Predicting transactive memory systems in multidisciplinary teams: The interplay between team and professional identities

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In explaining how communication quality predicts TMS in multidisciplinary teams, we drew on the social identity approach to investigate the mediating role of team identification and the moderating role of professional identification. Recognizing that professional identification could trigger intergroup biases among professional subgroups, or alternatively, could bring resources to the team, we explored the potential moderating role of professional identification in the relationship between team identification and TMS. Using data collected from 882 healthcare personnel working in 126 multidisciplinary hospital teams, results supported our hypothesis that perceived communication quality predicted TMS through team identification. Furthermore, findings provided support for a resource view of professional subgroup identities with results indicating that high levels of professional identification compensated for low levels of team identification in predicting TMS.

We provide recommendations on how social identities may be used to promote TMS in multidisciplinary teams.

Keywords: transactive memory system, team identification, professional identification, multidisciplinary teams
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In response to demands for complex work requiring the contribution and integration of a
diverse range of professional knowledge and skill sets, multidisciplinary (or cross-functional) teams
have become common work design features in today’s organizations. Multidisciplinary teams
require inter-professional collaboration and the distribution of workload according to areas of
expertise. In this respect, ensuring a well-developed transactive memory system (TMS) is especially
critical in these teams (Faraj & Yan, 2009; Jarvenpaa & Majchrzak, 2008; Kotlarsky, van den Hooff,
& Houtman, 2012). A TMS is defined as the shared division of cognitive labor for encoding, storing,
and retrieving information based on a collective awareness of where specialized knowledge resides in
the team (Lewis & Herndon, 2012). Whereas the positive effects of TMS have been well-
documented in the literature, such as improved team learning (e.g., Lewis, Lange, & Gillis, 2005;
Rau, 2006) and team performance (e.g., Chiang, Shih, & Hsu, 2014; Zhang, Hempel, Han, &
Tjosvold, 2007), there is notably less research on the antecedents of TMS (see Ren & Argote, 2011).

Ren and Argote’s (2011) empirical review of the literature highlighted that although there is
considerable support for the role of communication in predicting TMS, the processes through which
team members are motivated to build a well-developed TMS are not well understood. They argued
that social identification processes may be one potential factor in motivating TMS building because
members who identify with their team are more likely to rely on each other for expertise
coordination, and share knowledge with each other (see also Haslam, 2001; Liao, Jimmieson,
O’Brien, & Restubog, 2012). In accord with this argument, we draw upon social identity / self-
categorization theories (Tajfel, 1978; Tajfel & Turner, 1979; Turner, Hogg, Oakes, Reicher, &
Wetherell, 1987) to build on prior work showing the predictive role of communication on TMS.¹

Multidisciplinary teams are, by definition, composed of people with distinctive professional
skills, background, knowledge, and expertise who come together to work on collective tasks. Thus,
in such a context, there are two social identities that are salient and important in understanding how
team members can leverage each other’s expertise: a shared (common or superordinate) team identity
and an unshared (distinctive or subgroup) professional identity. Because important aspects of the self are derived from memberships to social groups, the extent to which people identify and internalise group memberships can shape and influence coordinated group efforts (Tajfel & Turner, 1979; Turner, 1985). Team members’ shared identity is important in understanding how team members perceive themselves and others as a team, and consequently, how they work together to achieve shared goals. Unshared professional identities also are critical in defining how individuals perceive their unique contributions, and also of how they respond to other team members’ contributions.

We aim to investigate the interplay between team identification and professional identification in explaining the relationship between communication and TMS in multidisciplinary teams. We argue for the importance of considering both shared (team) and unshared (professional) identities. Existing research typically advocates the benefits of a shared team identity in promoting knowledge sharing (Kane, 2010; Kane, Argote, & Levine, 2005; Sethi, 2000). We propose that team identification is an important mediating mechanism explaining how communication predicts a well-developed TMS. In contrast, a more complex picture has been painted regarding professional identities. On the one hand, some researchers describe professional identification as a trigger for intergroup conflict and segregated silo-work (e.g., Heckman, Bigley, Steensma, & Hereford, 2009; Heckman, Steensma, Bigley, & Hereford, 2009). On the other hand, some researchers argue that subgroup identification can bring along subgroup identity resources into the work environment (e.g., Haslam, Eggins, & Reynolds, 2003; Peters, Haslam, Ryan, & Fonseca, 2012).

In this paper, we first provide a brief summary of TMS research that identifies the role of communication as an antecedent in predicting a well-developed TMS in multidisciplinary teams. Next, we draw attention to the importance of social identities in understanding team processes, and we propose that team identification (a shared common identity) mediates the positive relationship between perceived communication quality and TMS. We also explore how professional identities may interact with team identification to predict levels of TMS in two alternative ways. Professional identities can accentuate the distinctiveness and relational distance between professional groups, and this silo-working effect may act as a barrier to team identification building a TMS. Alternatively,
professional identities can function as *important resources* for TMS because such identities emphasize one’s unique professional knowledge, and also motivate identity-specific contributions to the work of the team. In this paper, we respond to calls (e.g., Haslam, 2001; Liao et al., 2012; Ren & Argote, 2011) to extend TMS research beyond a cognitive-based group information-processing framework (which focuses on the cognitive processes involved in encoding, storing, and retrieving information; Wegner, 1995), and consider the interplay of social identification processes in predicting the level of TMS present in a team.

**The Role of Communication in Predicting TMS**

Communication is an important predictor of TMS (Ren & Argote, 2012). For example, TMS has been shown to be predicted by the number of messages posted on a webpage and the number of emails among team members (Yoo & Kanawattanachai, 2001), the proportion of actual communication compared to the total possible amount of communication (Palazzolo, Serb, She, Su, & Contractor, 2006), and frequent face-to-face communication (Lewis, 2004). Communication has been viewed as the initial building blocks of a TMS structure (Pearsall et al., 2010), and TMS processes also have been argued to occur in the communication and interactions among team members (Hollingshead & Brandon, 2003; Liao et al., 2012).

In multidisciplinary teams, the quality of communication experienced by team members is especially important for overcoming the challenges associated with cutting across professional knowledge boundaries. Multidisciplinary teams face challenges associated with disciplinary differences in syntactic (language) knowledge and pragmatic (procedural) knowledge, which Kotlarsky et al. (2012) showed negatively predicted TMS. However, they found that interactions aimed at reducing differences in practice-based knowledge dissemination promoted knowledge coordination in multidisciplinary healthcare research teams. Multidisciplinary teams also encounter potential discrepancies among team member goals, expectations, as well as tacit assumptions about each other’s knowledge. Hence, communication that can clarify these discrepancies by establishing rules of conversation is critical to knowledge collaboration efforts among different professionals (Jarvenpaa & Majchrzak, 2008). At the same time, communication practices that are collaborative in
nature and aimed at building a bridge between professional disciplines can reduce the need for lengthy conversations about knowledge differences (Majchrzak, More, & Faraj, 2012). In this way, high quality communication within teams (indicated by perceptions that communication involves meaningful and informative information-exchange, and positive relation-building experiences) should assist in forming a well-developed TMS. In the next sections, we examine the roles of team identification and professional identification in explaining how communication quality predicts TMS.

**The Role of Social Identities in Predicting TMS**

According to the social identity approach, social identities are definitions of the self based on group memberships that are cued by contextual factors (Tajfel & Turner, 1979; Turner, 1985). Social identities promote a sense of “one-ness” with the group because it is an extension of one’s individual self to incorporate the social collective (Ashforth & Mael, 1989). Self-categorization theory (Turner, 1985; Turner et al., 1987) further asserts that depending on the salience of social identities, categorization of the self with a group influences how people define themselves, as well as determine the perception and behaviour with those identified as belonging to the same group (in-group members) and those who do not (out-group members). When people identify strongly with a group, they internalize the group’s goals as their own, and are motivated to behave in a way that is aligned with being a prototypical group member (Hogg & Hains, 1996). Richter, West, van Dick, and Dawson (2006) showed that social identities in the workplace can simultaneously occur to influence intergroup conflict and intergroup productivity. Our paper investigates the contributions of a shared and an unshared social identity in predicting a well-developed TMS in multidisciplinary teams.

A substantial body of research demonstrates the benefits of a shared identity for a group’s performance and cohesiveness. For example, shared identities have been positively linked to meeting planned performance objectives (Sethi, 2000) and accepting and implementing knowledge (Kane, 2010; Kane, Argote, & Levine, 2005). In a sample of multidisciplinary software developing teams, Faraj and Yan (2009) showed that the team’s effort to create awareness of the boundaries among members to build a distinctive team identity (boundary reinforcement) predicted both psychological safety and team performance, especially when resources were scarce. Holding a shared team identity
results in perceiving other team members as in-group members, as well as internalizing the team’s goals as one’s own personal goals. Consequently, team identification can motivate team members to engage in coordinated group efforts and actions (Ellemers, de Gilder, & Haslam, 2004). In a meta-analysis, Riketta and van Dick (2005) showed that workgroup identification predicted workgroup extra-role behavior, workgroup climate, and workgroup satisfaction.

**Mediating role of team identification.** Social identification mechanisms have been implicated in research investigating the sharing of knowledge resources in teams (e.g., Gao & Riley, 2010; Van der Vegt & Bunderson, 2005). Prior TMS research examining the role of team identity in TMS did so in the context of ruling out alternative explanations for the positive impact of TMS group training on team performance (e.g., Liang, Moreland, & Argote, 1995; Moreland, Argote, & Krishnan, 1996; Myakovsky Moreland & Myakovsky, 2000). In these studies, training as a group predicted better team performance as compared to individual TMS training and team cohesion factors (brought about by team building exercises). However, such findings do not rule out a potential role for social identities in TMS building (see Haslam, 2001; Liao et al., 2012). Engaging in high quality communication with each other can create a collective sense of team identification that subsequently encourages team members to engage in collective goals of building a TMS. We argue that the process of identifying with a shared common group (i.e., team identification) mediates the positive relationship between perceived communication quality and TMS in multidisciplinary teams.

When team members engage in positive and high quality communications while working on collective team tasks, a sense of identification with the team is fostered (Ashforth & Mael, 1989; Haslam, 2001; Morton, Wright, Peters, Reynolds, & Haslam, 2012). For example, Millward, Haslam, and Postmes (2007) found that stronger team identification was developed among employees assigned to specific desks as compared to “hot-desks”, and that this effect was mediated through perceptions that communication between team members was valuable. Team identification also can promote better knowledge-sharing practices within teams because other team members are perceived as important constituents of a person’s social group (Haslam, 2001; Morton et al., 2012; Turner et al., 1987). Shared identities have been shown to lead to the retention of more detailed information
provided by members who belong to the same group than by those who do not share the same identity (Park & Rothbart, 1982), as well as the acceptance and consideration of other team members’ work perspectives and approaches (Sethi, 2000). In a study on the transfer of knowledge among team members, Kane (2010) demonstrated that the salience of a superordinate (shared) team identity between established team members and a newcomer promoted the consideration and transference of newcomers’ knowledge onto the task at hand, especially when the new team member possessed superior knowledge. We examine the mediating role of team identification in multidisciplinary team environments where team identity is the shared identity.

Hypothesis 1: Team identification mediates the positive relationship between perceived communication quality and the level of TMS in multidisciplinary teams.

Moderating Role of Professional Identification

As noted earlier, a social identity approach to understanding TMS in multidisciplinary teams also brings to the foreground the role of professional identities. Professional identification is the extent to which a person defines himself or herself in terms of the work and the prototypical characteristics associated with being a member of their professional occupational group (Mael & Ashforth, 1992). Professional identities are salient in multidisciplinary teams as team members come from a variety of professional backgrounds, occupy roles in the team based on their unique professional expertise, and are expected to contribute to the team tasks in these professional roles (Pratt, Rockman, & Kaufmann, 2006). Recognizing that employees can hold multiple social identities in the workplace and that these identities influence intergroup as well as intragroup behavior and goals (Richter et al., 2006), we review the literature on multiple identities within the workplace and consider the interplay between identities that are shared and unshared. First, we review literature examining the extent to which unshared identities (such as one’s professional identification) can accentuate the relational distance between members of different professional groups (i.e., “us versus them”). From this line of argument, professional identification can produce silo-working effects that weaken the effects of team identification on TMS. Alternatively, we examine studies that argue that professional identities can be important resources that motivate team
members to contribute to the work of the team with their professional knowledge, and that also protect the positive distinctiveness of subgroup identities.

**Silo-working effects.** Early intergroup research often focused on understanding inter-group competition, ingroup biases, and conflict elicited from unshared subgroup identities (e.g., Hogg, 1996; Tajfel & Turner, 1979). In these intergroup studies (where subgroup categorization creates an intergroup context), out-group members can be viewed as unsupportive of the in-group’s interests (Brewer, 1979). Subgroup categorization can evoke cognitions of relational distance (because there is a perception of “us versus them”) and engender intergroup biases, such that members from different professional backgrounds are perceived as out-group members belonging to different groups with different goals. Perceptual and cognitive biases that favour one’s in-group (as compared to out-groups) are also exaggerated in order to preserve the positive distinctiveness of the in-group. For example, out-group members are evaluated as less positive and more dissimilar to in-group members, especially when important social identities are under threat (Jetten, Spears, & Manstead, 1996).

In multidisciplinary work, professional identities have the potential to create subdivisions and trigger intergroup biases, and thus may act as barriers to organizational effectiveness. Lingard, Reznick, DeVito, and Espin’s (2002) interviews with healthcare personnel from inter-professional surgical teams (using ethnographic communication scenarios) revealed misinterpretation and oversimplification of other professional members’ roles and motives, especially during tense communication situations. In such contexts, they argued, the construction of other professional members as ‘outsiders’ leads to role simplification and distortion of other professionals’ motives.

In a study with healthcare professionals (primary care practitioners) working in a healthcare organization, Heckman, Steensma, Bigley et al. (2009) investigated the extent to which the professionals adopted new work behaviour introduced by the organisation’s administrators (in which they shared an organisational identity with, but did not share a professional identity). Perceptions of administrators’ social influence and monitoring of policy uptake negatively influenced the adoption of new work behavior by those healthcare professionals with low organizational and high professional identification. In contrast, the relationship between perceived administrator influence
and policy uptake was positive for those professionals with high organizational and low professional identification (see also Heckman, Bigley, Steensma et al., 2009, for a similar pattern of findings). Both studies suggest that professional identification (an unshared identity) heightened the perceived relational distance between physicians and administrators, whereas organizational identification (a shared identity) reduced intergroup differences. The potential for professional identification to exacerbate the relational distance among team members and trigger out-group member biases has implications for predicting TMS. Specifically, professional identification may create segregated silo-work among professional groups and weaken the positive effects of team identification on TMS.

**Subgroup identification resources.** In contrast to the silo-working perspective of professional identification in multidisciplinary teams, Haslam and colleagues (Egginns, Reynolds, & Haslam, 2002; Haslam et al., 2003; Peters et al., 2012) argue that subgroup identification (such as identification with one’s professional group in an organizational context) provides valuable subgroup identity-related resources for the achievement of organizational (shared) goals. For example, Peters et al. (2012) found subgroup identification positively predicted shared group outcomes, such as organizational strategy clarity. This resource view of subgroup identities recognizes that subgroup categorizations do not inevitably lead to intergroup competition and biases, but also can promote intergroup cooperative efforts. McGarty (2001) emphasizes the importance of considering the content (e.g., prototypical characteristics) of a specific social identity when determining how social identification mechanisms shape intergroup behaviors. In the case of professional identification, professional knowledge is a salient and valued attribute of that identity, and as such, a person holding strong identification to their profession may be particularly motivated to uniquely contribute to the task at hand with their professional knowledge (Gao & Riley, 2010).

To illustrate, let us consider the example of a nurse working in a multidisciplinary healthcare team. The content (and subsequent goals) of a nurse who identifies highly with the nursing profession is to provide quality patient care in his (or her) prescribed role as a nurse. In this scenario, nursing knowledge and skills is a shared core and defining characteristic of membership in the nursing profession. Thus, professional identification reinforces the nurse to speak and act as a
representative of his (or her) own professional group, and motivates contributions of nursing expertise to the team’s knowledge base. Similarly, the distinctive professional knowledge of other team members is likely to be viewed as positive and valuable because the content and goals of others’ professional identities are aligned with that of nurses (i.e., to provide quality patient care in accord with professional expertise). Research shows that valuing information diversity mitigates negative consequences of professional faultlines on team performance because people attend to and elaborate on each other’s information (Homan, van Knippenberg, Van Kleef, & De Dreu, 2007).

Because professional subgroup identities are important constituents of the self, the resources held within professional identification also may extend to protecting the positive distinctiveness of subgroup identities. Optimal distinctiveness theory (Brewer, 1991) suggests that individuals seek to balance the need for inclusiveness with distinctiveness and, thus, subgroup identities allow employees to fulfill both these desires. Threats to the positive distinctiveness or uniqueness of subgroup identities can instigate countervailing outcomes for intergroup relations (Huo, Smith, Tyler, & Lind, 1996). For example, expertise diversity relates negatively to team effectiveness under high levels of threats to professional identities, although is positively associated under low levels of threat (Mitchell, Parker, & Giles, 2011). Research on dual identity expressions also echoes the importance of preserving the uniqueness and positive distinctiveness of subgroup identities, especially for achieving effective intergroup outcomes (Gaertner & Dovidio, 2000; Stone & Crisp, 2007). In a qualitative study on professional boundaries in multidisciplinary mental health community teams, Brown, Crawford, and Darongkamas (2000) suggested that although shared responsibilities can reinforce teamwork, the blurring of professional roles also can threaten the distinctiveness of professional identities, and have a backlash effect of role confusion or overlap.

Overall, we predict that team identification and professional identification jointly influence TMS, and explore the nature of this interaction from both the silo-working and resource perspectives. On the one hand, professional identification may produce inter-group biases and silo-working effects. Alternatively, professional identification may provide resources that highlight the value of one’s own (and others’) professional knowledge, and protect the positive distinctiveness of subgroup identities.
Hypothesis 2: Professional identification moderates the positive relationship between team identification and the level of TMS. If professional identification produces silo-working effects, it will weaken the positive effect of team identification on TMS. If professional identification provides subgroup identification resources, it will strengthen the positive effect of team identification on TMS.

The purpose of the current study is to test the hypotheses using field data collected from hospital ward-based multidisciplinary teams. Healthcare teams typify the key characteristics of multidisciplinary teams, and TMS is likely to develop in these teams as there is a need to draw on a range of specializations when caring for patients.

Method

Participants

In this study, 126 multidisciplinary healthcare teams from 11 South-East Queensland hospitals in Australia were recruited. Teams were only recruited if they were multidisciplinary and ward-based teams. Teams were considered ward-based if they provided care for patients admitted into a hospital ward, rather than those teams caring for patients in emergency rooms or intensive care units, and outpatient services (Sutton, 2009). Teams were considered multidisciplinary if there was at least one representative from each of the following professional backgrounds or disciplines: medical (e.g., consulting doctors, registra, and residents), nursing (e.g., nurse unit managers and registered nurses), and allied health (e.g., physiotherapists, psychologists, social workers, occupational therapists, and speech pathologists).

Patient care delivery involves admitting patients, diagnosing current symptoms, planning and delivering medical treatment, monitoring recovery and potential complications, and developing discharge plans. Although team members typically interacted with the patient on an individual basis, the team also would regularly come together during ward-based meetings to make decisions about patient care, so that while each team member would provide a specialized area of patient care, knowledge coordination and collaboration would take the form of drawing on each other’s knowledge to make collective decisions about patient treatment. For example, a surgical team may
be treating a patient who had a shoulder operation. After surgery, the team would form a discharge plan, and this typically was based on information around medical complications (an assessment that the physician would make), post-surgery recovery (information that nurses would know from monitoring and taking care of the patient), expected shoulder recovery process (the physiotherapist may have insight into this based on their sessions with the patient), and conditions surrounding their home and carer environment (information that a social worker or psychologist would know from their patient visits). Thus, the multidisciplinary nature of the team arose from working with other healthcare personnel to collectively deliver patient care, including reaching decisions about patient treatment plan.

At the individual-level, 882 participants participated in this study, consisting of 76% female and 23% male participants (1% did not provide gender information). The average age of participants was 37.57 years (SD = 11.55), ranging from 20 to 76 years. The average number of employees who responded per team was 7.00 (SD = 3.72), and ranged from 3 to 21 respondents. Across the 126 teams, there was a mean response rate of 59%, ranging from 13% to 100%. A wide range of multidisciplinary ward-based healthcare teams were represented in the sample, including medical teams (n = 46; 37%), mental health teams (n = 39; 31%), and surgical teams (n = 21; 17%). There also were representations from specialty teams, including oncology and tumor teams (n = 10; 8%), geriatric teams (n = 6; 5%), paediatric teams (n = 2; 1%), and orthopaedic teams (n = 2; 1%).

**Data Collection Procedure**

Ethical clearance was first obtained from the director for each hospital, medical division leaders, and also team leaders (i.e., the consultant doctors). We sought permission to distribute the questionnaire during the weekly clinical team meetings at which, typically, the entire team would be present to discuss patient cases. Nurse unit managers (NUMs) were contacted three to four weeks prior to the research team’s visit to schedule data collection and also to brief the NUMs on the background for the research. Signed ethical consent forms from employees were either collected by NUMs during the time period leading up to the day of data collection, or returned on the day of data collection. The research team was allocated 15 minutes for data collection at the end of the team
meeting. Employees were provided with information on the research, and asked to complete and return the questionnaire prior to leaving the meeting, although they also were given the option of completing the questionnaire outside of the team meeting within a 24-hour period using a reply-paid envelope. Individual-level data was matched to the team using an anonymous team coding system.

We were unable to collect data for the predictor and criterion variables from different sources (e.g., supervisors), or to separate measurements of constructs over different time points due to the constraints imposed by the hospitals. Instead, common method biases were primarily addressed using procedural remedies (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). For example, we guaranteed response anonymity in data collection, psychologically separated the predictor and criterion variables by not uncovering the research question, mixed the order of focal scales in the questionnaire, and embedded the focal items with other unrelated scales in the questionnaire. Statistical analyses assessing common method variance (CMV) are presented in the results section.

**Measures**

All items were drawn from published scales. The appropriateness of items for the multidisciplinary healthcare team context was discussed with subject matter experts in the hospitals prior to the questionnaires being distributed. This process resulted in either minor changes in item wording, or a reduced pool of items.

**Perceived communication quality.** We operationalized the perceived quality of communication in the team as informative and meaningful in the information exchange, as well as the positive experience of the interpersonal interactions (Morton et al., 2012). Lewis and Herndon (2012) highlighted that communication focused around the work is the most critical to TMS, and thus, the quality of communication quality was asked within the context of work-related contact. Informed by Islam and Hewstone’s (1993) contact scale, participants assessed four items asking extent to which the teams’ work-related communication was: 1) useless—useful, 2) superficial—meaningful (for quality pertaining to the information exchanged), 3) negative—positive, and 4) unpleasant—pleasant (for quality pertaining to affective experience of interactions). These semantic differential items were rated on a 7-point scale. Cronbach’s $\alpha$ was .89 for the aggregated team data.
**Team identification.** Three items from Cameron’s (2004) social identification measure was used to assess team identification. Employees rated the extent to which they agreed with the following three items: (1) “I have strong ties to other team members”, (2) “I really ‘fit in’ with other team members”, and (3) “I really feel that I belong to my team”. Items were rated on a 7-point likert scale, ranging from 1, “strongly disagree” to 7, “strongly agree”. Cronbach’s $\alpha$ was .92 for the aggregated team sample.

**Professional identification.** In light of previous research, we used Blau’s (2003) occupational commitment scale to assess participants’ level of identification with their professional group (for a similar approach and rationale of using affective commitment to capture the emotional component of social identification, see Bergami & Bagozzi, 2000; Van der Vegt & Bunderson, 2005). We adapted the items so that the referent was the profession and three items were utilized: (1) My profession is important to my self-image, (2) I am proud to be in my profession, and (3) I strongly identify with my profession. Employees were asked to identify the extent to which they agreed with the items on a 7-point likert scale, ranging from 1, “strongly disagree” to 7, “strongly agree”. Cronbach’s $\alpha$ was .77 for the unaggregated individual data.

**Transactive memory system.** The extent to which a TMS exists in teams can be measured by three emergent cognitive states: coordinating the diversity of expertise (coordination), relying on each other for credible knowledge resource processing (credibility), and the specialization of knowledge that is domain-specific (specialization) (see Lewis & Herndon, 2012). Items from Lewis’ (2003) TMS scale were adapted to be meaningful for multidisciplinary healthcare teams, and because construct validation showed that reversed-scored items had correlated residuals, we adapted items so that there were no reversed-scoring of items. The three emergent manifest dimensions of TMS (i.e., specialization, coordination, and credibility) were assessed with five items for coordination (e.g., “My team rarely wastes time performing unnecessary tasks”), three items for specialization (e.g., “Each team member has specialized knowledge of some aspect in the delivery of patient care”), and five items for credibility (e.g., “I am confident relying on the information that other team members bring to the discussion”). All items were assessed using a 7-point likert scale, ranging from 1,
“strongly disagree” to 7, “strongly agree”. Cronbach’s α was .83 for specialization; .93 for coordination; .91 for credibility for the aggregated team sample.

**Data aggregation.** We measured group-level constructs of perceived communication quality, team identification, and TMS by sampling responses from individuals in teams on the basis that each person in a team should rate similarly to another person in the same team, and team members’ responses should be more similar to one another than to members in other teams (see Bliese, 2000; Chen, Mathieu, & Bliese, 2004). For example, Lewis (2003) argued that while TMS manifests as a collective cognition, it also exists in the mind of individuals and, thus, the TMS scale for field research is measured at the individual-level before being aggregated into a meaningful team-level construct. Consistent with LeBreton and Senter’s (2008) recommendations for creating group-level constructs measured at the individual-level, we first justified data aggregation for communication quality, team identification, and TMS by examining the within-group agreement using the $r_{wg}^*$ statistic for multiple-item scales. Next, we examined the variance attributable to the group-level using ICC (1), and the reliability of team member responses using ICC (2). As shown in Table 1, there was support for the aggregation of individuals’ responses to the team-level.

In contrast, it was expected that professional identification would not conceptually manifest as a group-level construct and, thus, data were not aggregated to the group-level to reflect the variation in employees’ identification with professional subgroups. However, there is some variance attributable to the group due to the nesting of the data (i.e., some of the variance in professional identification may be attributable to the clustering of teams). When modeled at the between-group level, professional identification reflects the collective resource of professional identification in the team, or a team’s stance on identification with professional subgroups. To ensure that there is sufficient between-cluster variability for modeling professional identification at the between-group effect level, we tested a baseline model with teams as the group nesting unit to obtain the unconditional intraclass-correlation (ICC), which determines the proportion of total score variability attributable to cluster variation (Muthén, 1994). A general rule of ICC > .05 indicates that variance due to group membership should not be ignored, providing support for multi-level analyses.
Professional identification obtained ICC (1) of .03 and ICC (2) of .19. Although these values suggest that professional identification is primarily reflected as an individual-level construct (most of the variance is accounted for at the within-groups level), some of the variance is attributable to the between-groups level (Cohen, Cohen, West, & Aiken, 2003).

**Results**

**Overview of Analyses**

Given that our model involves group-level variables and also an individual-level variable, analyses were conducted using multilevel structural equation modeling (ML-SEM) in Mplus 6.0 (Muthén & Muthén, 2007). The technique of ML-SEM simultaneously partitions out variance of the observed scores at the individual-level and decomposes into within-group effects (individual-level), and orthogonally separates it from variance attributable to between-group effects (group-level) to form separate variance-covariance matrices for each level of analysis. ML-SEM yields more reliable parameter estimates of the group-level effects because the group mean is modeled as a latent variable informed by individual responses, which appropriately accounts for uncertainty in the group mean (i.e., individuals in each group become reflective indicators for the group-level variables; see Ludtke, Marsh, Robitzsch, Trautwein, Asparouhov, & Muthén, 2008). We used ML-SEM over other multilevel modeling techniques (e.g., random coefficient modeling in HLM) to obtain unbiased estimates of standard errors for the estimated model parameters in a multi-level mediation SEM framework (see Preacher et al., 2010). Following Preacher et al.’s (2010) recommended steps for conducting mediation analyses in a ML-SEM framework, we first specified that perceived communication quality, team identification, and TMS are conceptually group-level constructs capturing shared aspects about the team. As such, we aggregated these group-level variables to run a 2-2-2 mediation, and estimated professional identification at both within- and between-group levels. As shown in Figures 1 and 2, the indicators of professional identification are depicted as latent variables at the between-level to denote that the intercepts of measured indicators were randomly varied at the between-level (see Preacher et al., 2010 for further discussion).

**Descriptive Statistics**
Table 2 presents the means, standard deviations, and bivariate correlations of variables for individual-level and group-level data. All variables were positively correlated, with the exception that team identification and professional identification were not correlated at the group-level.

Confirmatory Factor Analyses

We assessed the measurement model of all variables used in subsequent structural models. We used the parceling technique to reduce the number of dimensions required for LMS model computations in Mplus, and to improve the ratio between the sample size and the number of parameters to be modelled (Little, Cunningham, Shar, & Widaman, 2002). For TMS, three construct-based parcels were created to form three indicators of specialization, coordination, and credibility because parceling items that are conceptually similar enhances the accuracy of parameter estimates for multidimensional constructs (Hall, Snell, & Foust, 1999). Items were used as the manifest indicators for perceived communication quality, team identification, and professional identification, with the exception that one indicator in communication was parceled from two items. The fit of the model was acceptable, $\chi^2 (47) = 114.89, p < .001$, CFI = .96, RMSEA = .04, SRMR$_{\text{within}}$ = .01, SRMR$_{\text{between}}$ = .15. All items loaded significantly onto their respective factors (see Figure 1).

Common method variance. To statistically detect whether CMV posed a problem to the interpretation of results, we used the single common method factor approach, we compared the CFA with a model that constrained estimation of all indicators onto a single latent common method variance factor (CMVF) to be equal at the between-group level, and specified all latent variables to be uncorrelated with the CMVF (Podsakoff et al., 2003). The overall fit of the model was acceptable, $\chi^2 (48) = 86.03, p = 0.001$, CFI = .98, RMSEA = .03, SRMR$_{\text{within}}$ = .00, SRMR$_{\text{between}}$ = .10 and, although comparison tests revealed that the latter CFA improved model fit, $\Delta \chi^2 (1) = 28.86, p < .001$, the CMV factor explained only 9% of variance for indicators, which is well below the recommended cut-off value of 25% for self-reported data (Williams, Cote, & Buckley, 1989). Therefore, CMV does not pose as a strong threat to interpretation of our analyses.
Structural Model Testing

Based on results of the CFA, we tested a series of structural models using full-information maximum likelihood robust (MLR) estimation to correct for non-normality violations. In addition to using -2 times the loglikelihood (-2LL) and adjusting for scaling correction factor differences to assess the distributed chi-square difference for conducting model comparisons, we also examined the information criteria of AIC and sample-size adjusted BIC, with lower indices of AIC and BIC indicating better fit. Table 3 presents results from each model.

**Testing for main effects.** As shown in Table 3, we first tested the total effect of perceived communication quality on TMS, and results showed that there was good model fit, $\chi^2 (8) = 20.54, p = .009$, CFI = .95, RMSEA = .05, SRMR = .05. The effect of perceived communication quality on TMS was significantly positive ($b = .65, p < .001, 95\% CI = .341 - .963$).

**Testing for full versus partial mediation.** In order to test the mediating role of team identification in the relationship between perceived communication quality and TMS (H1), we first assessed whether there was full or partial mediation. For the hypothesized full mediation (Model A), we freely estimated structural paths from perceived communication quality (X) to team identification (M), and from team identification to TMS (Y). We constrained the direct path from perceived communication quality to TMS to zero. Paths from the moderating variable of professional identification (Z) to team identification and TMS also were freely estimated, and exogenous variables were covaried. All moderating effects of professional identification were constrained to zero, including paths from the interaction between perceived communication quality and professional identification (Int. XZ) to team identification and to TMS, and from the interaction between team identification and professional identification (Int. MZ) to TMS.

We compared Model A against an alternative partial mediation model (Model B), where the direct path from perceived communication quality to TMS was freely estimated. Comparison statistics of model fit demonstrated that there was no significant difference between the fit of Model A and Model B, $\Delta\chi^2$ (1 degrees of freedom difference; 0.62 test scaling correction difference) = -.011, ns. Inspection of the direct structural path from communication quality to TMS in Model B
showed a non-significant direct effect ($b = .06, SE = .29, p = .829, 95\% CI = -0.509 \text{ to } 0.635$). Thus, we accepted Model A because there was no significant differences between the two models’ fit (with Model A being more parsimonious), and the direct path in Model B also was non-significant. Taken together, there is support for H1 on the mediating role of team identification.

**Testing for an alternative mediation model.** Because our data were cross-sectional, we also tested for the possibility of an alternative mediation pathway, whereby team identification predicted TMS through perceived communication quality. A collective sense of team identification might produce better quality communication patterns because other team members are perceived as in-group members (see Morton et al., 2012; Oakes et al., 1994), and TMS may, in turn, develop from high quality communication (Hollingshead, 1998). We compared Model A to an alternative ‘causal-direction’ mediation model that specified structural paths from team identification to perceived communication quality and to TMS, and from perceived communication quality to TMS, while constraining to zero all interaction effects (Model C). A comparison of Model A and Model C demonstrated that Model A was a statistically better fitting model, $\Delta \chi^2$ (1 degrees of freedom difference; 0.93 test scaling correction difference) = -11.87, $p < .001$. Thus, we did not find support for the alternative mediation model.

**Testing for the hypothesized moderated-mediation model.** Next, we used Klein and Moosbrugger’s (2000) latent moderated structural (LMS) equations approach to fully test the moderation hypothesis (H2) and also the subsequent moderated-mediation that is inherent in the overall theoretical model. The LMS approach for assessing exogenous and continuous latent variable interactions yields unbiased and accurate estimates, and also conserves degrees of freedom because it uses all the available information without creating a new latent variable (Little, Bovaird, & Widaman, 2006). LMS uses MLR estimator for its numerical integration algorithm calculations to correct for non-normality. Because traditional fit statistics are not provided for with these analyses, we conducted nested model comparison testing using -2LL (see Table 3).
Because SEM allows for the simultaneous testing of both moderation and mediation, we integrated the mediation hypothesis (H1) and the 2-way interaction hypothesis (H2) together in our hypothesized model (Model D). We tested a model where the indirect effect was moderated by professional identification at the link between team identification (M) and TMS (Y); This model is referred to as “Model 3” by Preacher, Rucker, and Hayes (2007) and “Stage 2 moderation” by Edwards and Lambert (2007). To do this, we regressed TMS onto the latent variable interaction between team identification and professional identification (Int. MZ). Results showed that Model D (a full mediation with an interaction between team identification and professional identification on TMS) was a statistically better fitting model than Model A (a full mediation model with no interactions), $\Delta \chi^2$ (2 degrees of freedom difference; -0.30 test scaling correction difference) = -135.95, $p < .001$, providing initial support for the moderating role of professional identification at the link between team identification and TMS.

Testing for alternative moderated-mediation models. We adhered to Edwards and Lamberts’ (2007) recommendation to further test our hypothesized model with alternative moderation possibilities. We tested a model where professional identification moderated (1) the indirect effect at the link between communication quality and team identification (referred to as “Stage 1 moderation”), and (2) the direct effect at the link between communication quality and TMS (Model E). Results showed that there was no significant difference between the hypothesized Model D and the alternative Model E, $\Delta \chi^2$ (3 degrees of freedom difference; 1.55 test scaling correction difference) = 3.77, ns. Importantly, we inspected the parameters of Model E, and found that the alternative effects of professional identification moderating the Stage 1 link was non-significant ($b = .07, SE = 0.05, p = .187, 95\% CI = -0.032$ to 0.163), as was professional identification moderating the direct effect link ($b = .08, SE = .04, p = .074, 95\% CI = -.007$ to .161). Given that there were no differences between Model D and Model E (with the hypothesized Model D being more parsimonious), and the non-significant alternative Stage 1 and direct effect moderations, we accepted the hypothesized Model D over the alternative Model E. All subsequent hypotheses testing are based on the final accepted Model D.
Hypotheses Testing

Figure 2 presents the unstandardized estimates of the relationships depicted in Model D. Perceived communication quality was a significant positive predictor of team identification ($b = .31, SE = .05, p < .001, 95\% CI = .206 to .409$) and team identification was a significant positive predictor of TMS ($b = .27, SE = .07, p < .001, 95\% CI = .123 to .409$). In addition, professional identification positively predicted TMS ($b = .27, SE = .06, p < .001, 95\% CI = .142 to .391$).

**Indirect effects testing.** In order to examine the indirect effects of H1, we calculated the cross-product between the two structural paths of perceived communication quality $\rightarrow$ team identification, and of team identification $\rightarrow$ TMS, as well as the associated 95\% confidence intervals (Preacher et al., 2010). Results showed that the indirect effect of perceived communication quality on TMS through team identification was statistically different from zero at a confidence interval of 95\%, unstandardized indirect effect $= .08, SE = .03, p = .001, 95\% CI = .033 to .130$. Confirming H1, communication quality was indirectly related to TMS through team identification.

**Moderation testing.** To assess the direction and nature of the interaction for H2, we conducted simple slopes testing of the significant 2-way interaction using procedures outlined by Aiken and West (1996). One standard deviation above and below the mean (the mean of all latent variables is zero) were used as high and low scores for professional identification, respectively. In support of H2, we found a significant two-way interaction between team identification and professional identification on TMS ($b = -.23, SE = .06, p < .001, 95\% CI = -.342 to -.110$). Figure 3 depicts the relationship between team identification and TMS for high and low levels of professional identification. Simple slopes analyses revealed that there was a significant positive simple slope of team identification on TMS for low levels of professional identification ($b = .49, SE = .12, p < .001, 95\% CI = .257 to .726$). At high levels of professional identification, there was no relationship between team identification and TMS ($b = .04, SE = .06, p = .484, 95\% CI = -.073 to .154$).

**Discussion**
Summary of Findings

In response to calls to understand the social identification mechanisms involved in TMS building (e.g., Haslam, 2001; Liao, Jimmieson, O’Brien et al., 2012; Ren & Argote, 2011), we investigated the mediating role of team identification and the moderating role of professional identification in understanding how communication quality predicts TMS in multidisciplinary healthcare teams. Supporting H1, we found that perceived communication quality was positively associated with TMS through a collective sense of team identification. Consistent with research showing the importance of shared common identification in knowledge integration and transfer (Kane, 2010), this finding suggests that engaging in high quality communication leads to a well-developed TMS because team members identify with the team, share common goals with each other, and work in a manner that strives to achieve these common team goals (Hogg & Hains, 1996; Riketta & van Dick, 2005).

H2 considered the nature of the potential interactive relationship between team (a shared common identity) and professional (a subgroup identity) identities. We found that TMS was predicted by the combined effect of team identification and professional identification. In unpacking the nature of this interaction, we found that the positive effect of team identification on TMS was more marked for those with low professional identification. In contrast, teams characterized by team members with high professional identification reported well-developed TMSs at both low and high team identification, suggesting that professional identification has a “compensatory effect” when team identification is low. While professional identification did not strengthen the positive effects of team identification on TMS (as was predicted by the resource view), it did, however, compensate for the absence of team identification in TMS building. The direction of these results counters the silo-working effect view as professional identification did not weaken or disrupt team identification leading to better TMS. Thus, there is some evidence to support the view that professional identification can bring along potential resources to knowledge integration efforts in multidisciplinary teams.
First, team members can draw on, and harness, the specialized knowledge domains located in professional subgroups. Because professional identification draws attention to the distinctiveness of one’s own professional expertise (Gao & Riley, 2010), it can highlight the importance of contributing to the team with one’s own unique professional knowledge, and equally, it can promote valuing other’s specialized knowledge—both of which are required for accessing and integrating the multiple professional knowledge sets in the team. Second, the distinctive resources held within each professional category also can help define the boundaries between subgroups for achieving optimal distinctiveness of identities, and negate potential negative consequences of blurring professional identities (Brown et al., 2000). Thus, professional identification may bring along resources that strengthen the effects of team identification on TMS. Future researchers could directly measure the extent to which specific professional identification resources (i.e., valuing professional knowledge and identity distinctiveness) facilitate TMS in the absence of team identification.

**Theoretical Implications**

These findings contribute to the TMS literature by demonstrating the combined interactive roles of two social identities in predicting TMS (Liao et al., 2012). Importantly, our findings are in contrast to research suggesting that professional identification creates relational divisions among group categories and trigger intergroup biases (Heckman, Bigley, Steensma et al., 2009; Heckman, Steensma, Bigley et al., 2009). One possible reason for the discrepancy in our findings and in Heckman and colleagues’ studies, is that in their studies, the goals relating to administrators were primarily concerned with efficiency and profitability, which were in conflict with physicians’ goals of delivering quality service in patient care. However, within the context of developing TMSs in multidisciplinary healthcare teams, the goals prioritized by professional subgroup identification complement the goals stemming from team identification. Specifically, both identification processes place emphasis on capturing the diversity of professional expertise in the team in the delivery of patient care, and moreover, in building a TMS infrastructure (of where specialized knowledge is to be assigned, processed, and retrieved from), the focus also is on identifying the professional roles occupied in the team (Pearsall et al., 2010). Furthermore, Heckman and colleague examined
organisational identification and professional identification on organisational effectiveness outcomes. Although organisational identification is comparable to team identification in the sense that both are broader encompassing identities *shared* among employees, organizational identification is a more distal identity than team identities with more abstract shared goals (Ashforth & Mael, 1989).

Thus, in our consideration of professional identities as a form of team resource for building TMS, we note that there is an alignment of professional subgroup goals and the shared goals of the team—providing high quality professional service is *aligned* with bringing together a range of diverse professional skills and information, and making decisions based on the unique contribution of individual members’ professional expertise. Alignment of goals is an important consideration as competing goals are not conducive to the sharing and usage of specialized knowledge (Jarvenpaa & Majchrzak, 2008). In a scenario where group goals are not in competition with each other, professional identification builds a TMS because it draws attention to the professional roles and specialized knowledge residing in the team. In a further extension of McGarty’s (2001) observation that the content of social identities is important in conditioning intergroup relations, future research could extend our investigation of the interplay of social identities in TMS building by considering the contribution of perceived goal alignment (versus misalignment) between the subgroup identity and the shared group identity.

One of the core characteristics of TMS is the tension between the specialization of experience and knowledge, and the integration and coordination of knowledge, which is based on a shared awareness of each other’s expertise (Lewis & Herndon, 2012). Our findings speak to this tension because the content of team identification and professional identification also mirrors this tension. Specifically, whereas team identification provides resources of a shared group identity and shared group goals to reinforce collective behaviours that advance shared group interests, professional identification provides resources of identity distinctiveness and knowledge distinctiveness, which reinforces behaviours that reflect unique professional contributions, and the value of distinct professional specialization. These findings suggest that knowledge coordination in multidisciplinary teams is not simply about developing a shared sense of “we-ness” to mitigate intergroup bias
concerns of “us versus them”. Instead, it also is about identifying the resources located in professional groups, and valuing the professional knowledge resources embedded within these groups so that these diverse expertise are integrated and brought to bear onto the task at hand.

**Practical Implications**

Despite potential benefits from the cross-fertilization of ideas, a key challenge for multidisciplinary teams is that members come from different professional backgrounds and are required to cut across and transcend professional group boundaries to exchange knowledge bases and expertise (Bunderson & Sutcliffe, 2002; Majchrzak et al., 2012). Our findings have implications for multidisciplinary healthcare teams, which rely heavily on effective knowledge sharing and coordination to ensure quality patient care and patient safety (Sutton, 2009). Non-technical team-based skills (such as effective team communication skills and integrating diverse range of expertise) are important to achieving positive patient outcomes (Flin & Patey, 2009). Our findings on how communication and social identification processes operate in the prediction of TMS suggest potential avenues for developmental training courses aimed at promoting high quality information exchange and interpersonal relations, as well as fostering a shared common team identity that endorses the value of unshared professional identities.

Our findings suggest that managers should encourage team members to engage in high quality communication because meaningful and positive interactions ensure that team members internalize shared team goals, which in turn creates a system for knowledge coordination. To facilitate this, organizational support structures and systems that create and maintain effective team communication should be implemented. For example, organisations can adopt technology infrastructures that promote rich quality information, or scheduled meetings aimed at opening rich quality dialogue among team members. Managers may further supplement such structures with team-building exercises aimed at making members feel, think, and act in a way that aligns their self-concept with the multidisciplinary team.

Of particular interest is that professional identification seems to be beneficial for TMS building and, thus, those professional identities should not be minimised in the team. In cases where
it is difficult to achieve a collective sense of team identification, managers may seek to foster a high level of identification with members’ own professional subgroups to bridge and utilize the expertise resources embedded in the team. For example, dialogues about differences in distinct knowledge domains may be used to promote the sharing of professional knowledge. Research suggests that practices aimed at translating individual knowledge into collective knowledge are important components for successfully transcending knowledge boundaries in teams (Majchrzak, More, & Faraj, 2011; Van der Vegt & Bunderson, 2005). While a collective team orientation to problem-solving efforts is paramount, enabling a dialogue about differences in distinct knowledge domains (and the potential contributions of each disciplinary background) is also an important factor in facilitating task contributions that align with team members’ distinctive professional knowledge.

**Limitations and Future Research**

Limitations in our study offer potential avenues for future research. First, our study suffers from limitations inherent in most cross-sectional field research, such that we can not infer causality. Our ability to statistically rule out the possible alternative explanation of communication quality mediating the effects of team identification on TMS provides more confidence that team identification was the mediating mechanism. Nevertheless, future research that adopts a longitudinal design would make a valuable contribution to understanding the causal relationships in TMS developments. A cross-sectional design also restricted our ability to capture the potential change in social identification processes over time (Mael & Ashforth, 1992), or to unravel learning effects in TMS development (Lewis et al., 2005). Thus, a valuable direction for future research would be in exploring questions related to time-ordered inference, especially given that team processes are dynamic and iterative in nature (see Cronin, Weingart, & Todorova, 2011).

Second, we note that responses were collected from a single source. However, only 9% of the variance in the model was explained by a common method source, which is below the cut-off variance warranting concern (Williams et al., 1989). Future research may employ different rating methods to reduce problems associated with CMV, such as through supervisory ratings or diary
methods for assessing communication quality, and observational ratings for TMS (see Liang et al., 1995 for an example of observational ratings of TMS in a radio-assembly task).

Third, while we examined identification ties to both the multidisciplinary team and the professional group, we did not measure threats to professional subgroup identity or the misalignment of identification goals, which may have been a potential mechanism through which the two identities operated through to influence TMS. We inferred that there was alignment of group goals through rationalizing that the goals of the professional subgroup (contributing to the team with distinct professional knowledge) was consistent with the goals of the multidisciplinary team (integrating the diverse professional knowledge in patient care). We also inferred that there was an absence of subgroup identity threats by noting that, at the group-level, team identification was not negatively related to professional identification (in fact, the correlation was non-significant, although positively related). Future research should employ identity threat measures (see Mitchell et al., 2000) to directly assess the relationship between salient social identities and understand the mechanisms through which shared and unshared identities operate through to influence TMS.

Conclusion

The present study provided support for the benefits of team and professional identities in expertise coordination for multidisciplinary teams in hospital settings. First, the study showed that engaging in quality communication builds TMS through a collective sense of team identification. Second, in response to the alternative views on whether professional identification produces silo-working effects and intergroup biases, or provides resources of professional knowledge and identity distinctiveness in multidisciplinary teams, it was found to be a resource compensating for low levels of team identification to promote TMS. Our study speaks to how social identities operate in multidisciplinary teams, with implications that both shared identities and subgroup identities should be encouraged and recognized as important resources for TMS.

References


Table 1. Aggregation statistics of communication quality, team identification and TMS.

<table>
<thead>
<tr>
<th></th>
<th>R*wg median</th>
<th>R*wg mean</th>
<th>ICC (1)</th>
<th>ICC (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication quality</td>
<td></td>
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<tr>
<td></td>
<td>.85</td>
<td>.82</td>
<td>.06</td>
<td>.31</td>
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<tr>
<td>Team identification</td>
<td>.93</td>
<td>.92</td>
<td>.06</td>
<td>.32</td>
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<tr>
<td>TMS</td>
<td>.89</td>
<td>.87</td>
<td>.11</td>
<td>.47</td>
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Table 2. Descriptive statistics for individual-level and group-level data of variables.

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
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<tr>
<td>Individual-level data (N=882)</td>
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<tr>
<td>1. Perceived communication quality</td>
<td>5.76</td>
<td>0.91</td>
<td>.42***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Team identification</td>
<td>5.29</td>
<td>1.04</td>
<td>.18***</td>
<td>.15***</td>
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</tr>
<tr>
<td>3. Professional identification</td>
<td>5.93</td>
<td>0.90</td>
<td>.57***</td>
<td>.48***</td>
<td>.21***</td>
</tr>
<tr>
<td>4. Transactive memory system</td>
<td>5.63</td>
<td>0.73</td>
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<td>Group-level data (N=126)</td>
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<tr>
<td>1. Perceived communication quality</td>
<td>5.75</td>
<td>0.44</td>
<td>.53***</td>
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<td>2. Team identification</td>
<td>5.22</td>
<td>0.54</td>
<td>.29**</td>
<td>.14</td>
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<td>3. Professional identification</td>
<td>5.93</td>
<td>0.40</td>
<td>.64***</td>
<td>.57***</td>
<td>.30**</td>
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<tr>
<td>4. Transactive memory system</td>
<td>5.61</td>
<td>0.41</td>
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Note. All measures were assessed on a 7-point scale, with higher scores indicating higher levels.
*p<.05, **p<.01, ***p<.001
Table 3. Loglikelihood values, MLR test scaling corrections, and Information Criteria indicies for comparisons of ML-SEM mediation models and ML-SEM moderated-mediation models.

<table>
<thead>
<tr>
<th></th>
<th>Log-likelihood</th>
<th>Test scaling correction</th>
<th>Number of free parameters</th>
<th>AIC</th>
<th>Sample size adjusted BIC</th>
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<tr>
<td><strong>Two-level mediation models</strong></td>
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<tr>
<td>Model A: Full-mediation</td>
<td>-3613.73</td>
<td>1.63</td>
<td>43</td>
<td>7313.46</td>
<td>7382.54</td>
</tr>
<tr>
<td>i.e., Full mediation (X→M, M→Y,</td>
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<tr>
<td>and X→Y@0) controlling for moderator (Z→Y), with all interactions constrained to zero (Int. XZ→M@0, Int. XZ→Y@0, and Int. MZ→Y@0)</td>
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<tr>
<td>Model B: Partial-mediation</td>
<td>-3613.77</td>
<td>1.61</td>
<td>44</td>
<td>7315.53</td>
<td>7386.21</td>
</tr>
<tr>
<td>i.e., Partial mediation (X→M, M→Y,</td>
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<td>and X→Y) controlling for moderator (Z→Y), with all interactions constrained to zero (Int. XZ→M@0, Int. XZ→Y@0, and Int. MZ→Y@0)</td>
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<tr>
<td>Model C: Alternative ‘causal-direction’ mediation</td>
<td>-3619.25</td>
<td>1.62</td>
<td>44</td>
<td>7326.49</td>
<td>7397.17</td>
</tr>
<tr>
<td>i.e., Partial mediation (M→X, X→Y, and M→Y) controlling for moderator (Z→Y), with all interactions constrained to zero (Int. MZ→X@0, Int. MZ→Y@0, and Int. XZ→Y@0)</td>
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<td><strong>Two-level moderated-mediation models</strong></td>
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<tr>
<td>Model D: Hypothesized moderated-mediation; Stage 2 moderation</td>
<td>-3593.51</td>
<td>1.55</td>
<td>44</td>
<td>7275.01</td>
<td>7345.69</td>
</tr>
<tr>
<td>i.e., Full mediation (X→M, M→Y, and X→Y@0) controlling for moderator (Z→Y), with only Stage 2 interaction freely estimated (Int. XZ→M@0, Int. XZ→Y@0, and Int. MZ→Y)</td>
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<tr>
<td>Model E: Alternative moderated-mediation; Stage 1, Stage 2 and direct effect moderation</td>
<td>-3590.59</td>
<td>1.55</td>
<td>47</td>
<td>7275.18</td>
<td>7350.68</td>
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<tr>
<td>i.e., Partial mediation (X→M, M→Y, and X→Y) controlling for moderator (Z→Y), with Stage 1, Stage 2, and direct effect interactions freely estimated (Int. XZ→M, Int. XZ→Y, and Int. MZ→Y)</td>
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*Notes
X = perceived communication quality; M = team identification; Y = transactive memory system; Z = professional identification; Int. XZ = interaction between perceived communication quality and professional identification; Int. MZ = interaction between team identification and professional identification; → = structural path freely estimated; @0 = structural path constrained to zero; Exogenous variables (X and Z) covaried in all models.
Figure 1. Results of confirmatory factor analysis (standardized factor loadings and covariances of the measurement model).
Figure 2. Results of final accepted moderated-mediation model.

*Notes
All dashed arrow lines are structural paths constrained to zero and non-significant. All bolded arrow lines are estimated structural paths that are significant. Reported are the unstandardized regression paths. Uneven dashed lines denotes the interaction between two latent variables. Covariance between perceived communication quality and professional identification was significant, but not depicted in the model. \( r = .82^* \).

Int. MZ = interaction between team identification (M) and professional identification (Z)
Int. XZ = interaction between perceived communication quality (X) and professional identification (Z)
Figure 3. Simple slopes of team identification on TMS at high levels and low levels of professional identification.

*Note

High levels of professional identification is 1SD above the mean; low levels of professional identification is 1SD below the mean.
Footnotes

1. Throughout this paper, we conceptualize and measure the TMS construct consistent with Lewis’ (2003) definition and measurement of TMS (see also Lewis & Herndon, 2011). Thus, we focus on predicting the extent to which TMS is present in the team (or levels of TMS) as indicated by knowledge specialization, knowledge coordination and knowledge credibility in the team.