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By: **J. Kemp Ellington** and Erich C. Dierdorff

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Kemp Ellington, J., & Dierdorff, E. C. (2014). Individual Learning in Team Training: Self-Regulation and Team Context Effects. Small Group Research, 45(1), 37–67. https://doi.org/10.1177/1046496413511670. Publisher version of record available at: https://journals.sagepub.com/doi/full/10.1177/1046496413511670

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Although many analysts recognize that team-level learning is reliant on the acquisition of learning content by individuals, very little research has examined individual-level learning during team training. In a sample of 70 teams (*N* = 380) that participated in a simulation-based team training setting designed to teach strategic decision-making, we examined how self-regulation during team training influenced the extent to which team members subsequently demonstrated individual mastery of the team training content. We also investigated the extent to which team characteristics moderated the relationships between self-regulation and learning outcomes. Multilevel mediation results indicated that self-efficacy fully mediated the effects of metacognition, or self-monitoring of learning, on individual declarative and procedural knowledge of team training content. The results also revealed that these individual-level relationships were moderated by the team context. In particular, a team's overall performance and quality of cooperation amplified the positive effects of individual self-regulation. Implications for team training research and practice are discussed.

Keywords

team learning, team performance, metacognition, self-efficacy, simulations, self-regulation, team context

Teams have become ubiquitous as an organizing structure of work in contemporary organizations. Indeed, work teams are increasingly a preferred work arrangement across a broad range of industries and firms (S. T. Bell, 2007; Devine, Clayton, Philips, Dunford, & Melner, 1999; Salas, Stagl, & Burke, 2004). This trend has strengthened the need to understand factors that shape team effectiveness, and toward this end, an enormous body of research has developed (Aguinis & Kraiger, 2009; Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Mathieu, Maynard, Rapp, & Gilson, 2008). Team training is one of the critical elements promoting team effectiveness, and so it has also received extensive study. The results of this work have clearly supported team training as an effective means of producing team-level learning (Salas, Nichols, & Driskell, 2007). For example, a recent meta-analysis found that team training positively affected a host of team-level outcomes, including cognitive outcomes (e.g., declarative knowledge), affective outcomes (e.g., trust), teamwork processes (e.g., coordination), and team performance (Salas et al., 2008).

Although the evidence clearly shows that team training is effective in promoting team-level outcomes, several fundamental questions remain. First, despite the wide recognition that team-level learning is predicated on individual team members acquiring the learning content (Burke, Stagl, Salas, Pierce, & Kendall, 2006; Ellis et al., 2003), little empirical work has investigated individual-level learning processes in teams (B. S. Bell & Kozlowski, 2012; Chen & Klimoski, 2007; Dierdorff & Ellington, 2012). This lack of work exists even though training theory clearly suggests that a thorough understanding of any training intervention requires consideration of influences from multiple levels (Mathieu & Tesluk, 2010). Such an understanding is especially critical given the fluidity of team membership that has become common in so many organizational settings (see Peterson & Mannix, 2003; Tannenbaum, Mathieu, Salas, & Cohen, 2012). For example, estimates suggest that 78% of individuals spend 2 years or less with a single work team (Thompson, 2008). Moreover, academic courses designed to teach individuals to work in teams are popular across a variety of disciplines. This implies the need for team training to be transportable as individuals move from team to team in businesses or at school (Tannenbaum et al., 2012). Therefore, research that identifies the factors influencing individual acquisition of team training content is imperative to theory and practice.

Second, relatively little is yet known about the interaction between individual and team-level learning processes and outcomes (Chen & Klimoski, 2007). Teams are known to create salient contexts that can exert top-down influences on individual-level learning and behavior (Kozlowski, Gully, Nason, & Smith, 1999; Porter, 2008; Smith-Jentsch, Salas, & Brannick, 2001). For instance, some research shows that learning in groups can promote individual learning on problem-solving tasks (Laughlin & Adamopoulos, 1980; Laughlin, Carey, & Kerr, 2008; Laughlin & Ellis, 1986.). Consequently, it is critical to examine potentially influential characteristics of the team context that may affect individual learning in team training. In particular, contextual characteristics are known to moderate individual-level relationships (Johns, 2006; Kozlowski & Klein, 2000), so perhaps they can regulate the extent to which individual learning processes translate into learning outcomes. A better understanding of these team training context effects could improve theories of team training effectiveness (Kozlowski, Brown, Weissbein, Salas, & Cannon-Bowers, 2000), and has potential implications for practitioners seeking to maximize individual learning during team training. For example, armed with knowledge of how team contexts moderate individual learning, trainers may be able to shape those contexts to be more conducive to learning, and also target individuals or teams for additional instruction when team contexts are less favorable for individual learning.

With these needs in mind, we sought to examine specific factors that influence individual-level learning in team training. We applied a self-regulation theory framework (Kanfer & Kanfer, 1991) to build predictions regarding how individual self-regulation affects individual-level acquisition of team training content. More specifically, we examined metacognition and task-specific self-efficacy (hereafter referred to as self-efficacy) as key self-regulatory mechanisms. Metacognition is a form of self-monitoring that involves assessing and adjusting one's learning strategy with regard to task mastery (Cannon-Bowers, Salas, & Milham, 2003; Flavell, 1979). Self-efficacy, a general belief in one's capability to perform a particular task or to meet a set of situational demands (Bandura, 1997, 1982), represents an individual's self-evaluation of learning. We tested the mediating role of self-efficacy in the metacognition—individual learning relationship, as well as investigated how team-level contextual features (overall team performance and quality of intrateam cooperation) shaped the effects of these self-regulatory processes on subsequent individual-level learning.

Individual Self-Regulation and Team Training

Current conceptualizations of the training process recognize various influences on learning and the transfer of training that can occur before, during, and after training. In regard to forces operating during training, self-regulatory processes play a key role in shaping the intensity and persistence of effort toward learning (Beier & Kanfer, 2010; B. S. Bell & Kozlowski, 2010). Self-regulation allows individuals to guide their goal-directed actions over time and across fluctuating conditions (Karoly, 1993). Some relevant processes include planning, self-monitoring, and self-evaluation (Kanfer & Ackerman, 1989). People who monitor and evaluate their learning and adjust their strategies accordingly are thought to learn more effectively (Gully & Chen, 2010).

Among the key variables reflecting self-regulation are metacognition and self-efficacy (Kozlowski et al., 2001). Metacognition has been shown to positively influence learning and performance (B. S. Bell & Kozlowski, 2008; Ford, Smith, Weissbein, Gully, & Salas, 1998; Kozlowski & Bell, 2006), and self-efficacy plays an important role in motivation, successful learning (i.e., declarative knowledge and skill acquisition), and the transfer of trained skills (Brown & Sitzmann, 2011; Colquitt, LePine, & Noe, 2000). With regard to overall learning processes, metacognition and self-efficacy are often portrayed as interrelated components of a broader self-regulatory system (B. S. Bell & Kozlowski, 2010; Zimmerman, 1990). That is, although they are distinct facets of self-regulation, metacognition and self-efficacy are thought to be connected in an overall learning process. Research supports this notion by showing positive correlations between levels of metacognition and self-efficacy (B. S. Bell & Kozlowski, 2008; Pintrich & De Groot, 1990; Schmidt & Ford, 2003).

Yet there are reasons to believe that the relationship between metacognition and self-efficacy is sequential in certain circumstances, with self-efficacy mediating the influence of metacognition on learning outcomes. For example, metacognition is thought to influence learning outcomes in part by influencing motivation during training (Beier & Kanfer, 2010). In this sense, metacognition involves not only monitoring one's progress in learning new tasks but also making decisions about where to allocate resources and the intensity of effort directed toward acquiring training content. Because self-efficacy is recognized as a central motivational facet of self-regulation (B. S. Bell & Kozlowski, 2010), and often mediates individual-level learning processes (Chen, Gully, Whiteman, & Kilcullen, 2000), the extent to which metacognition leads to learning might be contingent on whether individuals believe they can effectively demonstrate mastery of the learning content. Even if learners actively monitor and adapt their learning strategies (i.e., metacognition), they may be unable to perform the learned task effectively if they do not believe they are capable of doing so (poor self-efficacy). Although these mediating effects have not yet been tested directly, related training research has shown that metacognitive activity is positively associated with self-efficacy (B. S. Bell & Kozlowski, 2008; Ford et al., 1998; Schmidt & Ford, 2003). Prompting self-regulation in trainees has also been found to have stronger effects on performance for those with higher levels of self-efficacy (Sitzmann, Bell, Kraiger, & Kanar, 2009). Finally, research from the general educational literature has shown that when learners' beliefs about their own self-monitoring increase so do their levels of self-efficacy about academic performance (Zimmerman et al., 1992). Taken collectively, all of this evidence suggests that in some circumstances self-efficacy is a key mediating variable that conveys the benefits of increased metacognition during training onto subsequent learning.

One circumstance where self-efficacy might mediate the effects of metacognition is when individuals are learning within team training settings. Although team functioning is indeed contingent on individual members (Ellis et al., 2003), the main focus of team training is on collective team-level outcomes. During such training, individual self-regulation may be particularly important for the individual-level acquisition of team training content because the instruction itself and the performance feedback it provides are not directed at the individual per se, but rather at the team. Thus, it is likely that individuals need to allocate even more resources to monitor and adjust their own progress and strategies to successfully learn the training content that is by nature delivered at the team level. This means that team members must apply team-level instruction to individual-level performance and therefore generalize the team-level training content to new situations. A key factor known to affect the extent to which individuals generalize training to new situations is self-efficacy (Baldwin & Ford, 1988; Blume, Ford, Baldwin, & Huang 2010). This suggests that the extent to which metacognitive activities ultimately influence the individual-level learning of team-level training depends on whether individuals believe they have the capacity to master team-level instruction. We therefore predicted that individuals' beliefs about their own capability to apply the team training content (i.e., self-efficacy) is a critical mechanism through which the positive effects of metacognition result in increased individual-level learning of team training content. Figure 1 displays the overall conceptual model guiding the study's hypotheses.

> **Hypothesis 1:** The positive effects of metacognition on individual-level learning of team training are mediated by individuals' self-efficacy.

Moderating Effects of Team Context on Individual Learning

The central focus of team training is to promote team learning, which is a relatively enduring change in the team's collective knowledge or skill, resulting from the shared experience of the team members (Stagl, Salas, & Day, 2008). An important implication of this is that individual-level learning

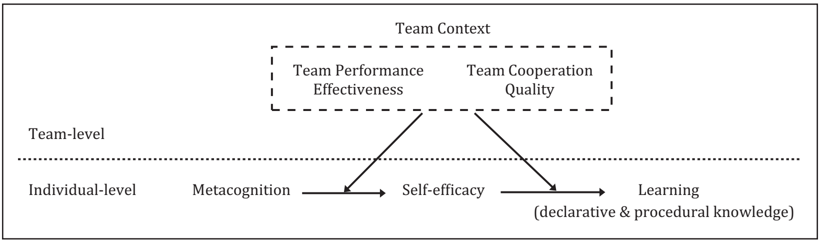

Figure 1. Conceptual model of self-regulation, team context, and individual-level learning.

during team training does not occur in isolation, but rather is embedded in a team context. This means that different teams will meaningfully differ in the learning environments they foster, and so even individuals in the same team-training event may have distinctive experiences that shape their self-regulated learning. In team training, the linkage between self-regulation and learning is nested in the team to which individuals belong, suggesting that team contexts will exert top-down influences on this individual-level process.

Context is generally viewed as the situational opportunities and constraints that affect behavior and cognition (Dierdorff, Rubin, & Morgeson, 2009; Johns, 2006; Mowday & Sutton, 1993). Contexts created by teams are influential because they encourage or discourage different team member behaviors, and can condition the way team members view learning opportunities and experiences (Hackman, 1992; Porter, 2008). For example, team context can influence the extent to which individual dispositions, such as goal orientations, affect learning and performance (Dierdorff & Ellington, 2012; LePine, 2005). Top-down influences of context are likely to moderate the relationships between lower level variables, especially when lower level variables are fundamentally individual in nature (Johns, 2006). Training scholars have further noted that, in relation to groups or units, top-down effects of context can moderate the relationships among individual motivation, learning, and transfer (Kozlowski et al., 2000). This suggests that team contexts will condition the individual-level relationships between self-regulation and learning during team training.

Nearly all team training seeks to improve activities tied to task completion and/or team member interactions (e.g., Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995; Goldstein & Ford, 2002; McIntyre & Salas, 1995). These aspects of team functioning have been referred to as *taskwork* and *teamwork*, respectively (Morgan, Salas, & Glickman, 1993). Research confirms the significance of taskwork and teamwork, with teams engaging in strategic planning (taskwork-focused) and developing team charters (teamwork-focused) outperforming other teams that spend less time engaged in these activities (Mathieu & Rapp, 2009). This suggests that qualitative differences in taskwork and teamwork across teams participating in team training create unique contexts within which individuals learn during team training.

A particular feature of the taskwork context that may be salient includes the extent to which a team successfully performs its overall tasks during training. More specifically, team performance could moderate the effectiveness of individual team members' self-regulation and ultimately their learning of the team training content. For example, team performance represents contextual information that provides positive and negative performance-related cues to team members and such cues are known to shape individuals' efficacy-related beliefs (Gist & Mitchell, 1992). Performance cues could also promote self-monitoring, such as metacognition, which is moderated by environmental factors (Schmidt & Ford, 2003). This suggests that in higher performing teams, where there is a successful collective mastery of learning content, team members receive more signals affirming that what they are doing is indeed correct. Successful team performance is thus likely to increase the prevalence of information that enhances the effects of self-regulation on learning, such as increased opportunities for vicarious reinforcement and verbal persuasion relating to effective learning and performance strategies (see Bandura, 1982; Gully, Incalcaterra, Joshi, & Beaubein, 2002). Following this logic, we predicted that the contexts created by high-performing teams would amplify the effects of team members' self-regulation on subsequent individual mastery of team training content.

> **Hypothesis 2:** Team performance moderates the indirect effects of metacognition through self-efficacy on individual-level learning of team training, such that higher team performance amplifies the positive effects of self-regulation on learning.

The extent to which a team engages in productive coordination and cooperation are salient aspects of the teamwork context. A team context of high-quality cooperation is one in which members share information and effort in a reciprocal fashion (Seers, 1989; Seers, Petty, & Cashman, 1995). Research has shown that higher quality cooperation within teams is associated with greater team effectiveness (Dierdorff, Bell, & Belohlav, 2011). It stands to reason that more information sharing among a team's members during their training would promote the linkages between individual self-regulation and learning of team training content. For example, an individual in a team context of ample and reciprocal coordination (high-quality cooperation) should receive greater amounts of performance feedback and have more opportunities to learn from other team members than someone in a team context of little (or poor quality) intrateam interaction. Increased sharing of learning among a team's members is likely to result in greater chances for vicarious learning, which is thought to promote self-efficacy and learning (Bandura, 1977). Moreover, the information that is exchanged within a team during team training may well encompass team-level strategies and performance monitoring, such as talking about what is working for the team, not working, and what to do about it (for exceptions, see Moreland & McMinn, 2010). A high-quality exchange of such information could in turn foster self-directed reflection on one's own learning because the manner with which teams engage in information processing is important to individual metacognition (Hinsz, Tindale, & Vollrath, 1997). With all of this in mind, we predicted team contexts with a higher quality of intrateam cooperation would amplify the effects of self-regulation on subsequent individual learning outcomes.

> **Hypothesis 3:** Team cooperation quality moderates the indirect effects of metacognition through self-efficacy on individual-level learning of team training, such that higher team cooperation quality amplifies the positive effects of self-regulation on learning.

Method

Participants

A total of 380 undergraduate and graduate students participated in the study. These individuals were members of 70 teams, with 4 to 6 individuals on each team (*M* = 5.25). The average age of the undergraduate participants was 21.2 years (53% male) and 33.4 years (70% male) for the graduate participants.[1] Team assignments were made using a stratified random approach whereby teams were balanced with individuals from different majors (e.g., finance, accounting, management, marketing). This approach was intended to ensure an even distribution of functional knowledge across the teams, and to mimic the cross-functional nature of top management teams in real-world companies.

Procedure

The training setting was a simulation-based team-training module conducted within a capstone business course at a large private university in the Midwestern United States. The primary instructional focus of the team training was business strategy and strategic decision-making in a group-based setting. Two simulation software programs developed by Capsim Business Simulations (www.capsim.com) were used. The first was a team-based simulation (Capstone®) that required participants to make complex sets of decisions involving all aspects of a business's operation. Participants made these decisions together, working in teams. In the simulation, teams competed in a real-time, interactive decision-making environment against other teams in the same course. The simulation software was designed to mimic a dynamic marketplace in which technology, customer values, and competitive pressures were all constantly changing. Participants acted as upper level managers in a manufacturing organization (i.e., top management teams). The simulation scenario required teams to turn around a poor performing company that they had "inherited." To accomplish this, teams had to make operating decisions involving a variety of issues, including research and development, marketing, production, human resources, total quality management, and finance. Each of these decisions required in-depth analysis, review, and discussion of various internal and external performance information (e.g., internal costs, financial data, production capacity, sales, etc.), in relation to the business strategy the teams wanted to implement. Performance occurred across eight simulated years or decision rounds, and lasted for approximately 5 weeks. At the conclusion of the team-based simulation, individuals completed measures of metacognition and team cooperation quality. To ensure temporal precedence, self-efficacy for transferring team training was assessed 3 to 4 days after the team-based simulation.

The second simulation (Comp-XM®) was an individual-based version of the team-based simulation, completed 7 to 10 days after the team-based simulation. The individual version consisted of (a) a business simulation similar in appearance and structure to the team simulation but during which students performed alone, and (b) a knowledge test of various topics related to business acumen and strategic decision-making. The simulation portion made students responsible for managing a well-established company against several other growing competitors, instead of inheriting a poor performing company in need of turn-around. Individuals made the same types of decisions as in the team-based simulation when it came to marketing, production, human resources, and finance, but they competed against computer-run companies (vs. other student-run firms). The knowledge test consisted of 42 multiple-choice items that assessed mastery of business acumen. For example, participants were asked to calculate various financial ratios, interpret a cash flow statement, conduct market forecasts, and differentiate business strategies (see the appendix for topics covered). Test items were administered in sets throughout the simulation, which spanned four simulated years (rounds), and a fifth round after the simulation where only test items were presented.

Measures

Metacognition. This variable was measured with 10 items derived from the scale described by Schmidt and Ford (2003; see the appendix). Instructions read, "When responding to the following items, think about *your own* thoughts, actions, and performance during strategic decisions for your Capstone company." Items were rated using a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*). Coefficient alpha for the composite measure was .92.

Self-efficacy. Individuals' efficacy for applying team training content to the individual-based simulation were captured using a six-item scale (see the appendix) developed by the study's authors following the guidelines described by Bandura (1997). Items were rated using a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*). Coefficient alpha for this measure was .94.

Team cooperation quality. This teamwork feature of team context was based on the *team-member exchange* scale (Seers, 1989; see the appendix). This 14-item scale reflects the quality of reciprocal relationships among a team's members (Dierdorff et al., 2011). Items were rated using a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*). Scores were averaged across team members to produce a team-level variable reflecting the average reciprocity across a team's members (Seers et al., 1995). Coefficient alpha for the scale at the individual level was .91. Aggregation was supported with sufficient levels of group-mean reliability, ICC(2) = .76.

Team performance. This taskwork feature of team context was operationalized using metrics automatically generated by the team-based simulation. The simulation computed financial indicators of business effectiveness by taking into account the decisions of each company relative to the simulated marketplace as a whole; this matches the way these indicators are measured in real-world organizations. The performance indicators included return-on-assets, return-on-sales, and stock value. Return-on-assets measured how effectively a company used assets to reach its level of performance. Return-on-sales assessed a company's level of performance relative to the amount of generated sales. Stock value represented how effectively debt and equity were used to create a firm's level of performance. A composite measure was created using these three metrics. Variables were standardized prior to creating the composite score. The coefficient alpha for the composite measure was .95.

Individual-level learning. Measures of individual-level learning of team training included declarative knowledge and procedural knowledge. These were assessed during the individually performed simulation (Comp-XM®).

Declarative knowledge was assessed with 42 multiple-choice items about various aspects of organizational strategy, functional integration, team decision-making, and so forth. Favorable reliability for this measure was demonstrated with a Kuder and Richardson (1937) Formula 20 estimate of .90. Procedural knowledge was operationalized using metrics automatically generated by the simulation to create a composite measure comprised of return-on-assets, return-on-sales, and stock value ($\alpha = .98$)

Analytical Strategy

The data were multilevel in nature, requiring that analyses account for hierarchical dependencies that can violate independence assumptions and produce biased estimates in multiple linear regression and path analysis (Hox, 2002; Kreft & de Leeuw, 1998; Raudenbush & Bryk, 2002). We used hierarchical linear modeling (HLM) to simultaneously model within and between-group variance in the criteria of interest (Hofmann, 1997). All models were conducted using HLM 6 software (Raudenbush, Bryk, Cheong, & Congdon, 2004). The hypotheses posited simple mediation and moderated mediation within a multilevel context. We thus followed the procedure outlined by Bauer, Preacher, and Gil (2006) for simultaneously testing multilevel mediation models with random effects across Level 2 units (teams). The multilevel mediation tested here is frequently labeled a 1-1-1 model, where mediation occurs with lower level variables that are nested hierarchically (Kenny, Kashy, & Bolger, 1998; Krull & MacKinnon, 2001). Lower level variables here were individual-level measures of metacognition, self-efficacy, and procedural and declarative knowledge for the members of the 70 teams. With regard to the predictions of moderation by team-level variables, the model we tested can be referred to as a 2 × (1-1-1) model, indicating that a higher level factor is moderating lower level indirect effects. To avoid the potential confounding influences that are associated with estimating indirect effects from 1-1-1 models, we followed the procedure described by Zhang, Zyphur, and Preacher (2009), which entailed group-mean centering all Level 1 variables and then reintroducing group means as separate Level 2 variables.

Results

Table 1 provides means, standard deviations, and correlations for study variables. Zero-order correlations showed metacognition and self-efficacy were positively related to declarative and procedural knowledge ($p < .05$). Team context variables showed a weak but significant positive correlation with procedural knowledge ($p < .01$), but not with declarative knowledge ($p > .05$).

Table 1. Means, Standard Deviations, and Correlations for Study Variables.

Variable	*M*	*SD*	1	2	3	4	5	6
1. Metacognition	4.08	0.65	*.92*					
2. Self-efficacy	3.92	0.79	.479**	*.94*				
3. Team performance	50.30	23.32	.063	.166**	*.95*			
4. Team cooperation quality	4.08	0.33	.177**	.162**	.313**	*.91*		
5. Declarative knowledge	321.10	85.17	.109*	.268**	.062	.077	*.90*	
6. Procedural knowledge	319.32	85.29	.143**	.245**	.221**	.141**	.584**	*.98*

Note. Coefficient alphas are shown in italics on the diagonal; team performance is disaggregated to the individual-level.
*$p < .05$. **$p < .01$.

Hypothesis 1 predicted that self-efficacy would mediate the relationship between metacognition and individual-level learning. Results of these analyses are found in Tables 2 and 3 for declarative knowledge and procedural knowledge, respectively. The findings indicated that self-efficacy fully mediates the effects of metacognition on declarative knowledge (Table 2) and procedural knowledge (Table 3). Metacognition significantly predicted self-efficacy (*a* paths) and self-efficacy significantly predicted both learning outcomes (*b* paths), whereas the main effects of metacognition on learning outcomes were not significant when controlling for self-efficacy (*c'* paths). The average indirect effect across teams for predicting declarative knowledge was 13.65 ($SD = 21.79$) and 9.66 ($SD = 18.34$) for predicting procedural knowledge across teams. To verify these average indirect effects, we used the Monte Carlo Method to construct 95% confidence intervals (20,000 repetitions) implemented with a utility developed by Selig and Preacher (2008). Research has shown this approach to outperform the Sobel test (MacKinnon, Lockwood, & Williams, 2004). As shown in Tables 2 and 3, the intervals did not contain zero and thus offered full support for Hypothesis 1. Metacognition and self-efficacy accounted for 36% of the variability across individuals in declarative knowledge and 37% in procedural knowledge variability. On average, 68% of the total effect of metacognition on declarative knowledge was indirect (i.e., mediated by self-efficacy). With regard to procedural knowledge, 53% of the total effect of metacognition was indirect.

Results from the two multilevel simple mediation models also provided results relevant to Hypotheses 2 and 3. Specifically, significant random effects for the relationship (i.e., slopes) between either the predictor and mediator (*a* path) or the mediator and the criterion (*b* path) were required to test for moderators that can account for this variability (Kenny, Korchmaros, & Bolger, 2003). That is, variability in the Level 1 indirect effects across teams must be

Table 2. Mediation Results for Declarative Knowledge.

Fixed effect	Coefficient	*SE*	*T*-ratio
d Yj	0.1644	0.1623	1.013
d Mj	0.0007	0.0004	1.965**
X.j	−0.0863	0.0497	−1.736*
M.j	0.0433	0.0358	1.207
a, X→M	0.5399	0.0543	9.949**
b, M→Y	24.9944	7.5933	3.292**
c', X→Y	−1.9796	7.6342	−0.259

		95% CI (Monte Carlo method)	
Random indirect	*SE*	*LL*	*UL*
Average = 13.65	5.34	3.464	24.68

Note. Y = declarative knowledge; X = metacognition; M = self-efficacy; X.j and M.j are group (team) means reintroduced as Level 2 control variables per Zhang, Zyphur, and Preacher (2009). CI = confidence interval; LL = Lower Limit; UL = Upper Limit.
*p < .05. **p < .01, one-tailed.

Table 3. Mediation Results for Procedural Knowledge.

Fixed Effect	Coefficient	*SE*	*T*-ratio
d Yj	0.1284	0.1096	1.172
d Mj	0.0007	0.0004	1.940*
X.j	−0.0098	0.0349	−0.281
M.j	−0.0210	0.0241	−0.874
a, X→M	0.5427	0.0552	9.824**
b, M→Y	16.2901	6.8308	2.385**
c', X→Y	8.4324	7.1403	1.181

		95% CI (Monte Carlo method)	
Random indirect	*SE*	*LL*	*UL*
Average = 9.66	4.77	0.6446	19.38

Note. Y = procedural knowledge; X = metacognition; M = self-efficacy; X.j and M.j are group (team) means reintroduced as Level 2 control variables per Zhang, Zyphur, and Preacher (2009). CI = confidence interval; LL = Lower Limit; UL = Upper Limit.
*p < .05. **p < .01, one-tailed.

evident to test for Level 2 effects from the team-level moderators. These tests therefore determined whether there was sufficient variance in any given Level 1 pathway for team context moderation to occur. Results for predicting declarative knowledge showed the model with heterogeneous residual variance across Level 2 units provided a better fit than did a homogenous model, ($\Delta\chi^2 = 2{,}899.88$, $df = 1$, $p < .01$). Significant variability ($\tau = 1{,}507.72$, $df = 58$, $\chi^2 = 114.16$, $p < .01$) was evident in the relationship between self-efficacy and declarative knowledge (*b* path), but was not evident ($\tau = 0.1207$, $df = 58$, $\chi^2 = 59.47$, $p > .10$) in the relationship between metacognition and self-efficacy (*a* path). Results for predicting procedural knowledge were similar; the model specifying heterogeneous residual variance providing better fit than did a homogeneous model ($\Delta\chi^2 = 2{,}875.93$, $df = 1$, $p < .01$), and there was evidence of significant variability in the relationship between self-efficacy and procedural knowledge ($\tau = 1{,}012.48$, $df = 58$, $\chi^2 = 98.04$, $p < .01$), but not in the relationship between metacognition and self-efficacy ($\tau = 0.1340$, $df = 58$, $\chi^2 = 59.64$, $p > .10$). These results indicated the presence of random effects in lower level mediation across Level 2 units (i.e., teams), a necessary condition for testing whether team-level variables can account for this variability. Because the *a* paths failed to display significant variability, subsequent models posited team-level predictors of only the variability in *b*-path relationships between self-efficacy and the knowledge outcomes (Kenny et al., 2003). Important to note is that significant prediction of variability in either the *a* path or *b* path represents a case of moderated mediation, because the strength of the indirect effect of the Level 1 predictor depends on the Level 2 moderator (Bauer et al., 2006).

Hypothesis 2 posited that the indirect effects of individual-level metacognition on individual-level procedural and declarative knowledge would be amplified for individuals training in higher performing teams during team training. Tables 4 and 5 present results for the moderated multilevel mediation models that test this hypothesis. The cross-level interactions from team performance were significant ($p < .05$) for declarative knowledge (Table 4) and procedural knowledge (Table 5). To display the pattern of moderated mediation, we calculated the indirect effects at three conditional values of the Level 2 moderator (Bauer & Curran, 2005) of team performance (–1 *SD, M*, and +1 *SD*) using the utility developed by Preacher, Curran, and Bauer (2006). Results for declarative knowledge (Table 4) showed the indirect effects were significant at each conditional value ($p < .05$) and increased as team performance increased. Results for procedural knowledge (Table 5) showed the indirect effects were significant at the mean and +1 *SD* conditional values ($p < .05$) and increased as team performance increased. Team performance explained approximately 7% of the variability across teams in

Table 4. Moderated Mediation by Team-level Performance on Declarative Knowledge.

Fixed Effect	Coefficient	*SE*	*T*-ratio
d Yj	0.2067	0.1648	1.254
d Mj	0.0007	0.0004	1.941*
X.j	−0.0934	0.0493	−1.892*
M.j	0.0373	0.0335	1.114
W.j	0.0003	0.0006	0.479
a, X→M	0.5409	0.0543	9.962**
b, M→Y	1.7718	15.6084	0.114
c', X→Y	−2.4095	7.5117	−0.321
b × W	0.5989	0.3016	1.986**
Team performance	**Indirect effect**	***SE***	***Z***
−1 *SD*	17.941	9.140	1.963
M	31.714	7.672	4.134
+1 *SD*	45.488	11.700	3.887

Note. Y = declarative knowledge; X = metacognition; M = self-efficacy; W = team performance (moderator); W.j is a main effect and used as a control (Bauer & Curran, 2005); X.j and M.j are group (team) means reintroduced as Level 2 control variables per Zhang, Zyphur, and Preacher (2009).
*$p < .05$. **$p < .01$, one-tailed.

the indirect effects of metacognition on declarative knowledge and about 14% of the variability in the indirect effects on procedural knowledge. Collectively, these results supported Hypothesis 2, indicating that team performance amplified the positive indirect effects of metacognition through self-efficacy on individual-level knowledge acquisition in team training.

Hypothesis 3 predicted that the quality of cooperation in a team would amplify the indirect effects of individual-level metacognition on individual-level procedural and declarative knowledge. As shown in Table 6, the cross-level interaction from team cooperation quality was not significant ($p > .05$) for declarative knowledge. However, in the model for procedural knowledge (Table 7), the cross-level interaction from team cooperation quality was significant ($p < .05$). The pattern of indirect effects indicated increasing and significant effects ($p < .01$) at each conditional value of team cooperation. Team cooperation quality explained approximately 9% of the variability across teams in the indirect effects of metacognition on procedural knowledge. These results provided partial support for Hypothesis 3, in that team cooperation quality only moderated the indirect effects for procedural knowledge.

Table 5. Moderated Mediation Results by Team-level Performance on Procedural Knowledge.

Fixed Effect	Coefficient	*SE*	*T*-ratio
d Yj	0.1483	0.1154	1.285
d Mj	0.0007	0.0004	1.923*
X.j	−0.0158	0.0349	−0.452
M.j	−0.0200	0.0213	−0.939
W.j	0.0001	0.0005	0.072
a, X→M	0.5439	0.0552	9.864**
b, M→Y	3.0075	13.4735	0.223
c', X→Y	8.2203	7.0765	1.162
b × W	0.4772	0.2363	2.019**
Team performance	Indirect effect	*SE*	*Z*
−1 *SD*	15.892	8.509	1.868
M	26.867	6.607	4.066
+1 *SD*	37.843	8.599	4.401

Note. Y = procedural knowledge; X = metacognition; M = self-efficacy; W = team performance (moderator); W.j is a main effect and used as a control (Bauer & Curran, 2005); X.j and M.j are group (team) means reintroduced as Level 2 control variables per Zhang, Zyphur, and Preacher (2009).
*p < .05. **p < .01, one-tailed.

Table 6. Moderated Mediation Results by Team-level Cooperation Quality on Declarative Knowledge.

Fixed Effect	Coefficient	*SE*	*T*-ratio
d Yj	0.0819	48.3880	0.002
d Mj	0.0007	0.0299	0.024
X.j	−0.1021	13.1795	−0.008
M.j	0.0389	8.2548	0.005
W.j	0.0403	9.9086	0.004
a, X→M	0.5399	0.0543	9.939**
b, M→Y	47.6682	82.8144	0.576
c', X→Y	−2.0371	7.6184	−0.267
b × W	−5.6012	20.3881	−0.275

Note. Y = declarative knowledge; X = metacognition; M = self-efficacy; W = team cooperation (moderator); W.j is a main effect and used as a control (Bauer & Curran, 2005); X.j and M.j are group (team) means reintroduced as Level 2 control variables per Zhang, Zyphur, and Preacher (2009).
*p < .05. **p < .01, one-tailed.

Table 7. Moderated Mediation Results by Team-level Cooperation Quality on Procedural Knowledge.

Fixed Effect	Coefficient	*SE*	*T*-ratio
d Yj	0.1738	47.1780	0.004
d Mj	0.0007	0.0299	0.024
X.j	−0.0014	12.8499	−0.000
M.j	−0.0191	8.0483	−0.002
W.j	−0.0214	9.6608	−0.002
a, X→M	0.5427	0.0553	9.814**
b, M→Y	−9.6046	68.9882	−0.139
c', X→Y	8.5374	7.1693	1.191
b × W	32.401	16.4215	1.973**
Team cooperation quality	Indirect effect	*SE*	*Z*
−1 *SD*	111.574	8.467	13.162
M	122.267	6.806	17.963
+1 *SD*	132.959	8.918	14.909

Note. Y = procedural knowledge; X = metacognition; M = self-efficacy; W = team cooperation (moderator); W.j is a main effect and used as a control (Bauer & Curran, 2005); X.j and M.j are group (team) means reintroduced as Level 2 control variables per Zhang, Zyphur, and Preacher (2009).
*p < .05. **p < .01, one-tailed.

Discussion

Our research explored an underdeveloped area of the team training literature by examining the influence of self-regulation on the acquisition of team training by individual team members. Learning during team training does not occur in isolation, but rather within the team milieu, and thus we investigated how team contexts moderate individual-level learning. We found that self-efficacy mediates the effects of metacognition on individuals' subsequent solo demonstration of team training content. Moreover, these indirect effects were conditional on how well teams performed overall and on the extent to which team members engaged in high-quality cooperation.

Several authors have called for additional research on the effects of metacognition in different training contexts (e.g., Ford, Kraiger, & Merritt, 2010; Gully & Chen, 2010). Indeed, compared with other factors related to self-regulation, such as self-efficacy and goal orientation, relatively few studies in the training literature have explicitly focused on metacognition. Our results confirm the positive effects found in other research, and extend such findings to a new training context (i.e., team training). Perhaps more importantly, our research revealed a key mechanism through which metacognition subsequently improves learning. We found that active monitoring and adjustments in learning strategies improve learning only when individuals believe they have the capability to perform the trained material. Scholars have described metacognition as an important variable that affects learning in part by influencing motivational variables, such as self-efficacy, and self-efficacy is further seen as a key factor that promotes the generalization of training to other contexts (Beier & Kanfer, 2010). The results of our research support this assertion and clarify the manner in which self-monitoring ultimately affects learning.

We speculated that team-based training represents a context where self-efficacy would mediate the effects of metacognition (because of the necessity in team training to apply team-level instruction to individual-level performance). This increases the importance of self-regulation, because instruction and performance feedback are directed at the team (vs. the individual). Research shows that post-training self-efficacy is a significant predictor of learning transfer to novel situations (Blume et al., 2010). We found similar effects for post-training self-efficacy, and demonstrated that it plays a key role in conveying the effects of metacognition. We also examined how self-efficacy was related to capability beliefs about applying team training content to individual-level performance. Although our results supported the importance of self-efficacy in this team training setting, future research is needed to replicate the mediation effects that we observed; however, such research should focus on other individual and team training settings, such as when different instructional techniques are used for individual learning, or when different kinds of teams are trained (e.g., intact work teams, project teams, creative teams). It may be that the mediation we found only holds when using more active instructional techniques, such as the simulation in this study or behavioral modeling. Under more passive instructional techniques (e.g., lecture), metacognition may be more likely to exhibit direct effects because such techniques generally do not present learners with many opportunities for "hands-on" practice that facilitates self-efficacy. Likewise, self-efficacy may not mediate the effects of metacognition when training intact work teams because such teams are likely to have established norms, routines, and roles that could have stronger effects on learning than that of individual self-efficacy. In addition, other components that reflect self-regulated learning should be examined, such as self-observation, practice behaviors, goal-setting, and emotional reactions to goal progress (B. S. Bell & Kozlowski, 2010; Schunk, 1990). For example, practice behaviors within a team or collective goal-setting might be key mediators through which the effects of metacognition flow through self-efficacy and ultimately to learning outcomes.

Our findings indicate that to fully understand individual self-regulation and the outcomes of self-regulation in team training, one must account for the contexts created by teams. Building on previous research indicating group-to-individual transfer effects (Laughlin et al., 2008), we found that teamwork and taskwork characteristics of the team context affected how team members ultimately mastered the learning content on their own. For example, our results showed that when individuals work in high-performing teams, the benefits of metacognitive activity and self-efficacy are amplified. This suggests that the extent to which a team experiences success during team training moderates the degree to which team members acquire the team-level training content. Such a finding, at first glance, may not seem surprising, given that higher performing teams are learning more effectively as a collective unit, which should likewise benefit the members of those teams. Yet the results also indicate that team performance does not exert main effects on individual-level learning outcomes (see Row 5 in Tables 4 and 5). Thus, our research highlights the complex relationships among the learning environment, the self-regulatory system, and the outcomes of self-regulated learning.

Our results also showed that the quality of cooperation reflected in a team's context moderates the effects of self-regulation. Yet this moderation appears to matter only for procedural knowledge, where a context of high-quality cooperation enhances the benefits of self-regulation for procedural knowledge. However, such contexts did not moderate the effects of self-regulation on individual-level declarative knowledge. These findings suggest that within-team cooperation is a key factor shaping knowledge acquisition pertaining to how the trained task is performed, but does little to influence knowledge about the task itself. One interesting implication from these results is that the benefits for learning from an increased self-focus (metacognition) are enhanced when an individual is immersed in a context with ample other-focused information (i.e., high-quality, reciprocal interpersonal exchanges). This may be due to the increased feedback from others that informs self-regulation (e.g., through adjustments in learning strategies, monitoring, vicarious learning). Research has found that self-efficacy can mediate the effects of practice on learning when individuals are afforded more diverse practice opportunities (Holladay & Quiñones, 2003). Perhaps high-quality intrateam cooperation promotes a team context where learners are exposed to more and varied learning experiences that are more likely to be shared among team members. Here again, the results further indicated that cooperation quality does not have a main effect, suggesting that high cooperation quality by itself is insufficient to promote individual-level procedural knowledge of team training.

Implications for Practice

Every organization presumably wants the content delivered in team training to not only change team-level outcomes but also affect team members. After all, the members of any given team are unlikely to stay with that team throughout their career with the organization. Training scholars have noted that such transitioning is now the current state of affairs with regard to teams, as teams can be expected to regularly separate, with members often being assigned to a new team or joining a pre-existing team (Tannenbaum et al., 2012). Others have also noted such dynamism can come with disadvantages, such as communication and commitment difficulties among team members (for a discussion, see Moreland & Argote, 2003). The increasing prevalence of courses in academic settings designed to teach students to work in teams further points to the criticality of individual-level learning in team training, especially considering that the central goal of these courses is for students to later become effective members of every work team to which they belong. Put simply, a better understanding of the mechanisms that influence individual mastery of team training stands to benefit not only the team in which the individual is being trained, but also potential individual and team-based work in the future. This is especially important because different work teams cannot be assumed to be equivalent in terms of goals and context, and yet at the same time, they are likely to share other characteristics, such as interdependent tasks, that are common to nearly all work teams (Moreland, Argote, & Krishnan, 1998).

Our results also have several specific implications for the practice of team training. For example, our finding regarding the mediated relationship between metacognition and learning outcomes suggests that for interventions intended to stimulate self-regulation to be effective, they should also include features aimed at enhancing self-efficacy. Without building trainees' confidence in their performance capabilities, monitoring and adjusting learning strategies may not translate into better declarative and procedural knowledge. The moderation results further suggest that trainers provide more focused instructional attention to individuals in poorer performing teams, so that the overall effectiveness of team training for teams and individuals is enhanced. Otherwise, such individuals may not reap the same learning benefits from increased self-regulation. Similarly, trainers may need to provide additional attention to individuals learning in teams that lack high-quality cooperation, a condition that appears to weaken the positive effects of self-regulation on individual-level procedural knowledge. In such teams, a potential tactic for mangers to use is providing instructional attention toward the importance of cooperation and coordination. Interestingly, these teamwork-focused components are likely to already be included in most team training efforts, and cumulative evidence from a meta-analysis suggests that improving teamwork benefits team-level performance (Salas et al., 2008). Yet the results of our research show that the consequences of inculcating content related to teamwork go beyond the teams themselves to include outcomes for individual team members as well.

Limitations

Our findings should be interpreted in light of certain limitations. First, given the design of our study, it is possible that individuals differed in terms of prior knowledge of the team training content, which may have influenced the results. However, it is worth noting that this was the participants' first experience with the team and individual simulations, and team assignments were made using a stratified random approach that ensured an even distribution of prior functional knowledge across the teams. Second, our measures of individual learning of team training focused primarily on the *taskwork* aspects of team functioning, to the neglect of *teamwork*-oriented training content (Morgan et al., 1993). This focus was driven by the nature of the criterion, which entailed an individual demonstration of team training content that encompassed business strategy and strategic decision-making. Thus, the criteria were primarily cognitive learning outcomes. Future research should therefore expand criteria to include teamwork elements, which would naturally entail more behavioral or skill-based learning outcomes. Third, our criterion measures were also somewhat highly correlated, suggesting a relatively high degree of overlap between the measures of declarative and procedural knowledge (i.e., 34% shared variance). Yet, the results indicated a different pattern of results for the two outcomes (i.e., team cooperation quality was a significant moderator for procedural knowledge, but not for declarative knowledge), suggesting the distinctiveness of the measures. Fourth, we measured task-specific self-efficacy because it was germane to the central questions we sought to examine. Other forms of self-efficacy are also likely to be important as antecedents (e.g., self-efficacy for self-regulation; Zimmerman et al., 1992) and consequents of team training (e.g., self-efficacy for skill generalization and maintenance). Fifth, although we captured the overall quality of cooperation within teams, we did not assess the particulars of between-person coordination (e.g., communication networks), nor did we record and analyze the specific interactions that team members had with one another. Doing so was beyond the scope of our study, yet it is an important avenue for future research because such factors could potentially be influential in team and individual learning (Moreland, Fetterman, Flagg, & Swanenburg, 2010). Finally, other characteristics of teams could be important teamwork contextual factors, but were unmeasured. For example, team efficacy is important to team functioning and is thought to be related to regulatory processes

(Bandura, 1997; Pescosolido, 2003). Future studies could also include process measures (e.g., backup behavior, conflict management) to determine if these shape the extent to which team members acquire team training.

In summary, the results of our research offer evidence of how individual self-regulation ultimately affects team member learning of team training content as well as the influences of team context on such learning. A central implication of our work is that a thorough understanding of team training not only requires a consideration of team-level effects (as in prior research), but also the consideration of individual learning processes within teams themselves. Accordingly, future team training researchers and practitioners would be well advised to consider team- and individual-level factors when examining the effectiveness of team training interventions.

Appendix

Metacognition

1. I asked myself questions to make sure I understood the things I had been trying to learn.
2. I tried to change the way I learned to fit the demands of the current situation.
3. I tried to think through each situation and decide what I was supposed to learn from it, rather than just jumping in without thinking.
4. I tried to determine which things I didn't understand well and adjusted my learning strategies accordingly.
5. I set goals for myself to direct my activities.
6. If I got confused I made sure I sorted it out as soon as I could before moving on.
7. I thought about how well my tactics for learning were working.
8. I tried to monitor closely the areas where I needed the most improvement.
9. I thought about what things I needed to do to learn.
10. I noticed where I made mistakes and focused on improving those areas.

Self-Efficacy

1. I am confident in my understanding of the inter-relatedness of different business functions (e.g., R&D, Production, Marketing).
2. I feel that I have the necessary skills to analyze and interpret business information regarding my own organization.
3. I feel that I have the necessary skills to analyze and interpret business information regarding my organization's potential competitors.

4. I am confident in my understanding of how business strategy impacts business performance.
5. I am confident in my ability to identify critical success factors that are important to business performance.
6. I am confident in my ability to develop accurate forecasts of future business success.

Team Cooperation Quality

1. Other team members usually let me know what they expected from me.
2. I normally checked with other team members before I did something that might affect them.
3. I usually let other team members know when they did something that affected my work.
4. Other team members usually let me know when I did something that affected their work.
5. I often made suggestions to other group members to improve performance.
6. I had a clear understanding of the problems associated with the Capstone simulation and the needs of my team during the simulation.
7. Other team members clearly understood my needs and problems related to performance during the simulation.
8. I received constructive criticism from other team members.
9. I often helped other team members solve problems associated with the simulation.
10. When I was busy, other team members volunteered to help me out.
11. When other team members were busy, I often helped them out.
12. Other team members were flexible about switching responsibilities to make things easier for me.
13. I was willing to finish work that had been given to other group members.
14. Other team members were willing to help finish work that was assigned to me.

Declarative Knowledge Test Content in Comp-XM® (42 Multiple-Choice Items)

Accounting topics:

> Break Even Analysis; Understanding the Accounting Equation; Revenue Recognition; Identifying Fixed vs. Variable Costs; Calculating Book Value; Identifying Change in Equity; Interpreting the Cash Flow Statement; Understanding the Carrying Values of Items on the Balance Sheet

Finance topics:

> Retirement of Debt; DuPont Analysis; Calculating Dividend Yield; Effects of Change in Depreciation Expense on the Financial Statements; Calculating Simple Ratios; Calculating Ratios from Annual Reports; Calculating Stock Repurchase; Cash Management; Effect of Investment Decisions

Marketing topics:

> Identifying Marketing Efficiency; Forecasting; Creating Marketing Budgets; Identifying Competitors; Demand Analysis; Identifying Price Elasticity; Market Sizing

Operations/production topics:

> Operational Impact of Unit Margin; TQM Break Even Analysis; Capacity Analysis; Determining Acceptable Inventory Levels; Cost of Right-Sizing Plant

Strategy topics:

> Developing Mission/Vision Statements; Identifying Strategies; Identifying Tactics for Building Competitive Advantage; Strategic Analysis; Competitive Analysis

Human resource topics:

> Calculating Productivity Impact; Calculating Recruiting Costs; Calculating Training Costs; Calculating Separation Costs; Calculating Future Labor Wages

Acknowledgment

We thank James Belohlav for his assistance with data collection.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Note

1. We measured and examined the effects of such surface-level diversity variables as age, sex, and race on individual self-regulation and learning outcomes. We also investigated the effects of these variables, as team composition characteristics, on various team-level outcomes, such as performance and the quality of cooperation. None of these effects were significant ($p > .05$). Therefore, we did not include these variables as control variables in our analyses.

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