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A Review and Integration of Team Composition Models: Moving Toward a Dynamic and Temporal Framework

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Although teams are considered to be the building blocks of modern organizational designs and numerous theoretical models, and narrative and meta-analytic reviews of the literature exist, there is a lack of coherence, integration, and understanding of how team composition effects relate to important team outcomes. Accordingly we have five primary goals for this article. First, we categorize team composition models into four types and highlight theory and research associated with each one. Second, we offer an integrative framework that represents members' attributes as simultaneously contributing variance to each of the four model types. Third, we overlay temporal considerations that suggest different team compositional mixes will be more or less salient at different periods of performance episodes or stages of team development. Fourth, we integrate membership dynamics into our model. And fifth, we advance an integrative optimization algorithm that incorporates implications from all for the four previous approaches, as well as temporal dynamics and membership change. In so doing, we provide a synthesis of previous work and theories and outline a research agenda for both research and practice.

Keywords: *team composition; staffing; team effectiveness*

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Teams have widely become accepted as the basic building blocks of modern-day organizations, and numerous recent reviews of the extant team literature have been published (e.g., Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Kozlowski & Ilgen, 2006; Mathieu, Maynard, Rapp, & Gilson, 2008). Moreover, several recent meta-analysis and reviews have detailed certain aspects of team composition, such as teams' personality mixes (e.g., Peeters, Tuijl, Rutte, & Reyman, 2006), demographic diversity (e.g., Bell, Villado, Lukasik, Belau, & Briggs, 2011), average cognitive ability (e.g., Devine & Philips, 2001), and attributes of core versus peripheral members (e.g., Humphrey, Hollenbeck, Meyer, & Ilgen, 2011), as related to important team outcomes. Yet as voluminous as this literature is, there is a lack of coherence and integration in the area of team composition effects.

Mathieu, Tannenbaum, Donsbach, and Alliger (2013) outlined six different types of human resource decisions concerning team composition. At the simplest, changes in team composition can involve the *addition, subtraction, or replacement of a single member*. Slightly more complex is a situation when *multiple team members are replaced simultaneously*. Third, a cohort of *new personnel might be distributed simultaneously* to multiple teams, such as when police officer academy graduates are given their assignments. Fourth, one might be staffing a *new team* (e.g., a cross-functional parallel team) to address some problem or opportunity; or fifth, one might be *simultaneously staffing multiple* such teams. And finally, one might be *reconfiguring members into teams* (or into new teams) as a function of an organizational redesign effort, merger, or downsizing. Whereas the challenge of optimizing team composition(s) becomes more complex with each type of successive decision chronicled above, what constitutes ideal member combinations and how one orchestrates them remain unanswered questions. This article is intended to review what is known about team composition, offer an integrative approach, and chart a course for future research and application.

We have five primary goals for the proposed article. First, we categorize team composition models into four types (detailed below) and highlight theory and research associated with each one. Second, we offer an integrative framework that represents members' attributes as simultaneously contributing variance to each of the four model types. Third, we overlay temporal considerations that suggest different team compositional mixes are more or less salient at different periods of performance episodes or stages of team development. Fourth, we integrate membership dynamics into our model in terms of the impacts of leavers and new arrivals to the team. And fifth, we advance an integrative optimization algorithm that incorporates implications from all for the four previous approaches, as well as temporal dynamics and membership change. In so doing, we provide a synthesis of previous work and theories and outline a future agenda for both theory and practice. Notably, our focus is primarily on how team compositional mixes affect team effectiveness in terms of performance quantity and quality, although we recognize other indices of effectiveness such as team viability, creativity, and innovation, as well as individual outcomes such as member development and learning. Although team success is ultimately contingent on a variety of factors, research and practice suggest that placing the right mix of people on a team sets the stage for effective team outcomes (Hackman, 1982; Mathieu et al., 2008).

Teams can be defined as

> (a) two or more individuals who (b) socially interact (face-to-face or increasingly, virtually); (c) possess one or more common goals; (d) are brought together to perform organizationally relevant tasks; (e) exhibit interdependence with respect to workflow, goals, and outcomes; (f) have different

> roles and responsibilities; and (g) are together embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment. (Kozlowski & Ilgen, 2006: 79)

The key elements of this definition are that, in order to have a team, members must have some shared goal and some degree of interdependence. In addition, members occupy team roles or positions and operate in a context that has implications for their functioning. Notably, some teams have clearly defined and designated positions (e.g., firefighting or submarine crews), whereas other teams have loosely defined or no designated positions per se. Yet even in those latter situations, team roles and member differentiation tend to evolve over time yielding informal positions.

Models of Team Composition

Team composition research focuses on the attributes of team members, and the impact of the combination of such attributes on processes, emergent states, and ultimately outcomes. Team composition research has a rich history dating back well over half a century (see Heslin, 1964, and Mann, 1959, for early reviews). The extant literature indicates that team processes and effectiveness are affected by aspects of group composition such as members' skills, job and organizational experiences, and group heterogeneity as a whole (Mathieu et al., 2008). Yet, challenges concerning how to best understand and index team composition, and how to model its influences, continue to plague the field (Ilgen, 1999; Ilgen et al., 2005; Kozlowski & Bell, 2003).

Kozlowski and Klein (2000) described two general types of aggregation processes—or manners by which lower-level attributes such as members' knowledge, skills, abilities, and other characteristics (KSAOs) can combine to form a higher-level variable such as team composition. First, they described *compositional* processes as relatively simple combination rules, such as average team member competencies as representing a higher-level construct such as team human capital. Diversity indices are also compositional in nature, as they represent the higher-level construct as a variance of members' individual characteristics (see Harrison & Klein, 2007). An important point to note about compositional models is that all lower-level entities are presumed to be comparable and weighted equally in the construction of the higher-level construct. In contrast, "in *compilation models*, the higher-level phenomenon is a complex combination of diverse lower-level contributions" (Kozlowski & Klein, 2000: 17). In other words, compilation describes a situation where the higher-level construct is something different from a mere descriptive statistic of members' attributes. For example, team performance may be unduly influenced by the least (or most) competent individual member, members who occupy certain positions in the team, or individuals who emerge and take on particular roles in the team such as leader or boundary spanner.

Historically, work on team composition has essentially progressed along two different overarching streams as illustrated in Table 1. First, there are *individual-based models* that have a focus either on individuals and job requirements, or on members' generic team-related KSAOs. These approaches derive from the application of traditional personnel psychology or human resource (HR) frameworks. These models are based on the assumption that one seeks to optimize the fit between individuals' KSAOs and the positions or roles that they

Table 1
Four Models of Team Composition Effectiveness

	Individual Focus	Team Focus
Individual models	Traditional personnel–position fit model *Position-specific KSAOs* • Cognitive ability • Psychomotor ability • Conscientiousness	Personnel model with teamwork considerations *Team-generic KSAOs* • Organizing skills • Cooperativeness • Team orientation
Team models	Relative contribution model *Relative KSAOs* • Weakest member • Highest leader propensity • Cooperativeness of most central person	Team profile model *KSAO distributions* • Particular language skills or tacit knowledge somewhere in the team • Functional diversity • Fault lines

Note: KSAOs = knowledge, skills, abilities, and other characteristics.

occupy. Notably, these individual-based models hinge on there being discernible positions in the team in order to index members' competencies relative to job demands. Second, there are *team-based models* that adopt a holistic or comparative view of individual members' KSAOs, or consider more complex combinations or team profiles of KSAOs. These approaches derive from social psychology and organizational behavior and view the team as a whole and focus on team composition distributional properties (e.g., averages, diversities) or complex compilation mixes and balances.

Tables 2 to 5 provide representative sources from the literature aligned with each model. These are in no way a comprehensive review of the literature, as doing so would be well beyond the scope of this article. The works that we cite, however, are illustrative of the different approaches and models that have been adopted in the past. They serve to illustrate the similarities and differences among the four heritages. Below we briefly review each approach and highlight its core assumptions. We then depict the implications of each model in evolving team composition formula, adding additional terms to incorporate the implications of each model. The formula serves as a heuristic and highlights how individuals contribute to overall team composition in a variety of different ways, each of which needs to be considered to derive an integrative view of team composition. We then introduce dynamic considerations in terms of temporal relationships and membership changes to complete the integration.

Traditional Personnel–Position Fit Model

The traditional personnel-position fit model essentially treats each position in a team as though it is an individual job in an organization. In effect, it does not formally consider the team context and member interrelationships. This is an "all-star model" of sorts in the sense in that it assumes that the team will be more effective to the extent that individuals are well suited for the positions that they occupy (Heslin, 1964). Morgan and Lassiter (1992: 84) reviewed the influences of team composition and staffing on team effectiveness. They

Table 2
Selected Examples of Team Composition Frameworks: Traditional Personnel–Position Fit Model

Source	Type of Contribution	Main Findings
Tziner and Eden (1985)	Empirical study	Members' abilities exhibited unique and interactive effects as related to team performance
Devine and Philips (2001)	Meta-analysis	Found a significant positive relationship between teams composed of smarter members and team performance
Cooke et al. (2003)	Empirical study	Members' specific position-based knowledge related positively to team effectiveness
Offermann et al. (2004)	Empirical study	Average individual performance effectiveness was significantly correlated with team effectiveness
LePine et al. (2011)	Theoretical review	Reviewed the literature and advanced a multilevel model of how members' personalities influence team outcomes through both individual contributions and via team processes
Harris et al. (2012)	Empirical study	Provided evidence that average individual position talent relates positively with team performance, especially to the extent that members have overlapping team tenure

Table 3
Selected Examples of Team Composition Frameworks: Personnel Model With Teamwork Considerations

Source	Type of Contribution	Main Findings
Stevens and Campion (1994, 1999)	Theoretical and empirical study	Submitted and found support for teamwork knowledge, skills, and abilities as providing incremental validity over traditional personnel predictors of individuals' teamwork behaviors
Morgeson et al. (2005)	Empirical study	Team members' teamwork knowledge evidenced incremental predictive validity over traditional personality and a situational judgment test in the prediction of individual contextual performance in team settings
Hirschfeld et al. (2006)	Empirical study	Team members' average teamwork knowledge positively predicted team effectiveness
Mumford et al. (2008)	Empirical study	Submitted and found support for team role knowledge and situational judgment tests as providing incremental validity over traditional personnel predictors of individuals' teamwork behaviors
Wildman et al. (2012)	Theoretical review	Average member team knowledge has positive relationships with team processes and outcomes

concluded that the results of studies "generally indicate that team performance is improved through the selection of individuals with high levels of task specific skills. However, these results have been somewhat inconsistent with respect to the exact nature of this relationship." Essentially the approach here is to identify positions or designated individual roles within a

Table 4
Selected Examples of Team Composition Frameworks: Team Profile Model

Source	Type of Contribution	Main Findings
Barry and Stewart (1997)	Empirical study	Proportion of members with high extraversion (but not other Big 5 variables) related in a curvilinear fashion (inverted U) with cohesion
Jackson et al. (2003)	Review article	Reviewed the team and organizational literature detailing different types and forms of diversity and considered contextual influences on their impact
Mohammed and Angell (2004)	Empirical study	Average member team orientation moderated (i.e., reduced) gender diversity–conflict relations
Humphrey et al. (2007)	Theoretical article	Advanced propositions concerning member supplementary and complimentary personality distribution fits related to team outcomes
Kearney et al. (2009)	Empirical study	Team members' average need for cognition moderated (offset) the negative effects of team age and educational diversity on team processes and outcomes
Bell et al. (2011)	Meta-analysis	Argued that diversity effects should be examined in terms of specifics and contexts; showed functional and educational background diversities had positive effects on team performance, particularly when creativity and innovation are important
Yeh et al. (2012)	Mathematical model	Advanced a mathematical model whereby team performance is maximized to the extent that personality types are balanced throughout the team

Table 5
Selected Examples of Team Composition Frameworks: Relative Contribution Model

Source	Type of Contribution	Main Findings
Devine and Philips (2001)	Meta-analysis	Both highest and lowest member cognitive ability correlated positively with team performance
Ellis et al. (2005)	Experimental study	Trained team knowledge of the most and least critical members (but not others) related positively to team processes
Pearsall and Ellis (2006)	Empirical study	Assertiveness of the most "critical team member" related positively to team performance and member satisfaction as mediated by transactive memory systems
Bell (2007)	Meta-analysis	Team minimum and maximum cognitive ability related positively to lab team performance; team minimal agreeableness related positively to field team performance
Humphrey et al. (2009)	Theoretical and empirical studies	Advanced a theory and empirical results suggesting that attributes of members occupying "core" team roles have a greater influence on team outcomes than attributes of members in peripheral roles
Cleveland et al. (2012)	Empirical study	Found that the most skilled team performers evidenced dysfunctional physiological responses when paired with inferior teammates, whereas inferior teammates reported positive reactions when paired with superior teammates

team, and then to conduct traditional task and KSAO analyses of the requisite attributes needed to successfully perform them (Guion, 1991; Klimoski & Jones, 1994). This model is implicitly embedded in the heritage of personnel psychology and HR and can be seen in applications ranging from utility models of the 1980s to strategic human resource management models of the 1990s to today. It suggests that achieving an ideal profile of task relevant KSAOs per role should enhance individuals' performance and thereby team performance. And as noted by LePine, Buckman, Crawford, and Methot (2011: 319), "It is assumed, but rarely ever directly assessed in research, that members' performance of task roles contributes to team effectiveness more or less directly through aggregation of accomplishments related to team tasks."

Some representative works aligned with the *traditional personnel–position fit model* are summarized in Table 2. For example, Cooke, Kiekel, Salas, Stout, Bowers, and Cannon-Bowers (2003) indexed members' position-specific knowledge and found that they collectively related positively to team performance. Similarly, Offermann, Bailey, Vasilopoulos, Seal, and Sass (2004) found that individuals' competencies related positively to team performance. Harris, McMahan, and Wright (2012) found that individuals' talent related positively to unit performance. Tziner and Eden (1985) found that tank crew performance was positively related to members' abilities to perform their respective positions. Meta-analyses have implicitly adopted the idea that teams composed of members with advantageous traits are likely to outperform others with less talented members. For example, Devine and Phillips (2001), Stewart (2006), and Bell (2007) conducted meta-analyses and concluded that average member general cognitive ability relates positively to team performance. Barrick, Stewart, Neubert, and Mount (1998) found significant correlations between members' average general cognitive ability and personalities and team performance. Barry and Stewart (1997) and O'Neill and Allen (2011) found support for members' personalities as predictors of individuals' impact on overall team functioning. Peeters et al. (2006) and Bell (2007) both found support for average member conscientiousness and agreeableness as positive predictors of team performance in field settings.

In summary, there are no guarantees that having talented individual members will ensure team effectiveness. In fact, there are notable instances when this has not been the case, such as the 2004 U.S. men's Olympic basketball team, which included the likes of Dwyane Wade, LeBron James, Carmelo Anthony, Tim Duncan, and Allen Iverson yet failed to reach the gold medal round. Nevertheless, generally speaking, having more talented members on the team enhances its likelihood of success. Moreover, it may well be that teams with talented members have surplus resources available and may be more amenable to additional performance-enhancing factors relating to team success. For example, perhaps teams with well-skilled members are better able to take advantage of empowerment designs than are less talented teams. Or perhaps highly skilled members will be freer to perform backup functions because they can perform their designated roles with lesser time or effort than less skilled members. In short, we suggest that future research not only consider the influence of members' KSAOs in regard to position demands, but also view scores from a traditional personnel–position fit model as enabling conditions or moderators of the influence of other predictors of team effectiveness.

In terms of formally representing the traditional personnel model, team members' contributions can be depicted as follows:

$$\mathrm{MP}_{mp} = \Sigma \mathrm{MC}_{mj} \mathrm{w}_{jk} \mathrm{RI}_{kp} \tag{1}$$

Where
MP_{mp} = performance of member *m* in position *p*
$\mathrm{MC}_{mj}\ \mathrm{w}_{jk}$ = member *m*'s weighted competency on position task *k*, consisting of:
MC_{mj} = member *m*'s score on competency *j*
w_{jk} = the weight of competency *j* in task *k*
RI_{kp} = relative importance of task *k* for performance in position *p*

For example, consider the composition of a typical surgical team consisting of a (a) surgeon, (b) anesthesiologist, (c) operating ("scrub") nurse, and (d) circulating nurse. The traditional personnel model would suggest that the success of the team is a function of performance of members occupying each position. Whereas all members of the team must be aware of what is transpiring during the surgery, different members have different duties that have different KSAO requirements. In other words, successful performance in each of the positions requires that members possess a particular set of KSAOs as would be reflected in a traditional job and task analysis. The implicit assumption, however, is that the performance of members in these different positions simply rolls up or additively contributes to overall team success in an unweighted fashion. Consequently, the traditional personnel–position fit model would represent team effectiveness as the sum of individual team members' performances:

$$\text{Team Effectiveness} = \Sigma \mathrm{MP}_{mp.} \tag{2}$$

Personnel Model With Teamwork Considerations

With the advent of team-based organizations, the KSAOs considered in the traditional model have been extended to include team-relevant competencies. Whereas the traditional personnel and relative contributions models maintain an individual focus, indexing members' contributions per positions and their interdependence, the team-focused models broaden our scope beyond position performance. In other words, these models consider members contributions to the team as a collective—not just via their individual position. For example, Cannon-Bowers, Tannenbaum, Salas, and Volpe (1995) discussed team-generic competencies as ones that would be universally valuable across team situations. The work highlighted in Table 3 provides evidence that extending beyond individuals' position-based KSAOs, and including factors such as teamwork knowledge, skills, abilities, and situational judgments, provides additional predictive validity as related to team effectiveness.

There have been several efforts to develop comprehensive categorization schemes for such team attributes. For example, Nieva, Fleishman, and Rieck (1978) developed a taxonomy of team performance functions with a direct focus on task accomplishment. Their four major categories included (a) team orientation functions, (b) team organizational functions, (c) team adaptation functions, and (d) team motivational functions. Cannon-Bowers et al. (1995) discussed eight teamwork skill dimensions that contribute to effectiveness: (a) adaptability, (b) shared situational awareness, (c) performance monitoring and feedback, (d) leadership/team management, (e) interpersonal relations, (f) coordination, (g) communication, and (h) decision making. Marks, Mathieu, and Zaccaro (2001) discussed 10 specific dimensions that clustered into transition (e.g., planning), action (e.g., coordination), and interpersonal (e.g., conflict management) processes. The critical point, however, is that a team task analysis will provide guidance regarding which of these team attributes will be most salient for any given application (Arthur, Edwards, Bell, Villado, & Bennett, 2005). Such an analysis will also serve to highlight the extent to which team effectiveness is attributable to the aggregate individual performances of team members versus their synthesis and capabilities to complete teamwork.

The underlying assumption of the personnel model with teamwork considerations is that team effectiveness is enhanced to the extent that members all possess generic team-related competencies. Like the traditional personnel–position fit model, this approach remains an individual focus and assumes that to the extent members, on average, possess greater team-related competencies, the team is likely to be more effective. Research has been supportive of this general assumption. For example, Stevens and Campion (1994, 1999) argued and found support for the idea that teamwork knowledge, skills, and abilities provide incremental validity over traditional personnel predictors of individuals' teamwork behaviors. Morgeson, Reider, and Campion (2005) found that members' teamwork knowledge predicted individual contextual performance beyond that accounted for by traditional personality and situational judgment measures. Similarly, Mumford, Van Iddekinge, Morgeson, and Campion (2008) illustrated that members' team role knowledge provided incremental validity over traditional personnel predictors of individuals' teamwork behaviors. Hirschfeld, Jordan, Feild, Giles, and Armenakis (2006) found that members' teamwork knowledge scores predicted team effectiveness controlling for their task proficiencies. Other work has reported positive relationships between members' team orientations and effectiveness (e.g., Bell, 2007; Jung & Sosik, 1999).

In summary, research has supported the implicit assumption that in environments that place a premium on collaborative activities, teams whose members possess high team-generic KSAOs are more effective than teams whose members possess lesser team-generic KSAOs. Whether task-related KSAOs or team-generic KSAOs prove more beneficial in any particular circumstance remains an open question. We anticipate that the balance may tip on the basis of task-based interdependencies, with the emphasis on individual position fit in relatively more team task independent circumstances, and more on team-generic KSAOs in more highly interdependent situations. And there may well be complex interactions linking facets of the individual models to team effectiveness. These represent ripe areas for future investigations. Furthermore, the individual models implicitly assume that the contributions of different members to overall team effectiveness are comparable. But that may not be the case.

Formula 2 depicts the aggregate contributions of members' competencies to their position performances and thereby to the overall performance of the team. As outlined above, to this end we need to consider members' contributions to collective team tasks, as well as the balance between individual and collective activities to overall team effectiveness. Formula 3 depicts the relationships between members' teamwork competencies and teamwork. At issue is that members who occupy certain positions in a team may be able to exert greater influence on overall team functioning than others. For example, insights from the crew resource management literature have shown that pilots in cockpit crews and surgeons in surgical teams have disproportionately high influence on team processes and functioning than do others. A team-oriented pilot or surgeon can create an atmosphere where members' contributions are welcomed and incorporated. Equally important, a dominating or less skilled pilot or surgeon can ruin teamwork and squelch the contributions of others. Importantly, differentially weighting individual contributions to overall team effectiveness helps to expand on the traditional individual based models and represents another avenue for future investigations. Accordingly, the $RI_{p(m)q}$ term in Formula 3 is designed to capture these position weighted effects on members' contributions to overall teamwork.

$$TW_q = \sum\left(RI_{p(m)q} TC_{p(m)j};\ \text{for all } m \text{ and } j\right) \tag{3}$$

Where
TW_q = Teamwork on team task q
$TC_{(m)pj}$ = Team Competency of member m in position p for competency j
$RI_{p(m)q}$ = Relative Importance of position p (filled by member m) for task q
Consequently, weighting the relative contributions of members' position performances and teamwork yields the following formula for predicting team effectiveness:

$$\text{Team Effectiveness } = x\sum MP_{mp} + (1-x)\sum TW_q \tag{4}$$

Where
x = relative contribution of aggregate member position performances to team effectiveness
$(1-x)$ = relative contribution of teamwork to team effectiveness.

Team Profile Model

The team profile model advocates a collective perspective and advances various combinations of team compositional properties. As shown in Table 4, this approach indexes composition in terms of descriptive statistics of members' KSAOs (e.g., mean values or some diversity index—see Harrison & Klein, 2007). We included mean scores earlier in the traditional personnel model; here we concentrate on distributional features of member composition. A key feature of these approaches is that team members' KSAOs are considered collectively rather than as linked to individuals' position fits. With these approaches, each member's characteristics contribute to a distributional feature that is indexed at the team level. As evident in Table 4, support for the predictive value of these approaches is mixed and appears to depend on the substantive variable in question, how it is indexed, and contextual factors.

Diversity research fits squarely in the team profile model. Scholars have categorized diversity along a number of dimensions including surface and deep level, highly and less job related, and readily detectible versus underlying (Bell et al., 2011; Harrison, Price, & Bell, 1998; Jackson, Joshi, & Erhardt, 2003; Webber & Donahue, 2001). Implicit in such an approach is that all members' scores are treated equally in these summary indices. In other words, no members or positions that individuals occupy are viewed as any more (or less) important than others. Findings have been inconsistent, as studies have reported diversity as being beneficial or detrimental and having no impact on team processes, states, and performance. In addition, studies have shown diversity factors to interact with other factors such as time (Harrison et al., 1998), the nature of a team's task (Jackson & Joshi, 2004; Joshi & Jackson, 2003; Pelled, Eisenhardt, & Xin, 1999), and organizational culture (Brickson, 2000;

Ely & Thomas, 2001). Elsewhere, Belbin (1981, 1993) and others (e.g., Aritzeta, Swailes, & Senior, 2007) have advanced a model concerning individuals' propensities to fulfill or occupy different team roles. Their theory suggests that to the extent team members have a diversity of role propensities there will be a better team balance, and thereby they will be more effective. Yeh, Wei, Wei, and Lei (2012) advanced a mathematical model to depict the advantages of such balance, but empirical research has been equivocal (e.g., Fisher, Hunter, & Macrosson, 2000; Senior, 1997).

Other work in this model has advanced more complex or nuanced approaches. For example, team fault lines are a particular type of compositional mix where multiple types of diversity align to solidify subgroups in a team (e.g., Lau & Murnighan, 1998; Polzer, Crisp, Jarvenpaa, & Kim, 2006). Elsewhere, Barry and Stewart (1997) hypothesized and found support for a curvilinear (inverted U) relationship between average members' extraversion and team cohesion. Mohammed and Angell (2004) illustrated that average member team orientation served to reduce gender diversity–conflict relations. Humphrey, Hollenbeck, Meyer, and Ilgen (2007, 2011) advanced propositions and reported evidence concerning member supplementary and complimentary personality distribution fits related to team outcomes. Kearney, Gebert, and Voelpel (2009) demonstrated that members' average need for cognition served to offset the negative effects of team age and educational diversity on team processes and outcomes.

Another form of team profile information may pertain to a *team requisite KSAO* that is not necessarily tied to any given position. There may well be instances when someone in the teams needs to know, for example, a local language, have knowledge of customer needs, or possess a high level of understanding of information technology, although those needs are not associated with any specific role or position—simply *someone in the team* must have them. Beyond knowledge and skills, perhaps the team needs some number of members to fulfill certain needs. For example, perhaps the team needs to liaison with other teams and must have a few members who are motivated to perform boundary spanning activities (Mumford et al., 2008). Or, perhaps, the team might benefit from some members who question that status quo, but if everyone did so it would be dysfunctional (Belbin, 1993). In all of these instances there is some type of ideal distribution of KSAOs that are not tied specifically to any role or position. For clarity, if *all members* would benefit from possessing such an attribute, it might fall in the personnel model with teamwork considerations, whereas if the focus is *strictly on one member* having high or low amounts of the attribute, it might fall in the relative contribution model. But if there is value in having some balance of some attribute in the team that is not tied to position requirements, then that feature would contribute via the team profile model.

In sum, the team profile model suggests that some distributions or more complex profiles of members' attributes serve to facilitate team processes and effectiveness. The underlying rationale is that such profiles do not necessarily enhance members' position performances per se, but rather contribute to the ability to orchestrate teamwork functions. Naturally these profiles may be many and different in nature, whether they are surface- or deep-level diversities, task- or non-task-related, personality balances, or some other complex combination of features. It is beyond the scope of this article to detail all of the potential combinations, but recent reviews and meta-analyses of the diversity literature have suggested that examining specific types of diversity as related to specific outcomes yielded higher effect sizes as compared to generic "diversity effects" (Bell et al., 2011). For example,

> Functional background variety diversity had a small positive relationship with general team performance as well as with team creativity and innovation. The relationship was strongest for design and product development teams. Educational background variety diversity was related to team creativity and innovation and to team performance for top management teams. (Bell et al., 2011: 709-710)

Accordingly, the relative importance of different profiles, as related to team processes and effectiveness, needs to be incorporated into these models. In some instances, such weighting can be derived from previous research, whereas in other instances some form of subject matter expert judgments will likely be necessary. Incorporating the team profile model implications into our evolving team effectiveness formula results in this:

$$\text{Team Effectiveness} = x\sum \text{MP}_{mp} + [(1-x)\sum \text{TW}_q + (\sum \text{TPro}_{\text{lmi}})] \tag{5}$$

Where
$\Sigma\text{TPro}_{\text{lm}}$ = sum of members m contributions to team profiles l
i = the relative importance of team profile l

Relative Contribution Model

The traditional personnel model makes the implicit assumption that members' contributions to team performance are equally weighted. Alternatively, many team-based approaches have advanced the notion that overall team performance depends more on the characteristics of certain members than others. Scholarship along these lines is summarized in Table 5. This approach, which represents a *compilation model* (Kozlowski & Klein, 2000), has often been referred to as the relative or selected score approach. Based mostly on the work of Steiner (1972), these studies have considered attributes such as the competencies of the weakest or strongest member, or the emotional stability of the most neurotic member. In this sense, given the nature of the task interdependencies, particular individuals can carry or undermine the entire team effort. For example, Devine and Philips (2001) found that both the highest and lowest member cognitive ability correlated positively with team performance, whereas Bell (2007) found that members' minimum and maximum cognitive ability related positively to lab team performance. In contrast, she found that minimum member agreeableness related positively to field team performance.

The fact that some members have a disproportionate influence on overall team functioning should not always be viewed in terms of a positive light. For example, Felps, Mitchell, and Byington (2006) noted how negative members can spawn dysfunctional group processes. In fact, negative members can have particularly insidious influences in multiple forms. First, outward pessimistic members can actively hurt group morale and put other members on the defensive. Second, members who shirk or socially loaf cause frustration, perceptions of negative inequity, and other negative affect among valuable members, which undermines their contributions. And third, counterproductive dynamics such as walling off negative members, excluding them from group interactions, developing fault lines, and a variety of other maladaptive efforts intended to deal with the negative member(s) may spill over and undermine team effectiveness. In short, negative members can exert a very high disproportionate influence on team activities and effectiveness, and their presence should be considered in team composition frameworks (Felps et al., 2006).

Scholars have recently advanced a variation on this general theme and submitted that the attributes of members who occupy more critical team roles would exhibit higher correlations with team outcomes than would those of others. For example, in an experimental investigation, Ellis, Bell, Ployhart, Hollenbeck, and Ilgen (2005) found that the trained team knowledge of the most and least critical members of a team (but not others) related positively to team processes. Pearsall and Ellis (2006) found that the assertiveness of the most "critical team member" related positively to team performance and member satisfaction as mediated by the team's transactive memory systems. Humphrey, Morgeson, and Mannor (2009) reported empirical results suggesting that experiences and skills of members occupying "core" team roles have a greater influence on team outcomes than do those of members in peripheral roles.

In summary, in all the above instances some members have a greater impact on team activities and outcomes than do others as a function of the positions or roles that they occupy. In effect, this approach advocates a network style model of team composition where it becomes important to understand the interrelationships of positions or roles in the team (Crawford & LePine, 2013). For example, Stewart and Nandkeolyar (2007) found that the variability of individuals' performances in a team setting could be predicted, in part, by the performances of their teammates. Cleveland, Finez, Blascovich, and Ginther (2012) found that when individuals were paired with inferior teammates they exhibited dysfunctional physiological responses. Therefore, rather than treating all members the same (compositional processes—as is done in the traditional personnel–position fit model), the competencies of different members are weighted differently (i.e., compilational processes) in this relative contribution model. Notably, such weighting need not be uniform across time or for all matters. For example, one person may be more influential (i.e., central) in a team network for planning activities, yet someone else might exert greater influence when it comes to managing conflict. The relative influence of different members may change as a function of the tasks that they are performing or other demands that are placed on the team. Consequently, the members' *linked* contributions to collective team performance are a function of their individual contributions (as indexed in Formula 2) adjusted by the performance of the other team members and the relative interdependence of the different positions:

$$LMP_{mp} = MP_{mp} * \Sigma MP_{qm'p'} I_{qpp'} \tag{6}$$

Where
LMP_{mp} = Linked Performance of member m in position p
MP_{mp} = member m's performance on task q in position p
$MP_{qm'p'}$ = performance of member m' in position p' *on task* q, where
m' = index of performance of other members in member m's team
p' = other positions in member m's team
$I_{qpp'}$ = The interdependence of members in positions p and p' on task q

What Formula 6 formally recognizes is that performance of some members who occupy certain team positions is more important for overall team success than the performance of

Figure 1
Hypothetical Surgical Team Interdependence Network

	Interdependent Members			
Focal Positions	Anesthesiologist	Surgeon	Operating ("Scrub") Nurse	Circulating Nurse
Anesthesiologist	(60)	25	15	0
Surgeon	15	(50)	30	5
Operating ("Scrub) Nurse	15	35	(30)	20
Circulating Nurse	10	20	40	(30)

Note: Across rows, the table values represent percentage breakdowns for each position. Diagonal entries represent the percentage of work per position that is individual, whereas the remaining percentages refer to interdependent work with each other member (per column).

members in other roles. The key component in this approach is the $I_{qpp'}$ function. We envision $I_{qpp'}$ as a member by member matrix for each task *q* that details the potential influence of each member on all other members. Figure 1 presents one such hypothetical interdependence matrix for the surgical team. Looking across the rows in Figure 1, the responsibilities break-downs for each position are shown. The relative *independence* of each position is shown in the diagonal, whereas each member's *interdependence with each other member* is shown in the remaining row entries, with higher values depicting relatively greater interdependence. For example, the anesthesiologist position is 60% role performance, and the member must coordinate efforts with the surgeon (25%) and operating nurse (15%). In contrast, the operating nurse is only 30% independent and devotes the majority of his or her time coordinating with the surgeon (35%), circulating nurse (20%), and anesthesiologist (15%). Whereas Figure 1 illustrates overall independence/interdependence for each position, there could be more detailed matrices for different specific team functions (e.g., preparation versus actual surgical operations).

This network style interdependence function would, for example, weight more heavily the contributions of "core" versus peripheral members (Humphrey et al., 2009), as well as members' contributions in more workflow central positions than others (Ellis et al., 2005). Moreover, the interdependence function could accommodate and appropriately weight the contributions of the most competent member in a disjunctive task, or the impact of the least competent member in a conjunctive task (Steiner, 1972). In short, the relative contribution model formally incorporates the fact that members' contributions in a team context are not likely to be a pure additive sum of their individual performances. This yields the following integrative formula:

$$\text{Team Effectiveness} = x\sum \text{LMP}_{mp} + \left[(1-x)\sum \text{TW}_q + \left(\sum \text{TPro}_{\text{lmi}}\right)\right] \tag{7}$$

In sum, Formula 7 represents the combination of the four approaches to team composition effects that are in the literature. The individual-focused traditional personnel–position fit and relative contribution models are represented in the $x\Sigma\text{LMP}_{mp}$ term, which indexes the fit of each member's KSAO to the position or role that she or he occupies, and the linked interdependencies of those position-based contributions. The $\Sigma TW_q + (\Sigma TPro_{lmi})$ terms carry the insights from the personnel model with teamwork considerations via the left side term, and from the team profile model via the right-side term. The relative impacts of linked position performances and teamwork to overall team effectiveness are represented by the *x* weighting factor. Collectively, these components subsume a vast array of individuals' KSAOs and weight them according to how they each contribute to the four different approaches to modeling team effectiveness.

Synthesis of the Models

The four models reviewed above are all discussed in the extant literature but, to date, have not been integrated. Our synthesis is an attempt to illustrate that team composition simultaneously encompasses all four approaches. All of the four approaches have advanced our understanding of compositional effects on team functioning and effectiveness. There may well be value in conducting comparative studies to contrast, perhaps, the relative predictive validity of the traditional personnel–position fit indices versus those derived from the personnel model with teamwork considerations. However, we believe that the most promising advances will come from a synthesis of models' predictions. All individual team members bring an array of KSAOs, some of which factor into overall team profiles, others of which enable them to perform the positions that they occupy in the team, whereas still others enable them to contribute to one or more teamwork functions. But individual members do not contribute in a vacuum. They occupy different team positions that may have differential impacts on team functioning, and their KSAOs may combine in nonadditive fashions with those of other team members in sometimes compensatory ways, in other instances there may be unique and advantageous blends, and in yet other ways there may be acidic or explosive combinations.

Deriving the various weights for Formulas 1 to 7 is perhaps the most daunting challenge for researchers and practitioners alike. Not only do they need to identify the critical positions and team tasks, the requisite member KSAOs to perform them, and the interrelationships between positions and team tasks, but the nature of the relationship function for each parameter also needs to be specified. In effect, what is needed is a new type of job analysis that incorporates team membership and associated parameters as a central concept.

For example, the traditional HR approach assumes that to the extent that individuals possess job relevant KSAOs they will perform better. In other words, it implicitly assumes a linear "more is better" function underlies that combination rules. Some traditional HR systems include noncompensatory minimum cutoffs (e.g., minimum qualifications), but rarely are other approaches such as the "diminishing gains" type of function employed. But perhaps they should be. For example, a team will surely benefit from having a member who focuses on organizing his or her work and defining various functional roles. However, if that person is overzealous, or if too many members focus on such activities, organizing efforts may become stifling and undermine teamwork. In sum, while most composition models that derive from classic HR implicitly assume that more of positive attributes (e.g., conscientiousness) and less of negative ones (e.g., neuroticism) is advantageous, team composition models explicitly beg the question as to whether there may be diminishing returns or tipping points, within or between members, beyond which a positive attribute turns negative. The algorithms advanced thus far are designed to highlight such relationships and to integrate them to the extent that they can be understood and articulated.

Notably, there have been three implicit assumptions in team composition models to date, that (a) members' compositional influences remain consistent over time, (b) member positions and roles remain consistent and equally important over time, and (c) team membership remains constant over time. However, none of these assumptions are likely to be accurate in practice. Therefore, we now turn to incorporate these dynamic effects.

Team Composition Over Time

Gully (2000: 35) submitted that "to fully understand work teams, researchers must investigate how team dynamics develop and change over time." It is widely accepted that teams are dynamic in that they have a past, present, and future. McGrath and Tschan (2007) noted the importance of understanding and incorporating temporal dynamics in team effectiveness models. Weingart (1997: 200) observed that "unfortunately, questions about dynamic processes in groups have been largely ignored in the organizational literature." Kozlowski and Bell (2003: 365) echoed this sentiment, suggesting that "it [time] is—with few exceptions—poorly represented in theory and is virtually ignored in research that is largely based on cross-sectional methodologies."

Several theories of team development or life cycles have been advanced over the years. These include Gersick's (1988) punctuated equilibrium conception, Morgan, Salas, and Glickman's (1993) team evolution and maturation approach, and Kozlowski, Gully, Nason, and Smith's (1999) theory of team compilation. Team development refers to "the path a [team] takes over its life-span toward the accomplishment of its main tasks" (Gersick, 1988: 9). Other time-based theories of team effectiveness have argued that teams perform different tasks at different times as related to stages of performance episodes. Theories along these lines include McGrath's (1991) time, interaction, and performance (TIP), Ancona and Chong's (1996) theory of entrainment, and Marks et al.'s (2001) episodic model of team processes. In a related vein, theoretical developments have suggested that team criteria measures are dynamic across time (Landis, 2001). While collectively these models differentially conceptualize temporal effects as occurring through sequential stages, repeating cycles, equilibrium, and adaptive response (Arrow, Poole, Henry, Wheelan, & Moreland, 2004), a common theme running throughout is the notion that teams change and develop systematically over time. Surprisingly, however, empirical studies of teams seldom include longitudinal criteria measures that allow actual analyses of predicted dynamic effects.

Table 6 provides some illustrative examples of temporal-based team research. Mohammed, Hamilton, and Lim (2009) recently advanced a multilevel framework for studying team effectiveness over time. They detailed the influence of members' time orientation, team-level temporal pacers such as deadlines, and contextual influences. Among other points, they noted that team compositional influences will likely vary over time. For example, Harrison and colleagues (Harrison, Mohammed, McGrath, Florey, & Vanderstoep, 2003; Harrison, Price, Gavin, & Florey, 2000) have argued that team surface-level diversity (e.g., based on members' demographics) would exert influences on team processes and effectiveness early in their life cycles. In contrast, deeper-level diversity (e.g., based on members' personalities, beliefs, and attitudes) would take time to manifest and would, thus, be more influential on

Table 6
Selected Examples of Team Composition Temporal Relationships

Source	Type of Contribution	Main Findings
Harrison et al. (2003)	Empirical study	Illustrated that surface-level diversity has influence on team effectiveness initially but dissipates over time; alternatively, the influence of deep-level diversity effects increases over time
Hollenbeck et al. (2004)	Review, theory, and practice	Posed a series of common myths about team composition and how research informs us differently; advanced an integrative approach including temporal considerations
Mohammed et al. (2009)	Review and theory	Advanced a multilevel model of member, team, and contextual temporal relationships on team effectiveness
Deuling et al. (2011)	Empirical study	Found that members' extraversion was predictive of influence during initial stages, but later stage influence was predicted by cognitive ability and openness to experience
Cheng et al. (2012)	Empirical study	Illustrated that self-managing multicultural teams benefit early on from low average but moderate variance in uncertainty avoidance, and later on from moderate levels of relationship orientations
Ishak and Ballard (2012)	Review and theory	Differentiated three types of actions of teams and detailed the importance of different team competencies and processes for each in a temporal framework

processes and performance later in a team's life cycle. Deuling, Denissen, van Zalk, Meeus, and Aken (2011) found that individuals' extraversion was particularly predictive of members' influence during initial developmental stages. Alternatively, members' cognitive ability and openness to experience evidenced positive effects, whereas their neuroticism and conscientiousness exhibited negative relationships, with perceived member influence late in teams' life cycles. Cheng, Chua, Morris, and Lee (2012) studied self-managing multicultural teams over time. They found that early in their life cycle, teams benefitted from a composition that had low average but moderate variance in members' uncertainty avoidance. Alternatively, later in their life cycles, teams benefitted more from a combination of high average and moderate variability of members' relationship orientation.

The common theme underlying all of these findings is that team composition–outcomes relationships are likely to be variable over time and need to be considered. Just as the relative impact of different individuals' KSAOs on performance changes as a function of time and experience on task, we would anticipate that the relative influences of different aspects of team compositions will vary over time. Unfortunately the extant literature is not sufficiently developed to generate precise implications. What is clear is that different team composition profiles will likely be important at different points in time. For example, from a developmental perspective, we know that teams that initially take the time to develop clear plans for how they will proceed, both in terms of task work and how they will function as a team, prove to be more successful in the long run than those that do not (cf. Hackman, 1982; Marks et al., 2001; Mathieu & Rapp, 2009). Accordingly, there is likely to be a premium on task planning and teamwork organizing (e.g., identifying and sorting our roles) during early team engagement. Later stages are more likely to be dominated by task execution activities, and perhaps position–fit and other task-related KSAOs will play a more prominent role in team effectiveness. We also know that teams tend to engage in midpoint reviews of their progress and functioning, whether that is done spontaneously (Gersick, 1988) or cued by an external source (e.g., Eddy, Tannenbaum, & Mathieu, in press). Therefore, the quality of midpoint transitions may hinge on team compositional attributes associated with problem identification, diagnosis, and the ability to develop future plans and ways of operating. Collectively, these dynamics suggest that either some members need to be highly skilled across different substantive domains, or different members are likely to be more active or perhaps take on leadership roles at different times (Erez, LePine, & Elms, 2002). The integrated formula for team composition–effectiveness relations can be expanded to accommodate such changes. For example, a temporal vector can be added to the integrated formula as follows:

$$\text{Team Effectiveness}_t = x_t \sum \text{LMP}_{mpt} + \ [(1 - x_t) \sum \text{TW}_{qt} + (\sum \text{TPro}_{\text{lmit}})] \tag{8}$$

Where
t = any particular temporal period.

In sum, what Formulas 8 illustrates is that the relationships between team members' competencies and their linked performances and teamwork will likely develop and change over time. At the individual position level, competencies that predict performance when individuals are new to a team (e.g., an early socialization/transition phase) will likely differ from those that are important once members have become socialized and familiar with their positions or roles (e.g., a later action or maintenance phase). However, the dynamics go beyond an individual in his or her role and include the interdependencies between members' position performances. Moreover, the success of team task accomplishments hinges on the synergies between interdependent members, which are likely to change over time.

Dynamic Team Membership Influences

Most team composition research indexes members' characteristics and models their influence on later team process or effectiveness criteria. In effect, they treat team membership as though it is a static variable. However, in many, if not most, modern-day organizations, members move in and out of teams altering the mix of individuals' histories of working together and member characteristics (Arrow, 1997; Arrow & McGrath, 1995; Tannenbaum, Mathieu, Salas, & Cohen, 2012). Team memberships are rarely constant over even modest periods of time. Therefore, the members contributing scores and variance to each of the models and their integration are fluid. Some of these changes are anticipated and planned, while others are unexpected.

Membership dynamics (Arrow & McGrath, 1995) are likely to have both positive and negative effects on teams. Specifically, fluidity of team members can provide the means for knowledge transfer (e.g., best practices) and other resources between groups (Ancona & Caldwell, 1988; Arrow & Crosson, 2003; Mohrman, Cohen, & Mohrman, 1995). In addition, membership adjustments can allow for better alignment with a dynamic environment and may aid in keeping the group flexible, and able to make adjustments to changing demands. However, membership changes may also diminish the stability of patterns of member production, member support, and group production (Arrow & McGrath, 1995). Some examples of dynamic membership focused studies appear in Table 7.

For example, Lewis, Belliveau, Herndon, and Keller (2007) examined the influence of partial member replacement and completely reconstituting teams on transactive memory

Table 7
Selected Examples of Dynamic Team Membership Relationships

Source	Type of Contribution	Main Findings
Arrow and McGrath (1995)	Theory and review	Reviewed the extant literature and advanced a theory of membership dynamics that incorporated attributes of stayers, leavers, and new arrivals, along with temporal and contextual influences
Gruenfeld et al. (2000)	Empirical study	Found that groups produced more unique ideas after itinerant members (ones who left a group for another and returned) returned than before they left or when they were away—but that the influence of the itinerant members themselves was not weighted heavily
Lewis et al. (2007)	Empirical study	Found that groups experiencing membership churn tend to rely on previously established transactive memory system structures to the detriment of future team effectiveness
Ramos-Villagrasa et al. (2012)	Empirical study	Advanced and tested a model of chaotic dynamics as related to team effectiveness over time
Summers et al. (2012)	Empirical study	Demonstrated that the value of member change hinges on the relative abilities of stayers and leavers, and coordination problems associated with how core the changing position is

systems (TMSs), as compared to intact teams. They found that partial replacement teams tended to maintain their TMS system and that newcomers tended to occupy the positions of their predecessors. Unfortunately this combination was associated with lower team performance. Gruenfeld, Martorana, and Fan (2000) found that groups produced more unique ideas after itinerant members (ones who left a group for another and later returned) returned, than before they left or when they were away. Interestingly, those new ideas were not attributable to the itinerant members who were often perceived by stable members to be more argumentative and their ideas were perceived to be less valuable. Rather, the new ideas came from the stable members.

Ramos-Villagrasa, Navarro, and Garcia-Izquierdo (2012) reported a creative study that examined chaotic dynamic performance patterns of professional basketball teams. They advanced and tested a model of chaotic dynamics as related to team effectiveness over time. They found that membership stability related positively to team effectiveness, but not to teams' complex adaptive systems. In contrast, having a limited number of roster changes enhanced team adaptation. In an experimental study, Summers, Humphrey, and Ferris (2012) manipulated member change in core versus peripheral team positions. They found that the impact of change depended, in part, on the relative ability of leavers versus new arrivals. The value of change also hinged on coordination problems that were more acute if a core member was replaced versus a peripheral member. Finally, Choi and Thompson (2005) conducted a pair of experimental studies that examined the influence of membership change on group creativity. They found that changing membership increased group creativity as compared to groups with a constant membership. Interestingly, the improvements were attributable to higher creativity of the newcomers. Moreover, if the newcomer to the group was highly creative, the old timers were stirred to become more creative as well. Here again we see that team composition is a dynamic and relative phenomenon.

Collectively, these works and others underscore the complexity involved in member replacement. In short, the value of changing members depends on the relative competencies of leavers and arrivers, and the consequences of "flux" or change in teamwork processes (Bedwell, Ramsay, & Salas, 2012; Summers et al., 2012). If replacement members possess different arrays of KSAOs, as compared to leavers, then clearly their position performances and teamwork will be affected. Their position-specific KSAOs will filter through the traditional personnel–position fit model features, whereas their teamwork-oriented KSAOs will be captured via the personnel model with teamwork considerations. Their relative impact on *team profiles* will be captured via that model, and the impact of who from the team is leaving and what positions they occupy will be incorporated through the relative contribution model and the network-style matrix of interdependencies (Hausknecht & Holwerda, 2013).

Naturally, the position of the leaver/arriver, and his or her interrelationships with other team members, will have spillover effects on the aggregate linked job performance. If new arrivals are more talented than leavers, or if they possess KSAOs that will be more suitable for changing team tasks and demands—all else being equal—membership change will be advantageous. However, all else is not equal, and changing members disrupts teamwork and causes the group to reconsider how they operate. Such reflection may be valuable and trigger new and better team states and processes that are beneficial. Or, the process may trigger conflicts, promote undue adherence to previous modes of operations, or lead to chaos. The various attributes of leavers and arrivals will filter through the integrated model advanced above (i.e., Formula 7) and be applied to different times or circumstances (i.e., Formula 8) to determine whether such changes, ultimately, are of benefit. In so doing, the integrative model helps to highlight where and why member changes may be functional versus dysfunctional—or even perhaps both at the same time. Equally important, the integrative model can help to target additional HR efforts (e.g., process consultation, debriefs, team building, leader influences) that may be leveraged to address team limitations, build on their strengths, and capitalize on the changing pieces of the larger puzzle.

Many organizations are designed to operate as a cluster of frequently reconfigured temporary teams (Ellis et al., 2003). In such designs, combinations of members are brought together for a particular task, project, or activity, after which they disband and become available for new assignments (e.g., Webber & Klimoski, 2004). For example, consider how certified public accounting and consulting firms often utilize such staffing schemes—constructing project teams based on factors such as experience within a particular industry or experience working with a specific client. As another example, the mix of firefighters who report to a given incident is a function of the nature of the fire (e.g., high-rise building vs. a residential or forest fire), the location of the fire relative to stations, the availability of crews given other calls, and so on. Consequently, on-scene commanders need to not only develop a strategy for handling the incident, but also determine how to deploy their human resources given the mix of who is available at any given time.

One advantage of adopting a reconfiguring-based approach toward team staffing is the assumption that it facilitates the transfer of knowledge and the alignment of member KSAOs with task demands (e.g., Ancona & Caldwell, 1988; Mohrman et al., 1995). However, to the extent that project-based staffing reduces the familiarity of team members, it may also have negative implications. Research has indicated that team member familiarity can have positive effects on team performance (e.g., Guzzo & Dickson, 1996). Thus, the flexibility advantages afforded by reconfiguring designs may be undermined by the inability to garner the advantages of having team members work with one another over time. At issue then is that research to date has not adequately accounted for the fact that, for each team configuration, there is a network of intermember histories of working together. Even on a new team, some members may have worked extensively together previously, whereas others may be meeting for the first time. Understanding the influence of these compositional networks represents a daunting challenge for researchers and practitioners alike. As a result, such relationships have not been studied extensively. Nevertheless, viewing team composition as a dynamic reconfiguring phenomena allows us to model how the composition of members' KSAOs, in concert with their histories of working with one another and their interdependencies, influence their ability to accomplish individual and joint work over time.

Incorporating members' networks of working together also permits us to examine developmental processes that transcend individual team histories. For example, traditional approaches of studying the effects of team composition too often ignore previous working relationships and treat each and every assignment (e.g., task force mission, firefighting engagement, or project team) as though it represented a "new team experience" (Kozlowski & Bell, 2003). Doing so ignores the diversity of members' work histories, as a team with members who have worked together on numerous other occasions would be considered the same as a newly formed team of strangers. It also fails to take into account the influence of positive and negative experiences that members may have had with one another on earlier occasions. In other words, treating each new team configuration as though members are strangers certainly fails to appreciate the influence that factors, such as intermember trust or personality clashes, have on future exchanges.

In summary, viewing team composition as a dynamic versus static phenomenon opens up new avenues for research and application. As combined with the importance of different membership mixes at different times, this synthesis reframes the team composition question into this: "*To what extent does the team have the best combination of members' attributes for a particular task or circumstance?*" Generally speaking, member replacement creates process loss by undermining established team routines, perhaps disrupting transactive memory systems, shared mental models, or any number of other advantageous team states or processes. Alternatively, bringing in new members may enhance the requisite KSAOs in the team and alter team balances, diversities, and so forth to work for the team's advantage. Exactly which factors come into play and where the tipping points lay are questions for future research. The integrative framework and formulas that we advance highlight the interdependent nature of these questions and promote a holistic approach to optimizing team composition.

Future Directions

There is no shortage of work that has been done examining the impact of different facets of team composition. Each of the four approaches that we have reviewed has a deep research base, and many reviews have been written and meta-analyses have been conducted. But the different approaches have not been integrated. When a member joins a team, she brings KSAOs that yield a certain fit with the position and role(s) that she occupies. She also brings a set of team-oriented KSAOs, and her features contribute to a multitude of diversity and other team profiles. Her joining the team may trigger the activation of a fault line or may serve to mitigate an existing one. She may become the weakest or strongest member tipping the team balance in one direction or the other. She may occupy a central or peripheral position in the team network, and thereby alter the relative positions of other members. Based on her interdependencies with others, some members' reactions and performances may benefit or be adversely affected. And all of these relationships may differ depending on when in a performance cycle or developmental phase she arrives. Replace her with a different member, and all of the above moving parameters and relationships are subject to change. Simultaneously lose, add, or replace multiple members, and the number of moving pieces goes up more than exponentially. As chaotic as all that seems, we believe that it also accurately represents the complicated dynamics underlying team composition. Below we consider some of the research and theory implications of embracing this integrated approach, as well as some of the applied implications that this unified view holds.

Theory and Research Implications

The integrated composition model raises several interesting questions for future research. Table 8 presents some of the more salient ones, sorted by category, which occurred to us. Perhaps the most pressing is whether any of the four underlying approaches is more important than the others for predicting team outcomes. We suspect that the relative importance of variance emanating from the four approaches may hinge on particulars of the team situation and which outcomes one considers. Clearly one driving force will be the extent to which the team has designated tightly defined positions versus a more emergent structure. In instances where there are clear and specific positions (e.g., cockpit crews, surgical teams, etc.) there will be premiums on performance in positions (i.e., individual-focused approaches). Alternatively, in situations where the team structure is more emergent, roles and duties are negotiated, and the structure is looser (e.g., parallel teams, quality teams, etc.), the team-focused approaches will become more salient and the mixes of members' attributes will play a larger part in determining team outcomes.

Another critical contextual variable to consider is *task or work-flow interdependence* (cf. Kozlowski & Ilgen, 2006; Mathieu et al., 2008). Tesluk, Mathieu, Zaccaro, and Marks (1997) described four forms of interdependence based on Thompson (1967). In *pooled interdependence* teamwork is essentially an additive product of individual members' contributions. We would predict that predictions from the traditional personnel–position fit model would be most applicable in those situations. In contrast, *sequential interdependence* arrangements describe long-linked arrangements (e.g., assembly lines) where the performance of the whole is limited by the weakest member or the KSAOs of the members in the most central positions. Predictions from the relative contribution model would likely be most applicable in those circumstances.

Tesluk et al. (1997) described *reciprocal interdependence* as instances where work flows back and forth in predictable patterns between members, and *intensive interdependence* as situations where all members have multiple linkages with others and there are very complex relationships among them (what network researchers would refer to as dense, strong bidirectional ties). In both of these circumstances the premium is less on individuals' position-specific performance and more on a team focus or how members' orchestrate teamwork and balance workloads. We anticipate that the personnel model with teamwork considerations and the team profile models would be most predictive in these situations.

Table 8
Selected Research Questions for Future Investigations

From Individual Models

1. What is the relative importance of members' position-specific KSAs versus team-generic KSAs for team effectiveness under different circumstances?
2. Do members' position-specific KSAs interact with team-generic KSAs as related to team effectiveness under different circumstances?
3. Do members' position-specific or team-generic KSAs enable them to better benefit from other team features (e.g., empowerment designs, job sharing arrangements)?
4. Are team-generic KSAs more important to team effectiveness for some team positions than others (e.g., for core or relatively more important positions)?
5. Is there some minimum proportion of team members who need to possess generic team KSAs for team KSAs to show incremental validity over an aggregate of position-specific KSAs?

From Team Models

6. What team diversity factors are related to which team processes and outcomes under what circumstances?
7. Are there important team requisite KSAs that are not embedded in any particular role or position?
8. What member network features (e.g., centralization in work flow) are associated with disproportionate influence in teams?
9. How can teams guard against or deal with the influence of negative team members?
10. Can we define a threshold beyond which diversity is harmful to team performance? Does this depend on the attribute measured?

From Temporal Considerations

11. Do surface team compositional features (e.g., demographic diversity) become less important over time, or do they "lock in" a particular mode of interaction from early team experiences?
12. Is compositional alignment more critical at early stages of team development or during later stages?
13. If different compositional features are important at different times or stages of development, are teams better off staffed with generalists who can adequately perform all functions, or with specialists and shared (rotated) leadership designs?
14. Do teams converge, diverge, or remain parallel in level of performance across time (i.e., what will happen to initial differences over time)?
15. If members of a newly constituted team have worked together in the past, does it facilitate or hinder their functioning on a new task?

From Dynamic Composition Considerations

16. At what point does the process loss associated with member turnover get offset if the KSAs of the replacement are better than those of the leaver?
17. Is there a "tipping" point beyond which the percentage of member replacements becomes so high that teams cannot sustain their performance effectiveness?
18. Are there critical times when member replacement is particularly detrimental (or advantageous)?
19. If the timing of member replacement is controllable or known in advance, does it mitigate its disruptive effects?
20. What (and how large) is the effect of previous work experience with team members in member replacement on team effectiveness?

Note: KSAs = knowledge, skills, and abilities.

The nature of the *team outcomes* may also change the relative predictive value of the different models. The individual-focused models are more directly aligned with traditional "in-role" task performances. Optimizing members' alignment with their positions and emphasizing the fit of the most critical members will likely have the most direct impacts on team task performance. In contrast, the team-focused approaches address how members deal with teamwork issues and products of their interactions. We therefore suggest that the variance emanating from personnel model with teamwork consideration and the team profile models will likely relate more strongly to criteria such as team processes and emergent states. Optimizing the fit of the team-focused approaches will also likely generate positive members' reactions and may spur creativity and non-position-specific types of performances (Paulus, 2000).

Attempting to research the complexity of the integrated model using traditional methods is probably not possible. Naturally some focused investigations homing in on a few select features can be done, and we encourage them. But no investigation will ever be able to sample the diversity of team compositions, model variances within and between the four different approaches, track effects over time and changing circumstances, and evaluate the impact of changing membership. But computational modeling techniques offer one approach that may enable researchers to explore the myriad of compositional combinations and derive predictions as to the most critical parameters and combination strategies (Carley, 2002; Weinhardt & Vancouver, 2012). Computational models are algorithmic representations of complex dynamic processes that are simulated and modeled using computer programs. Their goal is to create a representation of the parameters of a system that approximates the real-world dynamics presumed to exist in some phenomenon. Their beauty is that they force scholars to articulate their underlying assumptions and can then simulate complex combinations of values that would never be able to be sampled adequately in real-world situations. By modeling and simulating numerous combinations of system features, the critical underlying drivers and interactions among factors can be revealed (Weinhardt & Vancouver, 2012). Shifting temporal salience can be modeled by altering the various weighting functions, and changing membership can be incorporated by introducing various numbers and types of attritions, additions, or replacements. Such findings, then, can inform and guide empirical research with real teams.

A particularly attractive strategy for future investigations may be intensive longitudinal designs whereby team composition is considered as a time-varying covariate (Collins, 2006). These designs require extensive team process and outcome data, mostly likely generated through unobtrusive measures. Team membership could be tracked and compositional indices could be continuously updated. The longitudinal analysis framework could be applied in a growth modeling fashion (if the birth of team life cycles can be established), accommodate discontinuous changes (e.g., a significant change in the performance environment), and model reciprocal influences over time (Collins, 2006). These types of designs could be applied to samples as varied as top management teams and yearly organizational performance outcomes to classroom-based approaches (see Harrison et al., 2003) and even time-sensitive laboratory investigations with manipulated membership changes that monitor processes and performance on an ongoing basis.

An alternative direction for future research might be to conduct in-depth qualitative investigations. Firsthand experiences watching teams grapple with changing demands, fluid memberships, and struggles to balance position performances versus teamwork might prove quite enlightening. Despite the seemingly advanced state of team composition research, surprisingly little is really known about how teams manage and balance their own human capital, particularly in circumstances where positions are not rigidly fixed and members are free to adopt different work patterns. Qualitative investigations would be valuable for shining light on the goings-on inside the back boxes of dynamic team composition models.

Applied Implications

Adopting an integrative approach to the study of team composition holds many promises for enhancing application. To begin, simultaneously appreciating the four historical approaches leads one to the inescapable conclusion that no combination of members is likely to be ideal. Inevitably there will need to be trade-offs, but the integrative approach helps to make those trade-offs clearer. Moreover, restrictions ranging from the diversity and availability of members to various organizational contextual factors limit the leverage points that managers may have at their disposal to capitalize on various team compositions. In particular, to fully exploit the integrative model one would need to have complete KSAO information on all potential members as related to different positions, teamwork-oriented attributes, and mixes with other potential members. Few HR information systems are that elaborate and complete. Still, however, appreciating the trade-offs and their implications does clarify the value of other HR strategies.

Clearly one implication of adopting the integrative composition model pertains to *selection and staffing decisions*. When looking to replace one or just a few members of an existing team, the default strategy tends to be to focus on position requirements—to seek a person with the best position-KSAO match. But consider a situation where one applicant possesses superior position-specific KSAOs than another person, yet is far lower on the teamwork-oriented KSAOs and does not add to—or may even detract from—team diversity. Which is the better choice? What if the more position-competent individual has a combative interpersonal style and is likely to generate intrateam conflict and to also trigger the activation of a fault line in the team? What if the position in question resides at the hub of workflow and is particularly influential for team processes and morale? The integrated approach helps to articulate the relative value of choosing the more position competent person and dealing with the interpersonal fallout, versus adding a member who is less talented for the position that he or she might occupy, but who will enhance team spirit and coordination. Perhaps equally important, these decisions may inform the value of other compensatory HR programs, such as coaching, personal mentoring, or team development interventions in the former case, versus personal task skills training, task redesign, or member rotation efforts in the latter case. Presently such decisions are likely done on an ad hoc basis, whereas adopting an integrative approach would enable managers to anticipate certain problems and to take preventative actions to stave off or compensate for problems before they occur.

Appreciation of the integrated composition model may also suggest a *sequenced selection strategy*. For example, if there are one or more particularly critical positions in a team, managers might be best advised to concentrate on filling them and then to "round out" the team composition when choosing members for the remaining positions. In other words, if anyone on the team can contribute to teamwork orientations or overall team profiles, then overall composition fit might be maximized by making position–team trade-offs among members who occupy less critical positions.

Team cluster hiring may offer a viable staffing strategy in some instances. In cluster hiring, organizations staff entire teams at once and attempt to keep them intact while assigning them additional tasks or projects over time (Munyon, Summers, & Ferris, 2011). The logic of the cluster hiring approach is that it is easier to optimize team composition when the entire team is staffed simultaneously than it is when one is limited to replacing one or a few members. Munyon et al. (2011) proposed that while cluster hiring will likely be more costly than traditional approaches when first constituting teams, it should prove less costly to operate and be more effective in the long run, assuming that the team can remain entirely, or mostly, intact. Notably, cluster hiring or staffing represents a particularly viable strategy when facing needs such as constituting a *new team* (e.g., a parallel team), *simultaneously staffing multiple* teams or *reconfiguring members into multiple teams.* In short, the integrative composition approach makes clear that, where feasible, organizations may want to employ different strategies for staffing teams depending on the flexibility inherent in their system and on the type of staffing decision(s) they are facing.

The implications of the integrative composition model are also not limited to staffing decisions. As noted earlier, the likelihood that an optimal team composition can be established to begin with is fairly remote. Consequently, teams will likely benefit from one or more compensatory HR programs. For example, both team members and leaders might benefit when the team's compositional makeup is known and maximized. Training exercises that develop awareness of the team's compositional needs, strengths, and areas of vulnerability could be developed and offered to team leaders and members. The training could provide them with an awareness of when, during the team's assignment or mission, certain team member characteristics become more or less critical. Team members and leaders can discuss and develop strategies for leveraging team composition strengths and compensating for potential weaknesses. One can envision this type of training as a stand-alone initiative or as an element of an existing team or leadership training program.

The relative salience of the individual versus team-focused compositional approaches in any particular situation suggests the relative value that may be gleaned from *individual versus cross-training versus team-oriented training* (Salas, Weaver, DiazGranados, Lyons, & King, 2009). Training represents one of the more expensive HR programs in organizations, and it is difficult enough to schedule and administer individual interventions (Aguinis & Kraiger, 2009). Training intact teams is even more challenging, not only in terms of pedagogy, but also in terms of simple logistics and having all team members available simultaneously. To the extent that the ideal compositional mix hinges more on the team-focused approaches, surmounting the challenges associated with training intact teams or introducing cross-training schemes may be worth it. Contrasting the relative value of the different approaches initially can help to inform such decisions.

Misalignments between members' KSAOs and team demands may suggest other HR interventions. If the shortcomings fall in terms of position–task work competencies, perhaps some form of reassignment or workload rebalancing can be considered. In the extreme, it may prove advantageous to entirely redesign team tasks. Team-building interventions (Salas, Rozell, Mullen, & Driskell, 1999), after-action reviews or debriefs (Tannenbaum & Cerasoli, 2013), and focused leadership actions (Burke, Stagl, Klein, Goodwin, Salas, & Halpin, 2006) can all help to compensate for misaligned team profiles or members' shortages of teamwork competencies. In short, application of the integrated team composition model not only holds promise for team staffing type decisions but also signals the likely benefit associated with other team-oriented HR initiatives.

In sum, the team composition research to date has been voluminous but fragmented. We chronicled four different approaches in the extant literature and offered a synthesis. We then overlaid both temporal considerations and dynamic membership implications. We suggested both avenues for future research and application strategies. We believe that the time is ripe for a quantum leap forward in our understanding of team compositional effects. Recent efforts to move beyond means or variances of members' attributes and to embrace the complexity compositional dynamics were heralded, and we think that the future offers much promise for advancement.

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