003). Clearly, these studies did not allow for comparisons of the effect of collective-efficacy in tasks of high and low interdependence among team members[1]. Thus, the first objective of the present study was to examine the emergence of self- and collective-efficacy in tasks with differing levels of interdependence. We expected that the different natures of self- and collective-efficacy as individual versus group level constructs would become more salient in highly interdependent team tasks because effective group processes are crucial for team effectiveness. Even when individual group members feel highly self-efficacious, this may not result in high team performance, as they cannot accomplish the task by themselves. In such cases, collective-efficacy, which expresses team members' evaluation of their *team* competence, would serve as a better predictor of team performance. Therefore, a clear distinction between collective- and self-efficacy should emerge under highly interdependent tasks. On the other hand, under low task interdependence, when there is less need for group processes to occur in order to perform the team's task, there should be no difference between working alone, and working as part of a team. Consequently, collective-efficacy as a distinct construct should not come into play.

> *Hypothesis 1a*: Self-and collective-efficacy will emerge as two distinct constructs under conditions of high team task interdependence.
>
> *Hypothesis 1b*: Self-and collective-efficacy will not emerge as two distinct constructs under conditions of low team task interdependence.

The level of task interdependence constrains the interactions among team members, and the extent to which they need to coordinate their individual responses. Furthermore, it gives the team members an opportunity to inquire and learn about each other's skills and abilities (Kozlowski et al., 1996). Consensus among the team members about their team's collective-efficacy should increase over

[1] Gibson (1999) compared the effect of collective-efficacy on task performance on low and high task interdependence; however, task interdependence was measured as a perceived variable and the results demonstrated that all teams perceived themselves as highly interdependent.

time as they gain experience in performing together, indicating convergence of perceptions about the team and its environment (Kozlowski et al., 1999).

One study that recognized the development of collective-efficacy over time looked at hockey teams. Self- and collective-efficacy scores were obtained early in the season. In this early period, there were no significant differences between the effects of collective-efficacy, and the sum of the self-efficacy perceptions on the players' performance (Feltz et al., 1988). The authors explained the lack of a differential effect by arguing that collective-efficacy beliefs differentiated themselves from self-efficacy beliefs over time, when team members got to know each other, and learned how they related to each other. Therefore, the authors recommended measuring efficacy perceptions of group members at more than one point. This recommendation was implemented in another study that tested the effect of collective-efficacy on team performance during the first performance phase of new work teams, and after they had completed eight physically demanding tasks (Zaccaro et al., 1994). Results showed that collective-efficacy perceptions became more homogeneous within teams as they spent more time working together. Homogeneity of team members' perceptions is an indication of the emergence of a higher-level construct whose meaning is shared by the team members.

The above examples of sports teams represented highly interdependent tasks. We suggest that task interdependence will influence the emergence of collective-efficacy as a group level phenomenon, and will be expressed in the homogeneity level of collective-efficacy perceptions. Under high task interdependence, team members closely interact with each other, and thus, have the opportunity to develop similar perceptions of collective efficacy. This homogeneity level should grow stronger over multiple points in time.

> *Hypothesis 2a:* The homogeneity of perceptions of collective-efficacy will emerge as team members gain mutual experience of each other under conditions of high team task interdependence.

Hypothesis 2b: The homogeneity of perceptions of collective-efficacy will not emerge as team members gain mutual experience under conditions of low team task interdependence.

Task interdependence affects the emergence of collective-efficacy as a group level construct, and also influences the relationships between self- and collective-efficacy and team performance (Gully, Incalcaterra, Joshi & Beaubien, 2002). Numerous studies have demonstrated the effect of self-efficacy perceptions on individual performance of a variety of tasks (for example, Bandura, 1997; Lerner & Locke, 1995; Wood & Locke, 1987). They found that the stronger the efficacy perceptions, the better were the levels of individual performance.

Other studies examined the effect of collective-efficacy on team performance. Their findings demonstrated that the effect of collective-efficacy on team performance is analogous to the effect of self-efficacy on individual performance. For example, there was a significant effect of manipulated high and low collective-efficacy perceptions on team performance of a muscular endurance task while competing against other teams. High collective-efficacy teams improved their performance following failures, whereas low collective-efficacy teams exhibited a drop in performance (Hodge & Carron, 1992; Spink, 1990). Team efficacy perceptions predicted performance of hockey teams better than the aggregated self-efficacies of the players (Feltz & Lirgg, 1998). Collective-efficacy was positively correlated with group performance in a field study of nurses in hospitals (Gibson, 1999) and with the amount of effort exerted by team members in a group task of idea-generation (Zaccaro, Blair, Peterson & Zazanis, 1992). Collective-efficacy beliefs of teachers had positive effects on school achievements (Bandura, 2000, Parker, 1994), and positive effects on coping with work stress behavior (Jex & Gudanowski, 1992). Collective-efficacy also had a significant effect on the level of goal difficulty set by the team, and on the team's consequent performance; perceptions of high collective-efficacy led to higher goals being set by the team, which resulted in high performance levels (Seijts et al., 2000;

Whitney, 1994). A cross cultural study of the effect of collective- versus self-efficacy in coping responses to work stressors (Schaubroeck, Lam, & Xie, 2000) revealed the following: perceived high control mitigated the effects of demands on psychological health symptoms and turnover intentions only among Americans reporting high job self-efficacy. In Hong-Kong, collective-efficacy rather than self-efficacy perceptions moderated the control–health symptoms, and control–turnover relationships.

Most of the above studies examined either the effect of self-efficacy or of collective-efficacy on performance, and therefore, did not allow for comparisons of the two effects on performance in the same task at the same time. Furthermore, in all of these studies, task interdependence was not varied but was relatively high. Under high task interdependence, team members share knowledge, and it enables them to interpret cues in a similar manner, make compatible decisions, and take appropriate action (Mohammed & Dumville, 2001). Their shared mental model in regard to their team's ability should help them perform the team's task better (Cannon-Bowers & Salas, 2001).

Therefore, the present study was designed to allow for a simultaneous occurrence of what has previously only been tested separately. The present study tests the differential effect of self- and collective-efficacy on team performance of high and low interdependent tasks. Figures 1 and 2 are graphic representations of the third hypotheses.

Hypothesis 3a: Self-efficacy would affect team performance under conditions of low (but not of high) interdependence tasks.

Hypothesis 3b: Collective-efficacy would affect team performance under conditions of high (but not of low) interdependence tasks.

---Insert Figures 1 and 2 about here---

When considered longitudinally, the efficacy–performance relationships have a spiral nature. That is, initial efficacy perceptions affect performance, which in turn influences subsequent efficacy perceptions, and so on (Lindsley, Brass & Thomas, 1995). Bandura (1997) emphasized that self-

efficacy is a reliable predictor of performance when the task is new and challenging. Yet, after people gain experience in performing their tasks, past performance should become the major explanatory factor of future self-efficacy. Indeed, in Sexton, Tuckman and Crehan's (1992) study, perceived self-efficacy accounted for the variance in performance in the first performance stage, but after this initial "break-in" phase, earlier behavior accounted for most of the variance in the succeeding task performance. Similarly, self-efficacy correlated more with past performance than with future performance. Self-efficacy significantly predicted future performance only when past performance was held constant (Locke, Fredrick, Lee & Bobko, 1984).

The effect of past performance on efficacy perceptions should even be stronger for collective-efficacy, mainly when team members work under highly interdependent task. This is expected because collective-efficacy perceptions develop as the team members gain knowledge about how well they function together. In that case, the self-knowledge that each team member may have from his or her own personal history is not enough for evaluating how well the team will function as a unit. The shared perceptions of collective-efficacy influence team performance, and reciprocally, team performance influences the shared perceptions of collective-efficacy that follow performance (Baker, 2001; Feltz & Lirgg, 1998). Thus, we hypothesize the following;

> *Hypothesis 4:* Collective-efficacy, more than self-efficacy will be influenced by past performance under conditions of high task interdependence.

Method

Participants

One hundred and twenty engineering students (37% of whom were women) participated in the study, and were paid for their participation. They were randomly assigned to three-person work teams (N=40 teams). The average age of the students was 23.3 years (SD= 2.3), ranging from 19 to 31 years.

Participants were randomly assigned into teams of three. Team members were then randomly assigned different roles as would be explain next.

Task

The task was a performance appraisal task previously used by Saavedra et al. (1993). It required teams to recommend differential merit-based bonuses for fictitious employees in different departments. Participants in the teams received short descriptions of four personal characteristics of employees: effort, ability, performance, and friendliness. For example, "Carol Adams (scheduling department): Even though Carol is below average in skill level, she works unusually long hours and turns in satisfactory results. She is not liked by her co-workers". Participants were asked to rate each characteristic of these employees using a 3-point scheme (low, average, or high). Second, participants were told that each of the four characteristics had a different weight in different organizational departments. Participants had to identify the department to which each employee belonged. Then, for each employee, they had to multiply each of the four scores of each of the characteristics by its weight in a particular department. Finally, participants had to recommend a merit percentage increase for each employee based on the total score (Saavedra et al., 1993).

We manipulated high and low task interdependence by designing two types of tasks. Under the low interdependence task condition, each one of the three team members was required to perform the whole evaluation process for each employee individually. Team performance was the sum of the completed evaluations made by each one of the three-person teams. Participants were told that they would be working in a team, but that each member of the team would work individually to complete all steps in determining merit increases for employees. Under the high task interdependence condition, participants were instructed to divide the evaluation processes among them as follows: one team member wrote the name of the employee and the employee's department on the evaluation form. The second team member rated employees on the four characteristics, looked up departmental weights and

calculated the weighted scores. The third team member received the material from the other two members and recommended specific merit increases. S/he also helped the other two members in case they needed help. Under this high interdependence condition, the final evaluation was concluded only with the cooperation of all three team members. In such cases, team performance was the number of the evaluation forms completed by the team.

In order to identify individual contributions to the team's performance and to avoid potential social loafing (Latane, Williams, & Harkins, 1979), each team member used a different pen color to complete his/her part of the task.

Measures

Self-efficacy. (a) Low task interdependence condition: Self-efficacy perceptions were measured before and after each of the two performance trials (low and high task interdependence) using Bandura's (1997) measure. This measure consists of two subscales. First, participants answered yes or no when asked whether they were capable of evaluating a given number of employees (evaluate 4, 6, 8, 10, 12, 14, 16, and 18 employees in ten minutes. These specific levels represented the range of performance scores obtained in a pilot study). For example, answer yes or no to the question; "Do you think you can evaluate 10 employees in 10 minutes?". The sum of positive responses comprised the *self-efficacy magnitude* scale. Second, participants rated their confidence in obtaining each one of the performance levels ("How confident are you in your answer?" on a scale from 1-not certain at all to 10-very certain). The sum of the confidence scores comprised the *self-efficacy strength* scale. Since the two efficacy scales were highly correlated ($\underline{r}$ =.95), we used only the self-efficacy strength scale because of its wider variance (Gist & Mitchell, 1992).

(b) High task interdependence condition: we modified the scales so that they took into consideration the fact that each team member completed only part of the evaluation process of each employee. Participants were asked for their perceived ability to complete *their respective part in the*

appraisal process of evaluating 12, 14, 16, 18, 22, 24, and 26 employees in ten minutes (again, these numbers were based on a pilot study). For example, "Do you think you can do your part in the appraisal process for 10 employees in 10 minutes?" (Yes or No for the self-efficacy magnitude scale). Finally, participants were asked to mark their confidence level for their answer as above (on the 10-point scale for the self-efficacy strength scale).

Collective-efficacy[2]**.** In the present study, each participant was asked to rate his or her *team*'s ability to perform the task at different levels ("Do you think your team can evaluate 12 (14, 16, 18, 20, 22, 24, and 26) employees in ten minutes?") and his/her level of confidence in his/her answer regarding that specific level (on a scale from 1-not confident at all to 10-very confident). Here we also calculated the magnitude and strength scales (r = .94), as we did for self-efficacy, and used only the collective-efficacy strength scale in the analyses. We measured collective-efficacy at the team level by calculating the teams' mean score. The Pearson correlation between the self- and collective-efficacy strength scales under low task interdependence were r = .43 ($p<.01$), and under high task interdependence r = .30 ($p<.01$).

Performance measures. (a) Performance of the low interdependence task on the individual and team levels. The number of employees evaluated in 10 minutes according to the task rules measured

[2] The evolution of the measure of collective-efficacy represents the shift from an individual to a group level construct. Previously collective-efficacy had been measured as the aggregation of perceptions of individual self-efficacies (Gist, 1987). This measure does not reflect a group level phenomenon, which is not only the sum of the individuals' capabilities, but also the way they jointly interact to accomplish their group task, and is, therefore, "an insufficient representation of collective-efficacy as a predictor of team performance" (Feltz & Lirgg, 1998, p. 561). In its next phase, the measure was the average of the individual perceptions of the group-efficacy (Saavedra et al., 1993), while taking into consideration the level of within-group homogeneity with respect to the team members' perceptions of collective-efficacy. This approach elevates collective-efficacy to a group level construct (we used this method at the present study). A third method avoids aggregation by using a single response, thus representing the group. Nevertheless, forming a consensual judgment of group efficacy via group discussion is not recommended because it is subject to social persuasion by those who command power, and by pressures for conformity (Bandura, 2000). A fourth measure (Lindsley et al., 1995) asks group members to estimate the *group's* collective belief that it can perform a specific task, rather than the group members' *own* perceptions of the group efficacy.

individual performance. Team performance was measured by the sum of the correct evaluations made by each team member. (*b) Performance of the high interdependence task*. This was the number of correct evaluations made by the team. (Performance under high task interdependence makes individual performance meaningless since one team member cannot accomplish the whole task alone.)

Procedure

Upon arrival, participants were told that they were going to be part of a study on teamwork and they received general instructions about the simulation from the experimenter. Each participant received written descriptions of 100 "employees" in an organization, a list of departmental weights, a calculator, a pen, and an unlimited number of evaluation forms. The experiment consisted of two performance phases – for each team, working under low task interdependence, and working under high task interdependence. The order of tasks was counterbalanced; half of the teams performed under low task interdependence first, and following this, under the high task interdependence condition, while the other teams worked in the reverse order. The procedure was as follows: (a) five-minute practice trial of low (or high) task interdependence; (b) initial self- and collective-efficacy questionnaires; (c) a ten-minute performance trial of low (or high) task interdependence; (d) subsequent self- and collective-efficacy questionnaires; (e) a second five-minute practice trial of high (or low) task interdependence; (f) initial self- and collective-efficacy questionnaires; (g) a second ten-minute performance trial of high (or low) task interdependence; (h) subsequent self- and collective-efficacy questionnaires. There were no pauses between sessions and the entire procedure took about an hour. We tested for the main and interactive effects of order by self- and collective-efficacy on the performance of high and low interdependent tasks and found no significant effects.

Results

Descriptive statistics, Cronbach's alpha reliabilities, and inter-correlations among the self- and collective-efficacy measures are summarized in Table 1. The mean number of complete evaluations of the teams (N=40) under the low task interdependence conditions was 6.92 (S.D = 1.11), and under the high task interdependence conditions 5.39 (S.D = 1.11).

--Insert Table 1 about here--

Self- and collective-efficacy as two distinct concepts

To test Hypotheses 1a and 1b we used all the efficacy scales of strength and magnitude: eight measures of self-efficacy strength and magnitude, and eight measures of collective-efficacy strength and magnitude (before and after participants performed the low and the high interdependence tasks). To allow for comparability between self- and collective-efficacy, we standardized the scores. We conducted an exploratory factor analysis on these 16 efficacy measures, using a principal component analysis with a varimax rotation, and extracting four factors.

--Insert Table 2 about here--

The exploratory factor analysis resulted in four factors with eigenvalues larger than 2.00, explaining 68% of the total variance. The Kaiser measure of sampling adequacy (Hair et al., 1995) was 0.64 (see Table 2). For the high interdependence task, Factor I represented the four measures of self-efficacy before and after performance and Factor IV represented the four measures of collective-efficacy before and after performance. For the low interdependence task, Factor II represented the four measures of self- and collective-efficacy after performance, and Factor III represented the four self- and collective-efficacy measures before performance. Thus, the results of the exploratory factor analysis supported the first hypothesis, demonstrating that self- and collective-efficacy appeared as two distinct constructs only under high task interdependence (Factors I and IV), and not under low task interdependence (Factors II and III).

To test Hypotheses 2a and 2b, two methods were used to demonstrate within-group agreement. First, we demonstrated non-independence of scores (James, 1982; Chan, 1998). This means that linked observations (i.e., subjects working on the same team) are more similar on average than non-linked observations (i.e., subjects who worked on different teams). The SAS Mixed Procedure (version 6.12 for PC) uses mixed linear models, which are generalizations of the standard linear model such that the data are permitted to exhibit correlation and non-constant variability. Traditional mixed linear models contain both fixed- and random-effect parameters (Ramon, 1996). These models enable the testing of the null hypothesis that non-independence is zero (i.e., observations are completely independent or there are no team effects on the variables). Second, intraclass correlations were calculated. In our model, we accounted for the correlation between observations of the same subject[3]. Results of the chi-square statistic, which compares the deviance (-2log likelihood) with and without the group effect, and the intraclass correlations demonstrated that, under the low task interdependence condition, the group effects on initial and subsequent collective-efficacy were not significant ($\chi^2_{(1)} = 0.082$ n.s., ICC=0.114, p=.13; $\chi^2_{(1)} = 3.7$. p=.06, ICC=0.145, p=.08 respectively). Under the high task interdependence condition, there were significant group effects both on initial collective-efficacy ($\chi^2_{(1)} = 8.68$, p<.01, ICC=0.364, p=.001), and on subsequent collective-efficacy ($\chi^2_{(1)} = 11.57$, p<.01, ICC=0.237, p=.02). The difference between the two ICC scores was not significant (p>.1). Thus, the results partially supported the second hypothesis. As hypothesized, task interdependence influenced the level of homogeneity in perceptions of collective-efficacy, demonstrating significant in-group homogeneity only under the high interdependent task. However, the time effect was not supported.

The differential effect of self- and collective-efficacy on performance

Hypothesis 3a: We conducted two regression analyses that tested the differential effects of self- and collective-efficacy on performance under low task interdependence. In one regression we

[3] The technical details of the inference procedure are described in a technical report (Doveh & Cohen,

aggregated self-efficacy perceptions and individual performances to the team level, and regressed team performance of low interdependence task on aggregated initial self- and initial collective-efficacy (N=40, see Table 3a). The second regression was conducted at the individual level for comparison purposes. In this regression, we regressed individual performance of low interdependence task on initial self- and initial collective-efficacy (N=120, Table 3b).

--Insert Tables 3a, 3b, and 3c about here--

Results demonstrated that self-efficacy was significantly related to performance, both at the individual ($F_{(2, 118)} = 28.5$, $p < .001$) and at the team ($F_{(2, 38)} = 4.40$, $p < .05$) levels of analysis (see Tables 3a and 3b). Perceptions of self-efficacy accounted for 26% of the variance in performance on the individual level, and 24% on the team level of analysis. No significant effects of collective-efficacy on performance were found.

To test Hypothesis 3b we regressed team performance of high interdependence tasks on aggregated initial self- and initial collective-efficacy (since under conditions of high interdependence tasks performance was a joint outcome of all group members, we did not analyze it at the individual level; N=40, see Table 3c). Results demonstrated a significant effect of collective-efficacy on performance on the team level of analysis ($F_{(2, 38)} = 4.31$, $p = .04$). Collective-efficacy perceptions accounted for 10% of the variance in team performance. No significant effect of self-efficacy was found. Thus, the overall third hypothesis was confirmed.

In order to test the fourth hypothesis, we first conducted an analysis of variance (ANOVA) to test the effects on subsequent self-efficacy of the initial self-efficacy and performance. Second, we used an ANOVA to test the effects on subsequent collective-efficacy of the initial collective-efficacy and performance, both on the group level of analysis (N=40). We compared the standardized Beta estimates of the two ANOVAs (see Tables 4a and 4b).

2003).

--Insert Tables 4a, 4b, about here--

Self-efficacy: The ANOVA results demonstrated that both initial self-efficacy and performance explained 27.3% of the variance in subsequent self-efficacy (mean square = 5.33; $F_{(2,39)} = 6.97$; $p<.003$). The standardized Beta estimate of initial self-efficacy ($\beta=0.45$; $\underline{p}< .01$) was significantly higher ($\underline{p}<.05$) than that of performance ($\beta=0.33$).

Collective-efficacy: Both initial collective-efficacy and performance explained 61% of the variance in subsequent collective-efficacy (mean square = 11.91; $F_{(2,39)} = 29.04$; $\underline{p}<.001$). The standardized Beta estimate of performance ($\beta= 0.56$; $\underline{p} = .001$) was significantly higher ($p < .001$) than that of initial collective-efficacy ($\beta= 0.42$). These results supported the fourth hypothesis: Performance explained more variance in subsequent collective-efficacy than did initial collective-efficacy, while initial self-efficacy explained more variance in subsequent self-efficacy than did performance. It should be noted that at that group level of analysis, the model explained more variance in subsequent collective-efficacy ($R^2 = .61$) than the variance explained by the self-efficacy model ($R^2 = .27$). This finding also supports our notion that collective-efficacy, rather than self-efficacy, is a meaningful group level construct.

Discussion

The present study examined the relative importance of self- and collective-efficacy for performance on the individual and team levels in two parallel situations of high and low task interdependence. It was designed to overcome the limitations of previous research by allowing for simultaneous testing of what had previously been tested separately. Furthermore, in all earlier studies on collective-efficacy–team performance relationships, task interdependence was not varied, and, presumably, was relatively high (Bandura, 2000; Parker, 1994; Feltz & Lirgg, 1998).

The simultaneous testing of self- and collective-efficacy under both conditions of high and low task interdependence enabled us to make three theoretical contributions. First, the study validated task interdependence as a necessary condition for the emergence of collective-efficacy as a group level construct, distinct from self-efficacy. Second, it identified task interdependence as a structural variable that influenced the efficacy–performance relationship. Specifically, the study demonstrated that under high task interdependence only collective- and not self-efficacy influenced team performance, while under low task interdependence only self- and not collective-efficacy affected team members' performance. Third, it demonstrated the spiral relationships between efficacy perceptions and performance.

Task interdependence constrains the emergence of collective-efficacy as a group-level construct by facilitating or inhibiting the level of interaction among team members. Interdependence becomes an integral aspect of the multi-level approach, because it transforms a collective of individuals into a team that transcends the sum of its individual members (Kozlowski et al., 1999). Group members develop similar beliefs in their collective-efficacy due to shared cognitions (Cannon-Bowers & Salas, 2001), which are based on common experiences, and mutual involvement in social learning processes. This reality is not determined by the individual elements, but rather, by the composition of the elements that creates a new reality of the group as a whole (Bar-Tal, 1989). Individuals self-regulate their behavior in accordance with their self-efficacy perceptions. Similarly, groups collectively regulate their behavior in accordance with the group members' shared beliefs in their collective-efficacy. Collective-efficacy has its foundation in the cognitions of individuals, through which group members' interactions manifest themselves at the group level. The group members' shared beliefs in their group ability to perform the task collectively transcend the sum of their individual self-efficacies. This group level construct that emerges from individual level properties reflects a bottom-up process (Kozlowski & Klein, 2000). As a result, top-down factors such as task structure, shape individuals' perceptions and

their consequent behaviors. Reciprocally, this micro-level change in behavior reshapes perceptions of the macro-level group construct. Thus, there is a spiral process of shifting from bottom-up to top-down processes, continually shaping and reshaping the macro-and micro-level constructs. As a top-down process, the group forms a reality, which influences the perceptions and behaviors of its members.

Two sets of the present findings supported the first and second hypotheses about the effect of task interdependence on the emergence of collective-efficacy as a group level construct. First, factor analysis demonstrated that self- and collective-efficacy could not be separated when team members work under conditions of low task interdependence. It was only under the highly interdependent task that collective- and self-efficacy appeared as two distinct constructs. Second, collective-efficacy emerged as a homogeneous team level construct only under highly interdependent tasks. Once the individual members interacted with each other under high task interdependence, collective-efficacy transcended the individual perceptions, and a group level construct solidified.

There was a trend towards higher levels of homogeneity in collective-efficacy perceptions after rather than before task performance. However, when performing under the highly interdependent task condition, collective-efficacy perceptions were also homogeneous within groups in the initial phase of the group performance. This may have occurred because collective-efficacy was measured after the team members had a chance to interact with each other during the practice trial, and for half the participants, this practice trial took place after they performed together under the low task interdependence condition.

The second contribution of this study pertains to task interdependence as a structural variable that influences the efficacy–performance relationship. In line with the third hypothesis, our findings demonstrated that under the low task interdependence condition, self-efficacy has a significant role in explaining performance. Nevertheless, it did not explain group performance of tasks with high interdependence. These findings suggest that as tasks become more interdependent, it is harder for a

person to cognitively separate his or her own performance from that of the team, and to attribute performance to his or her self-efficacy perceptions (Lindsley et al., 1995). On the other hand, collective-efficacy did not affect team performance of low task interdependence, but did have a positive effect on the performance of highly interdependent tasks. Thus, task interdependence determined which type of efficacy perceptions became salient and influenced team performance.

Third, we further examined the effect of performance and prior efficacy perceptions on subsequent efficacy perceptions. As was expected by the fourth hypothesis, results showed that, under high task interdependence, the effect of performance on subsequent perceptions of collective-efficacy was stronger than that of initial collective-efficacy. Overall, the model consisting of performance and early collective-efficacy perceptions explained 61% of the variance in subsequent collective-efficacy (see Table 4b). Conversely, in the case of self-efficacy, only 23% of the variance in subsequent self-efficacy was explained by initial self-efficacy and team performance under conditions of low task interdependence (see Table 4a).

A comparison between subsequent self- and collective-efficacy, under high task interdependence, pointed at the importance of task interdependence for understanding the efficacy–performance–efficacy spiral process. While previous research focused on the impact of past performance on the development of self-efficacy perceptions, this study demonstrated that past performance is most relevant for the development of collective-efficacy perceptions under high task interdependence. Individuals develop their self-efficacy perceptions overtime, and across different tasks and situations. Therefore, a short experience in performing as part of a team has less impact on their subsequent self-efficacy perceptions. On the other hand, team members develop their collective-efficacy perceptions based on their experience in working together. Therefore, past team performance was more crucial for the development of subsequent collective-efficacy than for the development of self-efficacy.

Several limitations of the study should be mentioned. The study utilized a laboratory experiment in which ad-hoc groups performed a specific task with assessable outcomes, according to assigned rules. These specific features fall short of capturing some of the essential attributes of teams in organizations. For example, members of task-performing teams in organizations have longer tenure on their teams, experience higher levels of identification, and expect long-term relationships with their team members. As a result, the consequences of their behavior have implications that are more significant. However, previous research has demonstrated that the findings of laboratory experiments can be usefully implemented in organizational settings (Locke, 1986). Second, participants had relatively high exposure to the measures of self- and collective-efficacy, which may influence their results. People may be sensitive to having their competence measured. However, because of the random assignment of the participants to the different experimental conditions and teams, this should be a random, rather than systematic, error.

We suggest a number of directions for future research. First, the present study alluded to the time factor in the emergence of team level constructs. Therefore, we suggest a further examination of how time affects the emergence of team level constructs such as collective-efficacy. Furthermore, of special interest is the differential longitudinal effect of past performance and efficacy perceptions on the emergence of collective-efficacy under high and low task interdependence. Therefore, future research should further examine the effect of past team performance on the development of collective-efficacy under different task conditions. Third, Using Hackman's (1990) criteria, group effectiveness is defined as more than mere performance. It includes the quality of the team's processes, and team members' satisfaction. Thus, future research should examine the effect of collective-efficacy on group processes as communication, cooperation, and competition under different levels of task interdependence. Finally, future research should also examine the above in a real life organizational setting.

There are several practical implications to this study. The findings presented here should help managers to become better equipped for task design on the team level. Task design that allows a high level of interaction among team members helps the development of teams as a group level entity that is more than the sum of its individual members, and cultivates perceptions of collective-efficacy that affect team performance. Managers should not merely count on the strength of self-efficacy as a motivator when team members are interdependent. Collective-efficacy perceptions develop when there are opportunities for team members to interact, share knowledge, and learn about their relative strengths as a highly interdependent team on a continuous basis.

The team task influences the level of interaction among team members, but not necessarily the quality of the interpersonal relationships. Previous research has demonstrated the importance of team development programs for enhancing collaboration and reducing interpersonal conflicts (Gist, Schwoerer, & Rosen, 1989). In addition, training programs analogous to the ones developed on the individual level to enhance self-efficacy perceptions (Eden, 1993) can be developed to enhance collective-efficacy on the team level.

Past performance was found to have a significant effect on the development of collective-efficacy. Therefore, it is important to allow teams to develop positive work experiences in their early formation stages. This can be done by creating opportunities for communication and collaboration among team members through avoiding difficult team goals (Kanfer & Ackerman, 1989), and by first assigning tasks of relatively low levels of complexity, gradually shifting towards highly complex tasks.

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Table 1

Means, Pearson Correlation, and Cronbach's Alpha Reliabilities (on the diagonal) (N=120)

Self-Efficacy	Means	(SD)	1	2	3	4
High Task Interdependence						
1. Initial Strength	27.3	(23.4)	(.93)			
2. Subsequent Strength	34.4	(24.7)	.63**	(.92)		
Low Task Interdependence						
3. Initial Strength	31.6	(17.2)	.20*	.18*	(.88)	
4. Subsequent Strength	30.1	(11.8)	.35**	.38**	.47**	(.85)
Collective-Efficacy	Means	(SD)	1	2	3	4
High Task Interdependence						
1. Initial Strength	35.3	(21.4)	(.89)			
2. Subsequent Strength	43.9	(17.6)	.50**	(.84)		
Low Task Interdependence						
3. Initial Strength	40.2	(20.1)	.09*	.14	(.88)	
4. Subsequent Strength	53.6	(29.9)	-.03	.13	.27**	(.77)

**p<0.01 *p<0.05

Table 2

Factor Analysis: Rotated Factor Pattern (Varimax), Factor Loadings (N=120)

Variable	Factor 1	Factor 2	Factor 3	Factor 4
High Task Interdependence				
Initial Self-Efficacy – Strength	**.84**	-.07	.11	.22
Initial Self-Efficacy – Magnitude	**.86**	-.02	.19	.19
Subsequent Self-Efficacy – Strength	**.88**	.24	-.09	.05
Subsequent Self-Efficacy – Magnitude	**.88**	.28	-.04	.06
Initial Collective-Efficacy – Strength	.06	-.10	.06	**.92**
Initial Collective-Efficacy – Magnitude	.09	-.06	.17	**.90**
Subsequent Collective-Efficacy – Strength	.29	.43	-.12	**.69**
Subsequent Collective-Efficacy - Magnitude	.30	.45	-.10	**.67**
Low Task Interdependence				
Initial Self-Efficacy – Strength	.27	.15	**.82**	-.15
Initial Self-Efficacy – Magnitude	.28	.22	**.81**	-.12
Subsequent Self-Efficacy – Strength	.33	**.66**	.32	.11
Subsequent Self-Efficacy – Magnitude	.33	**.63**	.30	.05
Initial Collective-Efficacy – Strength	-.19	.25	**.76**	.22
Initial Collective-Efficacy – Magnitude	-.18	.29	**.76**	.26
Subsequent Collective-Efficacy – Strength	-.02	**.83**	.24	.00
Subsequent Collective-Efficacy – Magnitude	.00	**.84**	.20	.02

Table 3a

Regression analysis of team performance (low task interdependence) on initial self- and collective-efficacy (N=40)

Variable	B (SE B)	R^2	R^2 Change	F
Team Performance				
Collective-Efficacy	-.08 (0.19)			.16
Self-Efficacy	.39 (0.19)	.24	.285**	4.40*
Constant	6.51 (2.52)			6.65*

*p<0.05 **p<0.01

Table 3b

Regression analysis of individual performance (low task interdependence) on initial self- and collective-efficacy (N=120)

Variable	B (SE B)	R^2	R^2 Change	F
Individual Performance				
Collective Efficacy	.04 (0.07)			.046
Self-Efficacy	.41 (0.08)	.26	.265**	28.5**
Constant	5.05 (0.36)			192.09**

*p<0.05 **p<0.01

Table 3c

Regression analysis of high task interdependence team performance on initial self- and collective efficacy (N=40)

Variable	B (SE B)	R^2	R^2 Change	F
Team Performance				
Collective Efficacy	4.61 (2.47)			4.31*
Self-Efficacy	2.37 (1.32)	.10	.10	0.46
Constant	3.71 (1.38)			7.18**

*p<0.05 **p<0.01

Table 4a

Analysis of Variance of subsequent self-efficacy perceptions on initial self-efficacy and performance of high interdependence task (N= 40)

	Beta Estimate	**Standard Error**	**Mean Square**	**F Value**
Subsequent Self-Efficacy				
Initial Self-Efficacy	.45	.14	7.97	10.42**
Performance	.33	.14	4.31	5.64*
Intercept	-.00	.14		

*p<0.05 **p<0.01

Table 4b

Analysis of Variance of subsequent collective-efficacy perceptions on initial collective-efficacy and performance of high interdependence task (N= 40)

	Beta Estimate	**Standard Error**	**Mean Square**	**F Value**
Subsequent Collective-Efficacy				
Initial Collective-Efficacy	.42	.11	6.29	15.35**
Performance	.56	.11	11.32	27.61**
Intercept	.56	.11		

*p<0.05 **p<0.01

Figure 1
Proposed model of the effects of self- and collective-efficacy
on task performance under low task interdependence

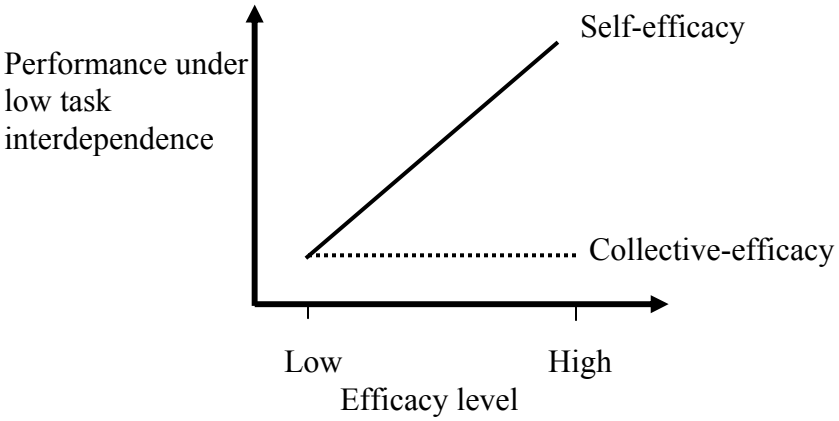

Figure 2
Proposed model of the effects of self- and collective-efficacy
on task performance under high task interdependence