Why Do 'Great Minds' Think Alike?: Antecedents of Team Member Schema Agreement

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Why do ‘great minds’ think alike?: antecedents of team member schema agreement

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Summary

The primary contribution of the present study, as implied by the title of this paper, was to delineate and to test antecedents of team member schema agreement and their indirect effects on team effectiveness. The study was conducted in a naturalistic setting involving 315 individuals who comprised 41 teams. Team member teamwork schema agreement was assessed using multidimensional scaling to analyse paired comparison ratings. Demography, team experience, team member recruitment, and team size were significantly related to team member schema agreement, which in turn was significantly related to team effectiveness. Several antecedents were related to team effectiveness indirectly through team member teamwork schema agreement. The results have implications for research on cognition in teams.

Introduction

Recently, several researchers have developed theoretical models in which they have hypothesized cognition in teams to be related directly or indirectly to team effectiveness (e.g., Cannon-Bowers et al., 1993; Klimoski and Mohammed, 1994; Rentsch and Hall, 1994). This fundamental hypothesis has received some modest empirical support (e.g., Mathieu et al., 2000; Rentsch et al., 1999 – Paper presented to the 14th Annual Conference of the SIOP, Atlanta, Georgia; Walsh et al., 1988). These researchers have also hypothesized several antecedents of cognition in teams. However, in contrast to the consequences of cognition in teams, the antecedents of cognition in teams have not received much empirical research attention. Therefore, the primary contribution of the present study was to delineate and to test several antecedents of cognition in teams.

In addition, we addressed two methodological issues in the present study. First, most of the research on cognition in teams has been conducted in laboratory or simulated settings in which researchers have attempted to create, promote, or manipulate cognition in teams (e.g., Mathieu et al., 2000). Although, this type of research is providing evidence to support the influence of cognition in teams and its relationship with team effectiveness, very little research has been conducted in naturalistic settings. Therefore, we conducted the present study in a naturalistic setting. Second, there is great ambiguity and confusion regarding how to measure cognition in teams (Mohammed et al., 2000). For this reason, much of the
research on this topic addresses the cognition variable indirectly (Klimoski and Mohammed, 1994). In the
present study, we assessed cognition in teams directly using paired comparison data and multidimensional
scaling analysis. Below, we describe our terminology and specify the variables examined in the study.

**Team member schema agreement**

Cognition in teams refers to a general category of related concepts including team mental models (e.g.,
Cannon-Bowers et al., 1993; Klimoski and Mohammed, 1994), shared internal frames of reference
(Mitchell, 1986), teamthink (Neck and Manz, 1992 – unpublished manuscript), negotiated belief struc-
tures (Walsh et al., 1988), team member schema similarity (Rentsch and Hall, 1994), and teammind
majority of these conceptualizations emphasize the shared mental representations regarding team-
related information that exist among team members. For the present study we elected, from amid
the myriad of available concepts, to borrow Rentsch and Hall’s (1994) terminology and to examine
team member schema similarity. We selected team member schema similarity because it specified
most clearly the aspect of team cognition we intended to investigate.

The reference to ‘team member’ communicates that cognitive representations originate within each
individual team member. ‘Schema’ refers to interconnected knowledge packages (Lord and Maher,
1991) that represent a structure for organizing and understanding phenomena (Poole et al., 1990). Rentsch
and Hall (1994) selected the term ‘similarity’ intentionally to articulate that team members’ schemas will
not be identical, as is implied by the term ‘shared,’ but rather that commonality among team members’
schemas will be characterized by incomplete agreement. Thus, team member schema similarity refers to
the degree to which team members have similar or compatible knowledge structures for organizing and
understanding team-related phenomena. Rentsch and Hall (1994) suggested that team member schema
similarity consisted of two components: team member schema accuracy and team member schema agree-
ment. In the present study, we focused on the team member schema agreement component, which is
defined as the degree to which team members’ schemas are similar in content and/or structure.

Any team-relevant domain may constitute the content of team members’ schemas. Researchers have
highlighted at least four team cognition content domains: equipment, task, team member, and team-
work (Cannon-Bowers et al., 1993). In the present study, we examined teamwork, because a core
teamwork schema is likely to generalize across teams (Rentsch et al., 1994 – Paper presented to
the 14th SIOP Conference, Georgia). Teamwork is described as team processes aimed at facilitating
team member interactions in an effort to promote successful task completion (Cannon-Bowers et al.,
1993). Salas et al. (1988 – Paper presented at the APA Meetings, Georgia) characterized teamwork as
‘activities that are devoted to enhancing the quality of the interactions, relationships, affects, coopera-
tion, communication, and the coordination of teams’ (p. 5). Similar teamwork schemas among team
members provide a common interpretation of the team’s process and are likely to enable team mem-
bers to predict one another’s behavior accurately, thereby enhancing team effectiveness. This type of
logic is incorporated into most team cognition models (e.g., Cannon-Bowers et al., 1993; Klimoski and
Mohammed, 1994; Rentsch and Hall, 1994). Indirect empirical evidence supports this basic hypothesis
(Mathieu et al., 2000). However, antecedents of cognition in teams, in general, and of team member
schema agreement, in particular, have not been examined extensively.

**Antecedents of team member schema agreement**

Theorists have proposed at least three likely antecedents of team member teamwork schema agree-
ment: team composition, team membership acquisition mode, and team size (e.g., Cannon-Bowers
et al., 1993; Klimoski and Mohammed, 1994; Rentsch and Hall, 1994).
Team composition

Team composition refers to the collection of the team members’ characteristics. Klimoski and Mohammed (1994) and others hypothesized that team composition (which was incorporated into team membership influences in Rentsch and Hall’s (1994) model) will be related to cognition in teams. However, the underlying nature and mechanisms by which team composition may influence cognition in teams has not been specified. Team composition may be related to team member schema agreement, because schemas are developed based upon life experience (Poole et al., 1990), and team composition may capture similarities among team members’ past life experiences. In the present study, we examined two types of team composition variables related to experience: team demography and team experience.

We hypothesized that demographic homogeneity among team members is related to team member schema agreement, because demographic variables can serve as surrogate measures of past experience (Zenger and Lawrence, 1989). For example, similarities in age, tenure, sex and so on provide substitute measures of similar life experience (Zenger and Lawrence, 1989). Evidence from the organizational and team demography literatures support the hypothesis that demographic homogeneity among team members will be related to team member schema agreement.

Demography is related to interaction frequency and quality, which is likely to be related to the development of schema agreement. Homogeneity among team members is expected to be associated with increased communication within the team, increased ability to achieve consensus readily, increased cohesion, and decreased experience of intrateam conflict (e.g., Jackson, 1996). For example, mixed-sex groups tend to experience more tension, more competition, lower efficiency, and lower cooperation than all-male groups (Gist et al., 1987). Age and tenure distributions differentially predicted the frequency of technical communication within and outside of engineering groups (Zenger and Lawrence, 1989). Others have argued that age heterogeneity within a team leads to conflict, because age variance is associated with variance in experience, and this variance leads to disagreements (Levine and Moreland, 1990). Heterogeneity within groups is also associated with such indicators of low team viability (Hackman, 1990) as high rates of turnover, increased conflict, frequent and severe power struggles, low cohesiveness, and low satisfaction with coworkers (e.g., Jackson et al., 1991). Demographically homogeneous teams have also been shown to outperform heterogeneous teams, regardless of the extent of task interdependence (Jackson, 1996).

In general, past research has revealed that homogeneity of such demographic variables as age, sex, tenure, and organizational level is likely to be related to team processes and team effectiveness. Perhaps, the behavioral and attitudinal differences reported in past research can be explained by understanding demographic variables as measures of life experience related to schema development. Past experiences, as assessed via demography, lead to similar language and similar interpretations of events (Zenger and Lawrence, 1989). In other words, similarity in past experience is likely to be related strongly to similar schemas. To the authors’ knowledge, however, the relationship between demographic variables and cognition in teams has not been investigated directly in previous research.

In addition to studying general life experience indirectly using demography, we examined a specific type of experience directly by assessing team experience. Individuals with high levels of team experience have been shown to have more similar teamwork schemas than individuals with low levels of team experience (Rentsch et al., 1994 – Paper presented to the 14th SIOP Conference, Georgia). Therefore, we hypothesized that teams composed of many high-experience members will have higher levels of teamwork schema agreement than teams composed of many low-experience members.

Team membership acquisition mode

The mode by which individuals acquire team membership is also likely to influence schema agreement. Levine and Moreland (1990) reported that members of naturally occurring groups tended to be homogeneous due, in part, to the entry, socialization, and exit process. This process is similar to Schneider’s (1987)
attraction, selection, and attrition (ASA) cycle. According to Schneider, people are attracted to, selected by, and remain in organizations that contain similar others, thereby producing homogeneity among organizational members. He hypothesized that homogeneity results in members thinking similarly.

Extending ASA theory, we hypothesized that teams comprised of a large proportion of members who had been recruited to join the team would be related to high levels of team member homogeneity. Levine and Moreland noted that individuals are attracted to groups whose members are similar to them, and groups tend to select as members those individuals who are similar to the existing group members. Recruitment involves attraction and selection processes. Team members may select to recruit as new team members those individuals who are known to be similar to current team members (Sundstrom, 1999). Furthermore, recruited individuals who join the team are likely to be attracted to the team because they are similar to its existing members. Thus, recruitment as a mode of acquiring team membership (as opposed to being assigned or volunteering to join a team) is expected to produce homogeneity among team members and to be related to team member schema agreement.

**Team size**

Organizational and team researchers agree that interacting individuals tend to develop similar understandings and interpretations of relevant events (e.g., Rentsch, 1990; Walsh et al., 1988). Interactions and communications by which team members share their team-related schemas are most likely to be related to team member schema agreement (Rentsch and Hall, 1994). Within team research, indirect evidence suggests that interaction among team members is a primary cause of schema agreement among team members (Walsh et al., 1988). In general, very few researchers have studied interaction and communication processes directly within work teams.

In an attempt to contribute additional indirect evidence to evaluate the hypothesis that team member interactions and communications are related to team member schema agreement, we tested team size as one rough estimate of team member interaction opportunity (Smith et al., 1994). Klimoski and Mohammed (1994) recognized the importance of team size in their model of cognition in teams. Team size is likely to be related to team member schema agreement because of its effects on opportunities for team members to interact with one another. Teams with very few members afford each member a high probability of interacting with every other member. Teams with many members however potentially limit the opportunity of any given member to interact with every other member. Thus, we hypothesized that team size would be negatively associated with team member schema agreement.

**Antecedents versus consequences of team member schema agreement**

Our thesis thus far is that team member schema agreement is an important influence on team effectiveness. We have argued that little is known about the antecedents of team member schema agreement, and we have presented team composition, team member recruitment, and team size as possible antecedents of team member schema agreement. We are implying that the antecedent variables will have indirect effects on team effectiveness through team member schema agreement, which is consistent with past theorizing (Cannon-Bowers et al., 1993; Klimoski and Mohammed, 1994; Rentsch and Hall, 1994). Therefore, we also tested the indirect effects of the antecedent variables on team effectiveness. The following hypotheses were tested.

**Hypothesis 1.** Team composition, operationalized as the percentage of team members with high team experience, age similarity, gender similarity, education similarity, and organizational level similarity, will be related positively to team member schema agreement.

**Hypothesis 2.** The percentage of team members who were recruited to join the team will be related positively to team member schema agreement.
Hypothesis 3. Team size will be related negatively to team member schema agreement.

Hypothesis 4. Team member schema agreement will be related positively to team effectiveness.

Hypothesis 5. Team member schema agreement will mediate the relationships between the antecedent variables and team effectiveness variables.

Methodology

Mohammed et al. (2000) noted that empirical work on team member cognition has lagged substantially behind the theoretical work. An essential problem for researchers is confusion and lack of agreement over how to assess cognition in teams. Therefore, much of the past research evidence regarding cognition in teams is indirect, although several researchers have urged direct measurement of cognition in teams (Mohammed et al., 2000). In the present study, we have attempted to assess team member schema agreement directly using multidimensional scaling (MDS) analysis.

MDS, used to analyse paired comparison data, aids in identifying the underlying dimensions that organize stimuli (Kruskal and Wish, 1978). In the present study, paired comparison data were collected from each team member, thereby maintaining consistency between the conceptual variable of interest and the operational variable. An individual differences MDS model was applied, because individual difference models provide information about the degree of agreement of cognitive organization among a group of individuals. Psychologists have used individual difference models to examine group interactions (Forgas, 1981), organizational meanings (Rentsch, 1990), and negotiated belief structures (Walsh et al., 1988).

MDS affords the researcher several choice points. One decision that we believe is very important in the study of team member schema agreement, is choosing to calculate a single solution for all teams participating in a particular study versus choosing to calculate a unique solution for each participating team. Choosing a single solution constrains the number of underlying dimensions to the same value for each team. This approach does not allow for the possibility that teams may have different numbers of underlying dimensions characterizing their teamwork schemas. However, previous work suggests that it is technically and theoretically possible to represent team member teamwork schema agreement uniquely for each team (e.g., Forgas, 1981; Rentsch, 1990; Sundstrom, 1999). Therefore, in the present study, a unique schema structure was computed for each team.

Method

Participants

Participants were 315 individuals representing members of 41 work teams from a U.S. Department of Defense organization. The teams ranged in size from 2 to 27 members, the median team size was seven. The sample included 69.4 per cent males and 79.1 per cent civilian personnel. Team members’ average age ranged between 31 and 40 years, the mean education level was a bachelor’s degree, and the average civil service grade level ranged between GS9 and GS10. An effort was made to recruit different types of teams. The teams were categorized using Sundstrom’s (1999) team types. Approximately 54 per cent of the participating teams were advice teams, 24 per cent were project teams, 5 per cent were service teams, 2 per cent were action teams, and 16 per cent were of unidentified team type.
Measures

Teamwork schema agreement
The teamwork schema measure was developed using methods shown to be effective in the development of other measures of schemas and cognitive congruence (e.g., Engle and Lord, 1997; Rentsch, 1990). A pilot study was carried out in which 13 interviews were conducted involving 54 individuals representing 21 teams. An effort was made to recruit members of all team types; however, no identifying information was obtained from these participants. The purpose of these interviews was to elicit teamwork schema information in the form of descriptions of prototypical events that occur as a team works and in the form of interpretations of the events. The interviews were conducted with groups of three to six individuals and lasted approximately two hours. Question were asked such as, ‘Can you give specific examples of teamwork?’ and ‘How do you define teamwork?’ Additional probes and questions were asked in an attempt to elicit events and the interpretations used to understand the events. The researchers made an effort to involve all participants in the discussions. The resulting interview data consisted of a list of teamwork descriptors and behavioral examples for each descriptor. The interview data were analysed by identifying the most frequently occurring descriptors. Behaviors exemplifying two or more of these high frequency descriptors were retained to develop event statements for the teamwork schema measure.

Fifteen event statements were presented on the Teamwork Schema Questionnaire (Organizational Research Group, 1998). Each of the 15 team event statements was paired with every other event statement. (Sample statements were ‘Personal preferences are compromised to meet team goals’ and ‘Members are concerned with working for their own personal benefits.’) Participants were to consider what each event meant to them about teamwork and then to rate the similarity of the meanings associated with each pair of events. The ratings were made on an 11-point scale ranging from very dissimilar (-5) to very similar (5). The order of presentation was randomized within pairs of events, across pairs of events, and across all questionnaires. This randomization process controlled for order of presentation effects and permitted the presentation of only 105 event pairs (or half of the 210 possible pairs) to each participant. These data were analysed using multidimensional scaling to obtain the team member teamwork schema agreement score for each team.

Team effectiveness
Three team effectiveness scales, developed for this study, were designed to assess Hackman’s (1990) three team effectiveness dimensions: client satisfaction, team viability, and team member growth. The first author wrote 22 items. Each item was designed to assess one of the three dimensions. Five graduate students, who were blind to the purpose of the study, sorted the items into the three dimensions. The results revealed 100 per cent agreement for three items for each dimension. Therefore, these nine items were retained for the scale. Participants in the present study rated the items on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The responses to these items were factor analyzed using varimax rotation. The items were forced onto three factors, which supported a three factor structure explaining 71.2 per cent of the variance (see Table 1). The means for team viability, member growth, and client satisfaction were 13.42, 16.09, and 14.01, respectively. The standard deviations were 4.08, 3.38, 3.75, respectively.

Team experience
A 7-item version of The Team Experience AssessMent (TEAM; Organizational Research Group, 1998) was used to assess team experience. The items were rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The mean was 38.28 and the standard deviation was 1.78. The measure correlated significantly with the longest time spent working on a team ($r = 0.21, p < 0.01$), and the number of teams on which the participant had been a member ($r = 0.21, p < 0.01$).
Table 1. Team effectiveness scale items and factor analysis results

<table>
<thead>
<tr>
<th>Item</th>
<th>Team viability</th>
<th>Client satisfaction</th>
<th>Member growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members look forward to team meetings</td>
<td>0.79</td>
<td>0.22</td>
<td>0.12</td>
</tr>
<tr>
<td>Team members ‘carry their weight’</td>
<td>0.81</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>Members are highly committed to the team</td>
<td>0.82</td>
<td>0.26</td>
<td>0.24</td>
</tr>
<tr>
<td>The team’s customer is satisfied with the team’s product</td>
<td>0.35</td>
<td>0.72</td>
<td>0.16</td>
</tr>
<tr>
<td>People outside of the team give the team positive feedback about its work</td>
<td>0.14</td>
<td>0.77</td>
<td>0.21</td>
</tr>
<tr>
<td>The team’s ‘owner’ or manager is satisfied with the team’s performance</td>
<td>0.19</td>
<td>0.83</td>
<td>0.11</td>
</tr>
<tr>
<td>Team members work better together now than when the team was formed</td>
<td>0.39</td>
<td>0.32</td>
<td>0.53</td>
</tr>
<tr>
<td>Team members are more aware of group dynamics now than when they joined the team</td>
<td>0.21</td>
<td>0.14</td>
<td>0.85</td>
</tr>
<tr>
<td>Being a part of this team helps members appreciate different types of people</td>
<td>0.11</td>
<td>0.15</td>
<td>0.88</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>4.25</td>
<td>1.15</td>
<td>1.01</td>
</tr>
<tr>
<td>Percent of variance explained</td>
<td>47.2</td>
<td>12.8</td>
<td>11.2</td>
</tr>
</tbody>
</table>

**Recruited for membership**

Team members indicated whether they were actively recruited, were mandated, or volunteered to be on the team that was participating in this study. Recruited membership was dummy coded as (1) recruited and (0) not recruited.

**Demographic information**

Age in years was assessed using a 7-category measure ranging from 1 (less than 20) to 7 (more than 60) ($M = 4.19$, $SD = 1.12$). A 7-category scale was also used to measure education level. This scale ranged from 1 (non-high school graduate) to 7 (doctoral degree) ($M = 4.12$, $SD = 1.30$). Organizational level was coded as civil service grade, which was recorded on a 7-category measure ranging from 1 (Grades 1–2) to 7 (Grades 13 and above) ($M = 5.08$, $SD = 1.78$). Gender was coded 1 for males and 2 for females. For age, education, and level, a team composition variable was computed as the team standard deviation for each variable. Team level gender was coded as the percentage of female members on each team.

**Team size**

Team size was calculated as the number of team members on each team.

**Procedure**

Researchers met teams at a time and place most convenient for team members. Typically, team members met in a conference room and completed the questionnaires. The researcher remained in the room to answer questions and waited to collect the completed questionnaires. All team members were assured of the confidentiality of their responses. They required approximately 60–90 minutes to complete the questionnaires.
Results

Preliminary analyses

Team member teamwork schema agreement was assessed using MDS. Before conducting the MDS analyses, all data from the teamwork schema questionnaire were recoded to range from 1 (very similar) to 11 (very dissimilar). These data formed 315 lower triangular $15 \times 15$ matrices (one for each participant). The individual matrices were arranged by the 41 teams. An individual-differences MDS analysis was conducted for each of the 41 teams. The INDSCAL model included in the SPSSX Aldscal procedure (SPSS, 1988) was used to analyse the data, and $R^2$ was used to measure the goodness of fit. $R^2$ indicates the variance accounted for by the dimensions produced in the MDS solution. Analyses were performed for two to four dimensions for each team (Schiffman et al., 1981). Two decision rules were used to determine the appropriate dimensionality for each team: (a) because there were only 15 rated stimuli, no more than four dimensions were permitted (Kruskal and Wish, 1978), and (b) at least a 5 per cent increase in variance explained was required before an additional dimension was accepted for the solution. The number of appropriate dimensions ranged from two to four and the mode was two. The fact that there was variability in the number of defining dimensions indicated that a single MDS solution for all teams would not have been appropriate and supported the assumption that different teamwork schema structures existed in different teams. The $R^2$ value for each team was the operationalization of team member teamwork schema agreement used in subsequent analyses.

The descriptive statistics and intercorrelations among the individual level variables are presented in Table 2. Team level variables were computed after preliminary analyses were conducted to justify aggregation. For each team within group agreement on the team effectiveness measures was assessed using $rwg$ (James et al., 1984). Teams were included in the analysis of any given variable if they had achieved the 0.70 criterion on that variable. It is interesting to note that of the nine teams with low $rwg$ values, six had $R^2$ values less than or equal to the mean. One-way analyses of variance were conducted to test for team differences on the team effectiveness measures. All tests revealed significant $F$ values.

For each team, the mean level of each effectiveness scale was calculated. Team experience composition was calculated as the percentage of members scoring high. The intercorrelations among the variables at the team level of analysis are presented in Table 2. Several correlations in Table 2 are worth noting. Percentage of recruited members correlated significantly with the percentage of female members and with age similarity. Level similarity was positively associated with education similarity. Although, highly speculative, one interpretation of these correlations is that team members’ tend to be attracted to others and to select others who are similar on ‘public’ characteristics (Jackson, 1996).

Tests of hypotheses

Antecedents of team member teamwork schema agreement were evaluated in tests of Hypotheses 1, 2, and 3. Hypothesis 1 received substantial support. As seen in Table 2, education similarity, level similarity, and percentage of team members with high team experience correlated significantly with teamwork schema agreement. However, gender similarity and age similarity were not significantly related to team member schema agreement. Hypothesis 2 was supported, because the percentage of recruited team members was also correlated significantly with teamwork schema agreement. Team size was significantly and negatively associated with teamwork schema agreement, which provided support for Hypothesis 3.

Hypothesis 4 focused on the effects of team member teamwork schema agreement. All team effectiveness measures correlated significantly and positively with team member teamwork schema agreement.
Table 2. Intercorrelations among variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender similarity (gender)</td>
<td>-</td>
<td>0.04</td>
<td>-0.27</td>
<td>-0.17</td>
<td>0.12</td>
<td>0.06</td>
<td>0.26</td>
<td>0.22</td>
<td>0.12</td>
<td>0.23</td>
<td>-</td>
</tr>
<tr>
<td>2. Age similarity(^a) (age)</td>
<td>-0.10</td>
<td>-</td>
<td>-0.05</td>
<td>0.27</td>
<td>0.10</td>
<td>0.04</td>
<td>0.12</td>
<td>0.18</td>
<td>0.10</td>
<td>0.16</td>
<td>-</td>
</tr>
<tr>
<td>3. Education similarity (education)</td>
<td>0.04</td>
<td>-0.01</td>
<td>-</td>
<td>0.10*</td>
<td>0.15</td>
<td>0.06</td>
<td>0.06</td>
<td>0.05</td>
<td>0.02</td>
<td>0.05</td>
<td>-</td>
</tr>
<tr>
<td>4. Level similarity (level)</td>
<td>-0.20</td>
<td>0.07</td>
<td>0.31*</td>
<td>-</td>
<td>-0.03</td>
<td>-0.07</td>
<td>-0.02</td>
<td>-0.05</td>
<td>0.05</td>
<td>-0.01</td>
<td>-</td>
</tr>
<tr>
<td>5. Percent high team experience (team experience)</td>
<td>0.11</td>
<td>0.24</td>
<td>-0.37*</td>
<td>-0.11</td>
<td>(0.80)</td>
<td>0.14*</td>
<td>0.38</td>
<td>0.30</td>
<td>0.27</td>
<td>0.38</td>
<td>-</td>
</tr>
<tr>
<td>6. Percent recruited (recruited)</td>
<td>0.36*</td>
<td>-0.39</td>
<td>-0.10</td>
<td>-0.24</td>
<td>0.02</td>
<td>-</td>
<td>0.09</td>
<td>0.08</td>
<td>0.04</td>
<td>0.09</td>
<td>-</td>
</tr>
<tr>
<td>7. Member growth(^b)</td>
<td>0.35*</td>
<td>0.01</td>
<td>-0.26</td>
<td>-0.48</td>
<td>0.42</td>
<td>0.19</td>
<td>(0.76)</td>
<td>0.56</td>
<td>0.53</td>
<td>0.82</td>
<td>-</td>
</tr>
<tr>
<td>8. Team viability(^c)</td>
<td>0.13</td>
<td>-0.05</td>
<td>-0.17</td>
<td>-0.19</td>
<td>0.42</td>
<td>0.39</td>
<td>0.77</td>
<td>(0.80)</td>
<td>0.50</td>
<td>0.85</td>
<td>-</td>
</tr>
<tr>
<td>9. Client satisfaction(^d)</td>
<td>-0.13</td>
<td>0.18</td>
<td>-0.02</td>
<td>-0.14</td>
<td>0.39</td>
<td>0.04</td>
<td>0.59</td>
<td>0.67</td>
<td>(0.75)</td>
<td>0.82</td>
<td>-</td>
</tr>
<tr>
<td>10. Overall effectiveness</td>
<td>0.13</td>
<td>-0.01</td>
<td>-0.08</td>
<td>-0.23</td>
<td>0.46</td>
<td>0.21</td>
<td>0.85</td>
<td>0.92</td>
<td>0.88</td>
<td>(0.86)</td>
<td>-</td>
</tr>
<tr>
<td>11. Team size</td>
<td>-0.14</td>
<td>0.19</td>
<td>0.29</td>
<td>0.20</td>
<td>-0.23</td>
<td>-0.42</td>
<td>-0.19</td>
<td>-0.43</td>
<td>-0.19</td>
<td>-0.34</td>
<td>-</td>
</tr>
<tr>
<td>12. Team member teamwork</td>
<td>0.13</td>
<td>-0.06</td>
<td>-0.27*</td>
<td>-0.52</td>
<td>0.32</td>
<td>0.43</td>
<td>0.50</td>
<td>0.48</td>
<td>0.39</td>
<td>0.48</td>
<td>-0.48</td>
</tr>
</tbody>
</table>

Team level correlations are in the lower triangle; \(N=41\); \(^a\)low scores indicate high levels of age similarity, education similarity, and level similarity; \(^b\)\(n=37\); \(^c\)\(n=35\); \(^d\)\(n=36\). Individual level correlations are in the upper triangle; \(N=272\); unique individual level variable names are listed in parentheses; internal consistency reliability estimates appear on the diagonal.

\(^{*}p < 0.05\). \(^{1}p < .01\).
agreement (see Table 2). Because the team effectiveness measures were highly interrelated, a composite effectiveness measure was created, which correlated 0.48 ($p < 0.01$) with team member teamwork schema agreement.

Hypothesis 5 proposed that team member schema agreement would mediate the relationships between the antecedent variables and team effectiveness variables. Only a subset of variables met the criteria required to evaluate mediation (i.e., significant relationships among the antecedent, mediator, and effectiveness (criterion) variables). Team member schema agreement was evaluated as a mediator of the following relationships: level similarity and member growth, percentage of members with high team experience and each of the effectiveness measures, percentage of recruited members and team viability, and team size and overall team effectiveness and team viability. The results are presented in Table 3. Evidence of mediation occurred when in Model 2, the beta of the antecedent was lower than in Model 1 and the mediator had a significant beta weight. Strong support for team member schema agreement mediating the antecedent–effectiveness relationship was obtained for the relationship between percentage of high experience team members with member growth and with team viability and between percentage of members recruited and team viability. Partial support was obtained for the relationships between team experience and overall effectiveness.

**Exploratory analyses**

We conducted a set of analyses in which we explored the potential of team type to provide insight on team member schema agreement. Team type is considered an important, yet somehow theoretically

<table>
<thead>
<tr>
<th>Criterion variable</th>
<th>Predictor variables</th>
<th>$\beta$</th>
<th>$R$</th>
<th>$R^2$</th>
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<td>Member growth</td>
<td>Model 1: Percent of high experience team members</td>
<td>0.42*</td>
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<td></td>
<td>Model 2: Percent of high experience team members</td>
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<td>0.26</td>
<td>0.09</td>
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<tr>
<td></td>
<td>Team member teamwork schema agreement</td>
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<td>0.55†</td>
<td>0.30</td>
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<tr>
<td></td>
<td>Model 1: Level similarity</td>
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<td>0.48†</td>
<td>0.23</td>
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<tr>
<td></td>
<td>Model 2: Level similarity</td>
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<td>-0.31</td>
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<tr>
<td></td>
<td>Team member teamwork schema agreement</td>
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<td>0.56†</td>
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<td>Team viability</td>
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<td>0.42*</td>
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<td>0.30</td>
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<tr>
<td></td>
<td>Team member teamwork schema agreement</td>
<td>0.38*</td>
<td>0.55†</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>Model 1: Percent of members recruited</td>
<td>0.39*</td>
<td>0.39*</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Model 2: Percent of members recruited</td>
<td>0.21</td>
<td>0.21</td>
<td></td>
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<tr>
<td></td>
<td>Team member teamwork schema agreement</td>
<td>0.38*</td>
<td>0.51†</td>
<td>0.26</td>
</tr>
<tr>
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<tr>
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<tr>
<td></td>
<td>Team member teamwork schema agreement</td>
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<td>0.51†</td>
<td>0.26</td>
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<td>Client satisfaction</td>
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<tr>
<td>Overall effectiveness</td>
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<td>0.46†</td>
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<td>0.34*</td>
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<tr>
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<td>Team member teamwork schema agreement</td>
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<td>0.58†</td>
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</tr>
<tr>
<td></td>
<td>Model 1: Team size</td>
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<tr>
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<td>Model 2: Team size</td>
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<td>-0.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team member teamwork schema agreement</td>
<td>0.42</td>
<td>0.50†</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*p < 0.05; †p < 0.01.
and empirically elusive variable in team research (e.g., Sundstrom, 1999). Using Sundstrom’s (1999) team typology, the majority of teams participating in the present study were categorized as advice teams. The remaining teams were distributed among the other three categories with 16 per cent categorized as unidentified team type. Therefore, we recategorized the teams either as advice teams or as other teams. One-way analyses of variance were conducted using each team effectiveness measure and team member schema agreement as criterion variables. The results revealed advice teams had significantly higher means than other teams for member growth ($M = 17.27$, $16.22$, respectively, $F(1,39) = 4.43$), overall effectiveness ($M = 47.57$, $43.39$, respectively, $F(1,39) = 4.20$), and team member schema agreement ($M = 0.24$, $0.18$, respectively, $F(1,39) = 4.48$; all $p < 0.05$). Tests of the moderating effect of team type on antecedent–team member schema agreement relationships and on team member schema agreement–effectiveness relationships did not reveal significant results.

**Discussion**

The primary purpose of the present study was to advance the study of cognition in teams by delineating and testing several antecedent variables. We examined their direct effects on team member schema agreement and their indirect effects, through team member schema agreement, on team effectiveness. In addition, we addressed two methodological issues by studying teams in their natural settings and by attempting to assess schemas directly using MDS. Below, we discuss the implications of the study’s results and limitations.

**Team member schema agreement antecedents and consequences**

Why do ‘great minds’ think alike? According to our results, high team member schema agreement is likely to exist in smaller teams with members who have similar life experiences as captured by educational similarity and level similarity, who have similar high levels of team experience, and who were recruited to join the team. These results may aid in the refinement of team cognition theories, in which team composition is proposed to be related to cognition in teams. Current theories do not specify the nature of the team composition variables, or the mechanisms by which team composition is assumed to affect cognition in teams. In the present study, we have obtained evidence that experience, life experience in general and team experience in particular, is one mechanism by which team composition influences team member schema agreement. These findings support the notion that demographic variables may serve as proxy measures of experience. Based on the present and past research findings, researchers might explore whether experience and team size are related directly to team member schema agreement and/or if these relationships are mediated by team member interactions and communications.

Team member schema agreement was found to mediate relationships between some antecedent variables and team effectiveness. In addition to supporting models of cognition in teams (e.g., Klimoski and Mohammed, 1994; Rentsch and Hall, 1994), the mediation findings may explain past research results. As stated above, demography has been found to be associated with team effectiveness and team processes (e.g., Jackson et al., 1991). Perhaps team member homogeneity increases team member teamwork schema agreement thereby producing smooth intrateam relationships resulting in high team effectiveness. Variables such as trust and cooperation may also play significant roles in these relationships.
We must note that although it could be argued that team member demographics, team experience, and recruitment could be differentiated temporally from team effectiveness, these variables were measured concurrently. Longitudinal research would provide a very strong test of mediating and causal effects.

The results from the present study (the mediation results, the factor analysis results, and the correlational results) suggested that team effectiveness is, as Hackman (1990) argued, multidimensional. For example, team member schema agreement was differentially related to the facets of team effectiveness and the antecedent variables correlated with different facets of team effectiveness. Indeed, different models may be required to understand each effectiveness dimension fully. For example, team size, percentage of recruited members, and percentage of high experience team members are likely to be significant variables in a model of team viability. Whereas, gender similarity, level similarity, and percentage of high experience team members are likely to be significant variables in a model of member growth.

Our results add to the accumulating evidence supporting a significant relationship between cognition in teams and team effectiveness. Team member teamwork schema agreement was strongly related to all team effectiveness measures in the present study. One limitation of the present study was that team members reported team effectiveness, which is a common methodological choice in this type of research. Many choices in research design require making decisions with trade-offs. In designing the present study, we chose to collect data from intact workteams in a natural setting where schema agreement was able to emerge without researcher influence as opposed to collecting data from teams in laboratory or simulated settings where schema agreement could be manipulated. In making the choice to study teams in their natural settings, we were willing to forego the ability to collect objective team performance measures. As noted by Hackman (1990), objective measures of team effectiveness often are not available in real world work settings. We believed we could make a more meaningful contribution to the team cognition research literature, which is short on naturalistic empirical studies, by testing the hypotheses in a naturalistic setting rather than testing them in a controlled environment. This choice yielded a sample size that restricted the nature of internal inferences that could be drawn.

**Methodological strengths and considerations for future research**

A primary strength of the study was that the naturalistic setting affords an inference of relatively high external validity. Presumably, these results should generalize to other work teams. Because, the majority of the teams were advice teams, we might expect stronger generalizability to these types of teams than to other team types. The exploratory results provided some suggestion that team type should not be ignored when considering the generalizability of results or when developing models of cognition in teams. Several team theorists have emphasized that variables associated with team type including team tasks, team structures, work cycles, and external relationships will affect team processes (e.g., Sundstrom, 1999).

However, team type may be of less importance when assessing a 'core’ teamwork schema, as we have attempted to do in the present study. We randomly selected eight pairs of teams from each of three team type categories: advice teams, other teams, cross-team type (i.e., one advice team and one other team). We compared the MDS solutions, which represented the structure of the teamwork schema, within each pair by calculating a coefficient $S$ (Lingoes and Schonemann, 1974). The average $S$ values were essentially the same for the three groups (0.69, 0.69, 0.71 for advice teams, other teams, and cross-team type, respectively), indicating that a 'core’ teamwork schema was assessed. If schema content highly relevant to one type of team had been assessed, then a higher degree of agreement would be expected among these teams compared to the degree of agreement occurring among other teams.
According to Mohammed et al. (2000), MDS is a desirable technique for assessing team member schema agreement, because it enables an assessment of cognitive structure. In addition, it was desirable that, in the present study, we elicited schema information directly from a sample of participants from the population under study. However, a limitation is that we were forced to select a set of stimuli from the elicited information. Obviously, the measurement of team cognition is complex and we add our voices to the many others calling for research comparing cognition measurement techniques. Many measurement options exist including congruence scores, concept mapping, and pathfinder.

**Future research on team cognition**

The focus of the present study was on teamwork schemas. However, alternative schema content domains should be examined. Cannon-Bowers et al. (1993) articulated a variety of team-relevant domains for which team members may develop similar cognitions. Recently, researchers have been distinguishing between taskwork and teamwork domains (e.g., Mathieu et al., 2000; Rentsch et al., 1999 – Paper presented to the 14th SIOP Conference, Georgia). The present study’s results revealed significant relationships between teamwork schema and team effectiveness variables. Walsh et al. (1988) found that task strategy schemas predicted team effectiveness. Perhaps in the most effective teams, members develop similar schemas for both teamwork and taskwork, and/or some other variety of team-related domains. This line of thinking also raises questions regarding the processes involved in developing schema agreement in different team-related domains. Perhaps schema agreement for some team-relevant domains should be ‘selected,’ others should be ‘trained,’ and others should be ‘negotiated.’

In the present study, we examined team member schema agreement only. Rentsch and Hall (1994) defined team member schema similarity as consisting of two components, team member schema agreement and team member schema accuracy. The latter component refers to the extent to which team members can report one another’s schemas accurately. This aspect of cognition in teams also deserves research attention.

In conclusion, although we recognize the limitations of our study, we believe that as an initial effort in the study of team cognition antecedents it contributes to the existing research literature. Yet, in the ‘schema of things,’ additional research is required to understand team cognition fully. We urge researchers to develop theories in which they specify the temporal, personal, and interpersonal antecedents of team cognition. We also encourage variation in the design of future studies, including measuring team cognition creatively, using an array of research settings, and using sophisticated multivariate research designs.

**Author biographies**

Richard J. Klimoski is a Professor of Psychology and Director of the Center for Behavioral and Cognitive Studies in the Department of Psychology at George Mason University in Fairfax, Virginia. His teaching and research interests revolve around the areas of organizational control systems in the form of performance appraisal and performance feedback programmes and team dynamics and team performance.

Joan R. Rentsch is currently Associate Professor of Industrial/Organizational Psychology in the Department of Management at the University of Tennessee. Her research interests include cognition in teams and organizations, measurement of cognitions, and absence.
References


