Asymmetry in task dependence among team members
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Downloaded from the University of Groningen/UMCG research database (Pure): http://www.rug.nl/research/portal. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.
A growing body of research evidence in the organization and management literatures suggests that work teams can differ considerably in the extent to which they pursue activities related to learning and continuous improvement and that these differences have important implications for team performance (Bunderson & Sutcliffe, 2002, 2003; Edmondson, 1999, 2002; Gibson & Vermeulen, 2003; Schippers, Den Hartog, Koopman, & Wienk, 2003; Van der Vegt & Bunderson, 2005; see also Argote, Gruenfeld, & Naquin, 2001). In today’s market environments where a firm’s success is contingent on its ability to improve and adapt more quickly than its competitors, teams with the capacity to continually improve processes and approaches in order to operate more quickly, efficiently, and intelligently have become a critical competitive advantage. Understanding the factors that promote or inhibit learning behaviors within a team has therefore become an important research agenda for management scholars (Argote, 1999).

One key factor that has emerged from this research agenda as being important for team learning is the configuration of power within a team. Specifically, many studies have suggested that teams simply will not engage in processes of learning, reflection, and improvement when there are power asymmetries within the team. For example, Brooks (1994) found that group reflection and process improvement did not occur when even one team

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8 This Chapter is based upon De Jong, Van der Vegt, Bunderson, & Molleman (Working paper).
member had significant power over others. Similarly, Edmondson (2002) conducted a qualitative study of learning behavior in 12 teams and found that in teams where learning behaviors were emphasized, “power differences were either absent or actively minimized …” (p. 139). Other research has suggested that in teams where there is stratification or inequality in power relations, team members do not learn from member differences (Bunderson, 2003a, 2003b; Pitcher & Smith, 2001). Van der Vegt, Bunderson, & Oosterhof (2006) found that power asymmetries arising from expertise perceptions led to patterns of intra-group commitment and advice-giving that advantaged the powerful. And Eisenhardt and Bourgeois (1988) found that power inequality heightens intra-group politics and undermines team self-improvement. In sum, the combined research evidence seems to suggest that team learning behaviors will be stifled if not crushed when power asymmetries exist within a team.

But power differences exist in virtually all teams. Power, in classic formulations, is defined as a function of dependence (Emerson, 1962). A has power over B (i.e., dyadic asymmetry in power exists) when B is more dependent on A for valued or needed resources (physical, emotional, informational) than A is dependent on B (Blau, 1964). In task groups, where multiple individuals coordinate their efforts to complete a particular task or achieve a particular goal, resource dependence among group members is simply a fact of life. Furthermore, while there may be cases where the power-dependence relations that exist between task group members will balance out (i.e., A’s dependence on B is balanced by B’s dependence on A such that neither has a power advantage), it is unreasonable to assume that perfect balance among all group members will be the normal or even a common state of affairs in interdependent task groups. In most groups, asymmetries in power-dependence relations will always exist due to differences in the formal or informal resources controlled by group members as a function of different roles, tenures, or natural endowments (e.g., intelligence, charisma; cf. Ragins & Sundstrom, 1989).

Moreover, these power-dependence asymmetries may actually point to important opportunities for learning to occur within a team. The very differences between team members that lead to power asymmetries – differences in experience, knowledge, information, ability, access, etc. – could lead a team to engage in discussion, reflection, debate, and information sharing in the service of more effective task accomplishment. In other words, one might argue that power-dependence asymmetries in task groups should be positively associated with team learning and that in teams where no power-dependence asymmetries exist, there may be limited motivation and opportunity for members to learn together (see King, 1998: p. 60).
This leads to an interesting and practically important research problem. On one hand, power asymmetry within a team seems to stifle team learning behaviors. On the other hand, power asymmetries exist in virtually all teams and particularly in those teams where opportunities for members to learn from one another are the greatest. How, then, can teams leverage their power-dependence asymmetries for learning instead of allowing those power-dependence asymmetries to stifle learning? We will suggest that one answer to this question can be found by considering the effect of performance feedback on the relationship between power-dependence asymmetry and team learning behavior. Performance feedback plays a critical role in virtually all theories of learning by shaping goal-directed behavior (e.g., Ilgen, Fisher, & Taylor, 1979; Nadler, 1979). We will argue here that when teams receive feedback on group as opposed to individual performance, power-dependence asymmetry can have a positive effect on team learning behavior and, through team learning behavior, on team performance outcomes. We tested hypotheses based on this general proposition in a sample of 218 employees from 46 work teams.

**THEORY AND HYPOTHESES**

**Power and team learning**

We conceptualize team learning in this paper using a group process lens (Edmondson, 1999). That is, we define team learning as “activities by which team members seek to acquire, share, refine, or combine task-relevant knowledge through interaction with one another” (Van der Vegt & Bunderson, 2005: p. 534). Examples of team learning behaviors include experimenting with new approaches or ideas, reflecting on past actions and action-outcome relationships, seeking different perspectives, and evaluating alternatives (e.g., Edmondson, 1999, 2002; Gibson & Vermeulen, 2003; Schippers et al., 2003; West, 2000). These team learning behaviors are a specific class of “interaction processes” in teams, processes involving interactions between team members which play a key role in transforming input factors into performance outcomes (Hackman & Morris, 1975). We therefore view team learning as conceptually distinct from the outcomes that might result from an engagement in learning-related activities, outcomes such as more adaptive decisions and actions, improved performance, or, perhaps in some cases, decreased efficiency resulting from a misallocation of effort (see Bunderson & Sutcliffe, 2003).

Past research has suggested that teams can differ considerably in the extent to which they engage in learning behaviors and that these differences matter for performance. So, for example, positive relationships between team
learning behaviors and supervisor ratings of team effectiveness have been reported in the pharmaceutical and medical products industry (156 teams; Gibson & Vermeulen, 2003), the oil and gas industry (57 teams; Van der Vegt & Bunderson, 2005), and the furniture manufacturing industry (51 teams; Edmondson, 1999). Furthermore, Bunderson and Sutcliffe (2003) found that learning behaviors in 44 management teams were significantly associated with business unit performance (unit profitability), although the relationship was curvilinear (teams could engage in too much learning behavior) and moderated by past performance (team learning was more beneficial for lower-performing teams). On the whole, these results provide robust support for learning behaviors as an important performance capability in teams.

But researchers have also suggested that learning behaviors are unlikely to emerge in teams where there are power asymmetries between members. A summary of that research was provided above. The argument for a negative effect between power asymmetry and team learning behaviors is based on the fact that team learning behaviors are inherently threatening because they require that team members acknowledge mistakes (in order to reflect on and learn from those mistakes), admit ignorance (in order to learn from others’ competence), and expose themselves to the possibility of failure (a likely outcome when experimenting with new ideas). As a result, before individuals will engage in a collective process of team learning, they need to feel that they will not be punished, reprimanded, or made to feel inadequate as a result. And this environment of “psychological safety” (Edmondson, 1999), the argument continues, is simply less likely when there are power asymmetries within the team. Power asymmetries between team members create an environment where individuals become concerned about negative evaluations from more powerful team members (e.g., those who are more senior in tenure, rank, or experience). They lead to patterns of deference which privilege the opinions and ideas of the powerful instead of allowing the full range of knowledge and ideas to emerge, clash, and recombine (Ridgeway, 2001). Power asymmetries can create a political dynamic within a team as each member competes for the attention of and favored relations with those in positions of higher power (Eisenhardt & Bourgeois, 1988). In sum, power asymmetries within teams can create an environment which is simply antithetical to honest and open reflection, risk-taking, and learning.

This line of reasoning leads to the natural conclusion that team learning will only really occur when team members have equivalent amounts of power. In designing teams where learning is a desired goal, we should therefore work to assemble members who have equal amounts of power. But this conclusion is problematic for at least two reasons. First, asymmetries in power are virtually unavoidable in teams. As noted above, power is
traditionally defined as asymmetrical dependence of one person on resources held by another (e.g., information, knowledge, emotional support; Emerson, 1962; Blau, 1964). In the context of a task group, A has power over B when 1) A holds resources that B needs to perform his or her portion of the group’s task and 2) the dependence of B on those resources is greater than the dependence of A on resources held by B. In task groups, these resource dependencies emerge naturally from the structure of the task, from formal roles and authority relations, and from informal social relationships. Furthermore, these dependencies will be asymmetrical in almost all cases since members almost invariably differ (and often by design) in key sources of power-dependence such as experience, seniority, formal authority, tenure, or charisma.

Second, power asymmetries within a team may point to real opportunities for members to learn from one another by actively engaging in team learning behaviors. As noted above, power asymmetries arise from member differences along dimensions such as experience, tenure, formal or informal roles, specialization, etc. We know from past research that these sorts of differences between team members can be an important input and impetus for intra-team learning and continuous improvement (Van der Vegt & Bunderson, 2005). In fact, educational psychologists have argued that “when same-ability peers are involved, ... learning activities are usually restricted to lower-level learning: mutual comprehension checking and mutual rehearsal of facts and concepts” (King, 1998: p. 60). So, power asymmetries within a team may actually motivate team learning since they signal an opportunity for members to apply their different perspectives, experience, information, and expertise to solving team problems and improving team processes. Moreover, these opportunities for learning are likely to be most pronounced in teams where member differences—and associated power asymmetries—are greatest.

In other words, the goal of fostering team learning behavior by working to eliminate power asymmetries within a team is both impossible and misdirected; asymmetries in power can never be eliminated and attempts to do so will only dilute the learning potential of a team. What we need are not power-neutral teams but, rather, a better understanding of how teams might overcome the negative implications of power-dependence asymmetries in order to realize the learning opportunities suggested by those asymmetries. That is, we need to move beyond a simplistic, main effects model of power

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9 Interestingly, while King (1998) argues that learning opportunities are limited in same-ability groups, she suggests that same ability groups may be preferable to different-ability groups because of the very power and status dynamics that concern us here. Her solution is to teach same-ability groups to engage in “higher-order” learning processes.
and learning which assumes that power is always bad for learning in order to explore the possibility that the positive or negative relationship between power asymmetry and team learning behavior is contingent on other factors within (or even outside of) the team. This paper identifies and examines one such factor – the type of performance feedback that the team receives.

The moderating role of performance feedback

Feedback can be defined simply as information about the effects of one’s actions or efforts on some criterion of interest (see Herold & Greller, 1977; Taylor, Fisher, & Ilgen, 1984). In its original cybernetic formulation (Wiener, 1948), the concept of feedback was used to describe the process by which systems (human or machine) self-regulate. Feedback about system performance allows a system to adapt and self-correct until desired performance standards are achieved. Feedback scholars have referred to this function of feedback as a “cueing” function (see Nadler, 1979; Vroom, 1964). In human systems, feedback also serves a “motivational” function by reinforcing the promise of a reward and by reinforcing behavior-reward instrumentalities (Annett, 1969; Ilgen et al., 1979: p. 361; Vroom, 1964). Given these key functions, feedback has long played a central role in theories of learning, continuous improvement, and performance achievement (Annett, 1969).

Feedback researchers have made an important distinction between feedback which provides information about the performance of individuals within a group (individual feedback) and feedback which provides information about the performance of a group as a whole (group feedback) (see Barr & Conlon, 1994; Nadler, 1979; Hinsz, Tindale, & Vollrath, 1997; DeShon, Kozlowski, Schmidt, Milner, & Wiechmann, 2004). So, for example, an individual might be working as a sales person within a team of sales people where each team member covers a different region within the broader sales district. This individual could be given feedback about their sales for the year (individual feedback), the sales figures for their team (group feedback), or both. Several studies have examined the independent and combined effects of individual and group feedback on performance in groups. While findings from these studies have been inconsistent, some important patterns have emerged. For example, DeShon et al. (2004) recently found that the effects of feedback on effort and performance were homologous across group and individual levels such that feedback (group or individual) increased attention and effort toward (group or individual) goals which led to higher (group or individual) performance. They also found that combinations of individual and group feedback led to weaker results than either feedback type independently. Based on a review of the group feedback literature, Nadler (1979: p. 324)
suggested that task interdependence may be an important boundary condition for a group feedback effect in that “[w]here the group task is structured interdependently, group level feedback may be most effective.”

A possible explanation for the effects of group feedback on group attention and effort observed by DeShon et al. (2004) and others (e.g., Barr & Conlon, 1994) can be found in the work of Hinsz et al. (1997). They suggest that group feedback “may change the self-attributional focus from the individual to the group, which is consistent with the notions of social categorization theory” (p. 53). That is, when feedback is received at the individual level of analysis, it directs attention toward the individual as the relevant actor and therefore motivates the individual to think about things that he or she could do as an individual to improve performance. But when feedback is received at the group level of analysis, attention is directed toward the group as the relevant actor and the individual as one piece of that larger collective. As a result, individual group members are motivated to think about things that they can do as a group to improve performance, e.g., better coordination, greater information sharing, etc. This argument is consistent with a study by Zander & Wolfe (1964) in which it was found that group feedback led to more cooperation and less interpersonal strain within a group than did individual feedback. This argument is also consistent with the broader literature on social categorization effects which has suggested that a shared group identity increases intra-group cooperation and mitigates intra-group conflict, even when group members are very different from one another (Brewer & Miller, 1984; Gaertner, Dovidio, & Bachman, 1996; Van der Vegt & Bunderson, 2005).

Given these effects of individual and group feedback on attention and effort in groups, it seemed plausible to us that the type of feedback a group receives could influence the effects of power asymmetry on group learning and performance and, more specifically, on whether power asymmetry becomes a stumbling block or an opportunity for a group. We might hypothesize, for example, that individual performance feedback will simply reinforce power and status differences in power asymmetric groups by drawing further attention to individual contributions and by motivating individuals to focus on their individual performance. In other words, individual performance feedback stimulates a competitive dynamic in power asymmetric groups by encouraging member-to-member social comparison and by fostering status-seeking behaviors (e.g., efforts to “move up in the pecking order” by outshining other group members). While these efforts could stimulate individual learning efforts, they are unlikely to create an environment where group members are motivated to share information with
one another, admit areas of ignorance, or problem solve together around team problems, i.e., team learning behaviors. We therefore expect that:

**Hypothesis 1**: Individual performance feedback moderates the relationship between power asymmetry within a team and team learning behavior; power asymmetry is more strongly and negatively related to team learning behavior when individual performance feedback is high.

In contrast, we might expect that group performance feedback will stimulate team learning behaviors by inducing a collective mindset within the group. When feedback is received at the group level, asymmetries in power are likely to be cast in a very different light. That is, group feedback recasts power asymmetries not as an individual resource which team members jealously guard in order to maximize their own performance and subsequent status within the group, but as a group resource which can be leveraged by the group in order to influence the collective performance metric. So, whereas individual performance feedback sets up a competitive dynamic within a power asymmetric team, group performance feedback should stimulate a cooperative learning dynamic as individuals with different resources and degrees of power-dependence work together to solve problems and improve performance. In other words, we hypothesize that:

**Hypothesis 2**: Group performance feedback moderates the relationship between power asymmetry within a team and team learning behavior; power asymmetry is positively related to team learning behavior when group performance feedback is high but negatively related to team learning behavior when group performance feedback is low.

**Power asymmetry, learning, and team performance**

Finally, we would expect that the above effects of power asymmetry on team learning behavior will have important implications for team performance. As noted in our earlier review, several studies have demonstrated a positive relationship between team learning behaviors and team performance (Bunderson & Sutcliffe, 2003; Edmondson, 1999; Gibson & Vermeulen, 2003; Schippers et al., 2003; Van der Vegt & Bunderson, 2005). The argument for a relationship between team learning behaviors and team performance rests on the assumption that adaptation and continuous improvement is a critical performance capability in all teams, regardless of what they do or how much innovation is required in their context. Teams that engage in learning
behaviors are more likely to learn from their mistakes, integrate new information about their environment, benefit from member experience, effectively utilize member diversity of information and perspective, and better coordinate their efforts.

These arguments suggest a relationship between power asymmetry and team performance which is mediated through team learning behavior. That is, we would expect that power asymmetric teams which receive group performance feedback will perform better and that power asymmetric teams which receive individual performance feedback will perform worse. Furthermore, we expect that these effects of power asymmetry on performance will operate through team learning behavior. So, power asymmetric teams which receive group performance feedback will perform better because they are more likely to engage in team learning behavior. These arguments suggest the following hypotheses:

Hypothesis 3: Individual performance feedback moderates the relationship between power asymmetry within a team and team performance; power asymmetry is more strongly and negatively related to team performance when individual performance feedback is high.

Hypothesis 4: Group performance feedback moderates the relationship between power asymmetry within a team and team performance; power asymmetry is positively related to team performance when group performance feedback is high, but negatively related to team performance when group performance feedback is low.

Hypothesis 5: Team learning behavior mediates these moderated relationships between power asymmetry and team performance.

METHOD

Sample and procedure
The above hypotheses were tested using a sample of 268 employees from 46 teams. These teams worked in a variety of settings ranging from the banking sector to the medical sector and consisted of at least 3 team members ($M=5.83$, $SD=3.68$). In most of these teams at least some hierarchical differences and/or differences in degree of specialization between team members were present. For example, teams from the banking sector included a product advisor and an assistant, the medical teams consisted of different types of
nurses with different specializations and/or different levels of authority within the team, and the technical, management and consultancy teams consisted of senior team members and more junior professionals. We reasoned that these intrateam differences, which are characteristic of the types of member differences that exist in many work teams, should result in considerable power-dependence asymmetries within these teams.

We approached the teams via personal contacts with and a presentation to managers about the research project during a post-graduate MBA course. When a manager agreed to participate, s/he informed the team and two different types of questionnaires were subsequently sent to the team: a supervisor questionnaire and a team member questionnaire. The supervisor questionnaire was primarily used to collect team performance data, whereas the team member questionnaire was used to collect power asymmetry, feedback, and learning data. We approached 50 supervisors and received 46 usable supervisor questionnaires (92%) and 218 team members (out of 268) returned their questionnaire (81%). Of these respondents, 146 were female (67%) and the mean age of the respondents was 36.9 years (SD= 10.4). Twenty percent of these respondents had a high school degree, 44% a vocational degree, 29% a bachelor degree, and 7% of the respondents possessed a master’s degree or higher. Educational background also varied within our sample: 31% of the respondents had a degree related to economics, 21% had a degree related to the medical field, 12% had a degree related to engineering, and 10% had a degree related to business. Degrees in other fields (e.g., law, linguistics, social or natural sciences) were held by less then 10% of the respondents.

Measures

Power asymmetry. This variable was measured using a peer rating approach. Consistent with a conceptualization of power as resource dependence (Thibaut & Kelley, 1959; Emerson, 1962), we used the following two items to measure the task dependence of a team member (A) on another team member (B): “How dependent are you on B for materials, means, information, etc. in order to carry out your work adequately?” and “How dependent is B on you for materials, means, information, etc. in order to carry out his or her work adequately?” (1=“not dependent”, 7=“completely dependent”). In all items, B was replaced by the name of a specific fellow team member.

Because we measured A’s dependence on B as well as B’s dependence on A from the perspectives of both A and B, we were able to examine the

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10 Supervisors were not included as part of a team for the purposes of this analysis.
relationship between A’s perception of his or her dependence on B and B’s perception of A’s dependence on him or her. This correlation was .31 (p< .001)\(^{11}\), indicating considerable agreement between the two parties. Additionally, a univariate analysis of variance indicated that within-dyad variance was significantly smaller than between-dyad variance ($F[1402,1096]= 1.81, p< .001$). We therefore used the pooled perspectives of A and B in each relationship to compute our power asymmetry measure (cf. Borgatti & Everett, 1999). More specifically, we averaged A’s and B’s ratings of A’s dependence on B to obtain a pooled measure of A’s dependence on B, and A’s and B’s rating of B’s dependence on A to obtain a pooled measure of B’s dependence on A. Next, we computed the absolute difference between A’s dependence on B and B’s dependence on A for each pair of team members and averaged all these scores per individual. We then aggregated these individual scores to obtain a team-level power asymmetry score. This operationalization of power asymmetry is summarized in the following formula:

\[
\sum_{i=1}^{k} \left[ \frac{\sum_{j=1}^{r} |DBAi - DABi|}{r} \right] / k
\]

Where DBAi is the mean of A’s and B’s perceptions of the task dependence of B on A in relationship \(i\), DABi is the mean of A’s and B’s perceptions of A’s dependence on B in relationship \(i\), \(r\) is the number of relationships which team member \(j\) has in the team, and \(k\) is the number of team members. The amount of power asymmetry in these teams ranged from 0 to 1.75 (M= .60, SD= .42), with higher scores indicating more power asymmetry between team members\(^{12}\).

\(^{11}\) The magnitude of this correlation is in line with prior research involving dyads (e.g., Kenny & Acitelli, 2001; see p. 443, Table 3; the correlations they reported ranged from .20 to .47).

\(^{12}\) Our measure of power asymmetry is related to but conceptually and mathematically different from prior conceptions of power centralization (e.g., Bunderson, 2003b; Freeman, 1979). Power centralization scores are normally calculated from individual level influence nominations despite the fact that power centralization is argued to capture the "stratification or inequality in the extent to which actors are involved in relations" (Ibarra, 1992: p.170). Our measure of power asymmetry explicitly accounts for the dyadic nature of power as proposed by Emerson (1962) by using dyadic dependence measures. It is, however, possible to calculate a power centralization score from these dyadic data using more traditional centralization formulae:
Group performance feedback. This variable was measured with three items adapted from Van der Vegt et al. (2003). The items were: “We receive feedback as a team about the team performance”; “When we do not perform well, we are held responsible as a team”; “We regularly receive feedback about how good or bad we performed as a team”. These items were measured on a seven-point scale (1= “totally disagree”, 7=“totally agree”). Cronbach's alpha for the individual-level responses was .84.

Individual performance feedback. This variable was also measured with three items adapted from Van der Vegt et al. (2003): “I receive individual feedback about my own performance”; “When I do not perform well, I am held responsible as an individual”; “I regularly receive feedback about how good or bad I performed”. These items were measured with a seven-point scale (1= “totally disagree”, 7=“totally agree”) and Cronbach's alpha was .86.

Team learning behavior. This variable was measured with six items used by Schippers et al. (2003). The items were: “We talk about different ways in which we can reach our objectives”; “In this team the results of actions are evaluated”; “If things don’t work out as planned, we consider what we can do about it”; “We ask ourselves how effective our procedures for reacting to changes are”; “We regularly discuss whether the team is working effectively”; “The team often reviews its methods for getting the job done”. These six items were selected out of the original 24 items based on factor loadings and were measured on a seven-point scale (1= “totally disagree”, 7=“totally agree”). Cronbach's alpha was .89.

Team performance. Since we focused on a rather diverse sample of teams with different tasks and responsibilities we used a broad measure of team performance (cf. Ancona & Caldwell, 1992). Specifically, we asked each manager to compare the performance of his or her team with that of relevant other teams with similar tasks and customers on the following performance criteria: efficiency, continuity of the production process, use of capacities, speed with which the team produces, control over the production process,

\[
APA_j = \frac{\sum_{i=1}^{r}[DBA_i - DAB_i]}{r}
\]

\[
PC = \frac{\sum_{j=1}^{k}[P_{max} - APA_j]}{(k-1)}
\]

Where APAj stands for Average Power (dis)Advantage of team member j, PC stands for Power Centralization, and Pmax is the largest power advantage score in the team. All other symbols were defined above. The correlation between this more traditional measure and our measure of power asymmetry was .80 (p< .001). Also, analyses using this more traditional measure generated similar, albeit weaker, results to those obtained with our power asymmetry measure. We used our alternative power asymmetry measure because we felt that it more fully captures the range of dyadic power asymmetries that exist within a team.
quality of work, and overall team performance. They rated the team’s performance using a seven-point scale (1=“far below average”, 4=“average”, 7=“far above average”). Cronbach’s alpha was .90.

Control variables. Given that group size has been shown to relate to team learning and team performance in past research (e.g., Bunderson & Sutcliffe, 2003), we controlled for team size in all of our analyses. Team size information was collected using the supervisor questionnaire. Additionally, past research suggests that the overall level of task interdependence might be associated with team learning (e.g., Molleman & Timmerman, 2003). In order to explicitly consider the possible effects of task interdependence we also controlled for this variable in all of our analyses. Task interdependence was measured using team member responses to four items adapted from past research (Van der Vegt & Van de Vliert, 2005): “I have a one-person job”; “I rarely have to check or work with the other team members (reversed)”; “I have to work closely with my team members to do my work properly”; “The other team members and I depend on each other for information and resources to complete our tasks successfully”. These items were rated on a seven-point scale (1=“totally disagree”, 7=“totally agree”). Cronbach’s alpha was .77.

Discriminant and convergent validity. We used confirmatory factor analysis to assess the discriminant and convergent validity of the group feedback, individual feedback, and team learning behavior scales. We computed parameter estimates with the LISREL 8.51 computer package, using the maximum likelihood method. We first tested a model in which the group and individual feedback and team learning behavior items loaded on three corresponding latent constructs. The overall fit of the model to the data was adequate ($\chi^2$ [51, 218] = 166.65, $p<.001$, the standardized root mean square of the residuals (SRMSR) was .05, the goodness-of-fit index (GFI) was .89, and the comparative fit index (CFI) was .92). The factor loading of each item was significant at the .001 level or better.

In order to further evaluate the discriminant validity of our scales we computed two alternative models. In the first model all feedback items loaded on one latent feedback construct and the learning items on a separate learning construct. The fit of this model was significantly worse than that of the hypothesized measurement model ($\Delta \chi^2$ [2] = 219.87, $p<.001$, SRMSR = .07, GFI=.77, CFI=.82). The second alternative model contained only one latent variable. Again, the fit of this model was significantly worse than that of the original model ($\Delta \chi^2$ [3] = 496.07, $p<.001$, SRMSR=.11, GFI=.66, CFI=.68). Hence, we concluded that the hypothesized three-factor measurement model was the most appropriate for the situation under consideration.
A separate confirmatory factor analysis had to be conducted for team performance because the performance ratings were provided by team managers. We tested a model in which all seven team performance items loaded on a single factor and the overall fit of this model was very good ($\chi^2_{[14, 46]} = 13.95$, n.s.). The fit indices were all satisfactory: the SRMSR was .043, GFI was .92 and CFI was .99, and all factor loadings were significant at the .001 level or better.

**Inter-rater agreement and reliability.** We measured feedback and learning by asking all team members to evaluate these variables within their team. Since all team members are rating the same team-level constructs, we would expect that ratings from members of the same team are similar to one another and that these ratings are more similar to one another than they are to the ratings of these constructs by members of other teams (see Bliese, 2000). This expectation was investigated by calculating the average inter-rater agreement coefficient ($r_{wg}$; James, Demaree, & Wolf, 1984) and the intra-class correlation coefficients (ICC[1] and ICC[2]; Bliese, 2000). Median $r_{wg}$ values were .69 for group feedback, .74 for individual feedback, and .78 for team learning behavior. These numbers suggest that team members agreed in their ratings of these variables.

One-way analyses of variance suggested that team member ratings of group and individual feedback and team learning behavior all differed significantly ($p<.01$) between teams. The ICC(1) was .21 for group feedback, and .17 for individual feedback and learning. These figures indicate that a considerable amount of the variance in ratings was due to team membership (Bliese, 2000). The reliability of the group means was examined by calculating the ICC(2) coefficients. The ICC(2) values were .69 for group feedback, .63 for individual feedback, and .62 for team learning behavior. Overall, these results support the aggregation of individual team member responses to create team-level variables for group feedback, individual feedback, and team learning behavior.

**Analyses**

We used hierarchical multiple regression analyses to test our hypotheses. Following the recommendations of Aiken and West (1991) we standardized all independent variables and computed interaction effects by taking the product of the respective standardized independent variables. We tested four models to isolate the contribution of different terms. The first model tested the effects of our control variables. In the second model, the main effects of

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13 The inter-rater agreement for level of task interdependence within the team was .66, ICC(1)= .10, and ICC(2)= .48. This variable was aggregated by taking the average score within the team.
power asymmetry and group and individual feedback were added to the regression model, followed by the inclusion of the hypothesized 2-way interactions between power asymmetry and feedback in the third model. In the case of our performance dependent variable, we also examined a fourth model to test the mediating effect of team learning behavior.

RESULTS

Descriptive statistics
The means, standard deviations, and Pearson zero-order correlations between variables are presented in Table 4.1. As can be seen, the correlation between group and individual feedback was positive and significant ($r = .73$, $p < .001$), indicating that these variables share slightly more than 50% of their variance. While this correlation is below the .75 standard above which multicollinearity becomes particularly problematic (Ashford & Tsui, 1991), it was high enough to warrant careful examination of variance inflation factors in all regression models. Team learning behavior was positively related to both types of feedback ($r = .58$, $p < .001$ for group feedback and $r = .62$, $p < .001$ for individual feedback). Finally, perceptions of team learning behavior were positively associated with supervisor ratings of team performance ($r = .40$, $p < .01$).
Table 4.1: Descriptive Statistics and Pearson Zero-Order Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
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<tbody>
<tr>
<td>1 Team size</td>
<td>5.83</td>
<td>3.68</td>
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<td>.93</td>
<td>-.24</td>
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<tr>
<td>3 Power asymmetry</td>
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<td>.42</td>
<td>.06</td>
<td>-.12</td>
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<td>4 Group performance feedback</td>
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<td>.92</td>
<td>.02</td>
<td>.31*</td>
<td>.07</td>
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<td>5 Individual performance feedback</td>
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<td>.10</td>
<td>.06</td>
<td>.12</td>
<td>.73***</td>
<td></td>
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<tr>
<td>6 Team learning behavior</td>
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<td>.13</td>
<td>.26~</td>
<td>.00</td>
<td>.58***</td>
<td>.62***</td>
</tr>
<tr>
<td>7 Team performance</td>
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<td>.75</td>
<td>.06</td>
<td>.02</td>
<td>.13</td>
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<td>.14</td>
</tr>
</tbody>
</table>

~ p < .10
* p < .05
** p < .01
*** p < .001
Hypothesis tests: team learning behavior

Regression results for models with team learning behavior as the dependent variable are summarized in Table 4.2. There was some evidence for a positive relationship between task interdependence and team learning behavior in Model 1, although the effect of the control variables was not significant. The addition of power asymmetry and group and individual feedback in Model 2 significantly increased the explanatory power of the model ($\Delta R^2 = .36$, $p < .001$) with a positive and significant coefficient for individual feedback; groups that reported receiving more individual feedback also reported more learning behavior. The coefficients for the interactions between group feedback and power asymmetry and between individual feedback and power asymmetry, added in Model 3, were both significant at $p < .01$ ($b = -.51$ for individual feedback and .44 for group feedback) and the addition of these two terms significantly increased the explanatory power of the model ($\Delta R^2 = .11$, $p < .05$). Variance inflation factors (VIF) for the third model were all well below 4, suggesting that multicollinearity was not a problem in these analyses (e.g., Langfred, 2004; Miles & Shevlin, 2001).

Simple slope tests suggested that power asymmetry was negatively related to team learning behavior when individual feedback was high ($b = -.85$, $SE = .28$, $p < .001$) and positively related to learning when individual feedback was low ($b = .52$, $SE = .24$, $p < .05$). These findings support Hypothesis 1. To facilitate interpretation we plotted this interaction in Figure 4.1a. Simple slope tests also suggested that power asymmetry was positively associated with learning when group feedback was high ($b = .38$, $SE = .23$, $p < .05$) and negatively associated with learning when group feedback was low ($b = -.71$, $SE = .27$, $p < .01$), consistent with Hypothesis 2 (see Figure 4.1b).
### Table 4.2: Results of Regression Analysis for Team Learning Behavior

<table>
<thead>
<tr>
<th>Model</th>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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<td></td>
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<td>SE</td>
<td>B</td>
</tr>
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<td>Task interdependence</td>
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<td>.11</td>
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<td>Power asymmetry</td>
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<td>.11</td>
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<td>.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual performance feedback</td>
<td>.39**</td>
<td>.14</td>
</tr>
<tr>
<td>3</td>
<td>2-way interaction</td>
<td>Power asymmetry * Group performance feedback</td>
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<td>.16</td>
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<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
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<td>ΔR²</td>
<td>.11~</td>
<td>.36***</td>
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n=46

* p<.05
** p<.01
*** p<.001
Figure 4.1: Power Asymmetry and Team Learning Behavior at Different Amounts and Types of Feedback
Hypothesis tests: team performance

Regression results for models with team performance as the dependent variable are summarized in Table 4.3. Neither of the control variables was significantly related to team performance in Model 1 and the addition of power asymmetry along with both types of feedback in Model 2 did not increase the explanatory power of the model. The addition of the two interaction terms in Model 3 did explain significant variance in performance ($\Delta R^2 = .15, p < .05$) with a positive and significant coefficient for the group feedback interaction ($b = .44, p < .05$) and a negative and significant coefficient for the individual feedback interaction ($b = -.61, p < .01$), as suggested in Hypotheses 3 and 4. Once again, multicollinearity did not appear to be a problem given that VIF scores for the fourth model were all well below 4.

In support of Hypothesis 3, the simple slope tests revealed that power asymmetry was negatively related to team performance when individual feedback was high ($b = -.58, SE = .29, p < .05$) and positively related to team performance when individual feedback was low ($b = .65, SE = .24, p < .01$). And simple slope tests for the interaction between power asymmetry and group feedback suggested that power asymmetry was positively related to team performance when group feedback was high ($b = .48, SE = .24, p < .05$), but only weakly negatively related to team performance when group feedback was low ($b = -.40, SE = .27, p < .10$) which is generally consistent with Hypothesis 4. These effects are plotted in Figure 4.2.

Finally, Model 4 tests for a mediated effect (as hypothesized in H5) by adding team learning behavior to the regression model. The addition of team learning behavior to the model resulted in a significant increase in $R^2$ ($\Delta R^2 = .10, p < .05$) with a positive and significant coefficient for team learning behavior ($b = .36, p < .05$). Furthermore, with team learning behavior in the model, the group and individual feedback interactions became non-significant ($b = .23, n.s.,$ for power asymmetry x group feedback and $b = -.37, n.s.$ for power asymmetry x individual feedback). These results suggest that team learning mediated the moderated effects of power asymmetry on team performance as suggested in Hypothesis 5.

---

14 We did not find any support for three-way interactions between power asymmetry and individual and group feedback. The coefficients for these three-way interactions were $b = -.20, SE = .13, n.s.$ in the team learning behavior regression and $b = -.12, SE = .17, n.s.$ for the team performance analyses. All the hypothesized two-way interactions remained significant, and the additional two-way interaction of individual and group feedback did not reach significance.
Table 4.3: Results of Regression Analysis for Team Performance

<table>
<thead>
<tr>
<th>Model</th>
<th>Variable</th>
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<th>Model 3</th>
<th></th>
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<td>-.16</td>
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<td>-.26</td>
<td>.18</td>
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<tr>
<td></td>
<td>Power asymmetry * Group performance feedback</td>
<td>.44*</td>
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<td>.44*</td>
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\[ \begin{align*} 
R^2 & = .01 \quad .08 \quad .23 \quad .33 \\
\Delta R^2 & = .01 \quad .07 \quad .15* \quad .10* 
\end{align*} \]

n=46

* p< .05
** p< .01
Figure 4.2: Power Asymmetry and Team Performance at Different Levels and Types of Feedback

Figure 2a. Individual performance feedback

Figure 2b. Group performance feedback

Figure 4.2: Power Asymmetry and Team Performance at Different Levels and Types of Feedback
DISCUSSION

Past research has suggested that an active involvement in team learning will be difficult if not impossible to achieve in teams where power differences exist between and among team members. While we acknowledge the very real obstacles to reflection and feedback-seeking that result from intra-team power differences, we also recognize that the very differences between members that lead to power asymmetries in teams could also spur learning, dialogue, and debate within a group, i.e., a greater engagement in team learning behaviors. Our goal in this paper has been to examine one key factor which may explain when intra-team power differences will motivate as opposed to dampen learning efforts within a team: the nature of performance feedback that the team receives. Specifically, we argued that whereas individual performance feedback would strengthen a generally negative relationship between power asymmetry and team learning behavior, group performance feedback would result in a positive relationship. These hypotheses were strongly supported overall. In terms of specific results, we found that the relationship between power asymmetry and both team learning behavior and team performance was positive under conditions of high group or low individual performance feedback but negative under conditions of high individual or low group performance feedback. We also found that team learning behavior mediated the relationship between power asymmetry and team performance.

Theoretical implications

The theory, method, and results of this study have several important implications for research on teams, learning, and power. First, this study directly challenges the notion that power differences always stifle learning behaviors within a team and suggests that, in fact, power differences may be an impetus for team learning behaviors under certain conditions. That is, we suggest that the relationship between power asymmetry and team learning may be contingent on other factors within a group. We identified one such factor – the nature of performance feedback received by the group – but there may be others. In fact, we would expect that any group design element which serves to foster a collective mindset and sense of group identification within a team should help to mitigate the negative effects of power asymmetry. Future research can begin to elaborate those elements.

Second, most research on power asymmetry within groups has conceptualized power at the individual and/or the group level, i.e., power is something which each member possesses to greater or lesser degrees and which can be evaluated to capture power configurations within a group (e.g.,
power centralization). But power, in classic formulations, is a relational property which emerges from the dependence of one actor on resources controlled by another (Emerson, 1962; Thibaut & Kelley, 1959). It is therefore possible – and even likely – that a given group member will have a power advantage in one relationship but not in another. This study explicitly acknowledges this possibility by conceptualizing power asymmetry within a group as something which emerges from dyadic resource dependence. That is, we suggested that in order to fully represent power asymmetry within a group, one must attend to patterns of asymmetric dependence between each of the dyadic relationships within that group. This study therefore introduces an approach to conceptualizing and measuring power differences in groups which more directly builds on the theoretical underpinnings of power and dependence research.

Third, this study contributes to the literature on feedback by confirming that group and individual performance feedback can have very different implications for group process and performance. We found that while group and individual feedback do seem to be correlated (suggesting that teams adopting one type of feedback are more likely to also adopt the other type of feedback), these are two separate constructs which exhibit markedly different moderating effects on a key input-to-process relationship. Furthermore, these results suggest that the type of feedback group members receive (i.e., individual or group) is important in part because it influences whether group members adopt a collective versus an individual mindset (Hinsz et al., 1997). Our results therefore contribute to the literature on feedback in teams by empirically investigating the scarcely researched effects of different types of performance feedback (DeShon et al., 2004).

**Unexpected findings and future research directions**

While the pattern of results described here was largely consistent with our expectations, several of our findings raise important follow-up questions which suggest important directions for future research. For example, we found a positive and significant direct relationship between individual performance feedback and team learning behavior in our regression analysis but no significant direct relationship between group performance feedback and team learning behavior (after accounting for the effect of the control variables in our analysis). This result initially appears somewhat counter-intuitive since it suggests that team learning behaviors – i.e., behaviors associated with reflection, feedback seeking, and experimentation within a team – are more likely to result when team members receive feedback on their own as opposed to the group’s performance. If individual feedback prompts attention and effort toward individual goals and group feedback
prompts attention and effort toward group goals (i.e., DeShon et al., 2004), wouldn’t we expect that group feedback will be more likely to encourage collective learning efforts?

The answer to this question may derive from the fact that, ultimately, team learning behaviors rely on individual team members engaging other team members in processes of reflection and discussion. So whereas group feedback may help to induce a collective mindset within a group, individual feedback more directly motivates individual effort. This possibility suggests an interesting dilemma. On one hand, the use of individual performance feedback in power-asymmetric teams may reinforce the negative effects of power differences and dampen learning behaviors, suggesting the need for group performance feedback. On the other hand, individual performance feedback seems to have a stronger direct effect on team learning behaviors than does group performance feedback. This suggests that there may be some ideal combination of group and individual performance feedback in teams which motivates individuals to engage in learning behaviors while still attending to the performance goals of the group. In other words, there may be some optimal configuration of individual feedback, group feedback, and power asymmetry which maximizes learning behaviors within a team.

While this is an interesting possibility, we did not find a significant relationship between a linear power asymmetry X group feedback X individual feedback interaction term and team learning behaviors in our post hoc analyses (described above). And the interaction between group feedback and individual feedback was also unrelated to team learning behavior. So if the interaction between feedback type and power asymmetry does affect team learning behavior, that relationship is likely more complex than is captured in a linear-by-linear-by-linear interaction term. It may be, for example, that the optimal combination of individual performance feedback, group performance feedback, and power asymmetry involves quadratic-by-linear-by-linear or even quadratic-by-quadratic-by-linear interactions. Deeper investigation of these interactions is one provocative and interesting direction for future research.

Secondly, we hypothesized that individual performance feedback would serve to amplify and group performance feedback would serve to attenuate a generally negative relationship between power asymmetry and team learning behavior. But while we did find that the direct relationship between power asymmetry and team learning behavior was negative (albeit weak and not statistically significant), we also found that the relationship between power asymmetry and team learning behavior was positive under conditions of low individual performance feedback. After further reflection, we attribute this result to an avoidance dynamic among survey respondents. That is, it seems likely that survey respondents who “strongly disagreed” with
statements about whether their team receives individual feedback are signaling that, in fact, their team deliberately and consciously avoids individual performance feedback – which points to a set of shared values around recognizing collective as opposed to individual efforts. The positive relationship between power asymmetry and team learning behavior in teams where individual performance feedback was low may, therefore, result from the same theoretical mechanism that we believe is triggered by group performance feedback: a collective mindset. This suggests that if we had measured feedback using extent scales rather than agree/disagree scales, we may not have found this unexpected effect. This may be a useful design consideration for future research in this area.

Study limitations
As with any study, certain aspects of the present study suggest the need for caution in how these results should be interpreted and/or generalized. For example, this study adopted a cross-sectional design which limits our ability to draw firm conclusions about the direction of causality. While alternative arguments about reverse causality are not as likely from a theoretical standpoint in this case, the fact remains that we cannot conclusively eliminate them and must therefore leave that exercise for future research.

One might also question whether the use of a survey to collect measures of power asymmetry, feedback, and team learning behavior might have introduced common method bias into these results (Podsakoff et al., 2003). Given that group measures of power asymmetry were constructed from dyadic comparisons, it seems highly unlikely that correlations between these measures and the other group process measures would be artificially inflated. But it is possible that relationships among the two types of feedback and team learning behavior could be inflated due to common method variance. We explicitly considered the effect of the high correlation between our two types of feedback by examining variance inflation factors. And any inflated correlations between team learning behavior and the two types of feedback should not affect the relationships of core theoretical interest in this study. We would therefore suggest that common method variance should not be a major concern in this study.

Practical implications
Based on the premise that any differences in member power frustrate intra-team learning behaviors, some researchers have suggested or implied that in cases where team learning is the goal, teams should be constructed in ways that minimize or eliminate power differences. So, for example, differences in tenure or experience should be minimized, authority relations should be
eliminated, etc. We question this approach for several reasons. First, attempts to eliminate or minimize power differences cannot ever succeed entirely since power and status differences can and will emerge around any number of member differences, however subtle or intangible (e.g., assertiveness, gender, age, informal coalitions). Second, even if these attempts were successful at reducing power differences, they come at a high cost since they reduce the very richness of experience, perspective, contact, and expertise that stimulates and facilitates intra-group learning.

This paper offers an alternative solution to the design and operation of teams where intra-team learning is the goal. Specifically, we suggest that when power differences exist between and among group members, it is particularly important that members adopt a collective mindset and base of identification rather than an individual mindset. Furthermore, we suggest that one way of inducing this collective mindset is to provide group rather than individual performance feedback to group members. In other words, we argue that the solution to dealing with power differences in teams where learning is a goal is not to eliminate those differences but, rather, to manage them so that they become an asset rather than an impediment.