CAPITALIZING ON THOUGHT DIVERSITY FOR INNOVATION

Team dynamics can affect innovation both positively and negatively. Here’s how to accentuate the positive.

Corinne Post, Emilio De Lia, Nancy DiTomaso, Thomas M. Tirpak, Rajendra Borwankar

OVERVIEW: The multiple and often contradictory team dynamics that arise in diverse teams present organizations with major challenges. For example, while a team’s functional diversity can help produce innovation, it also leads to detrimental team dynamics. This study of 28 innovation teams found that strategies to foster a team’s innovation include increasing its functional diversity, reducing the team’s tendency to think sequentially and increasing its tendency to engage in connective thinking. Team members should be encouraged to learn from each other and to voice divergent opinions. They should also be cautioned about relying on a single, shared mindset if they want to be better prepared to innovate and to achieve breakthrough innovation.

KEY CONCEPTS: innovation, teams, thought diversity, collaborative learning.

Diversity in R&D innovation teams is unavoidable. The growing need for scientific discoveries that bridge fields and reduce time to market has led to greater reliance on cross-functional teams, cross-disciplinary work, and open innovation. In addition, changes in the scientific and technical workforce have brought people together who are not always used to working with each other.

In these circumstances, companies face the challenge of developing breakthrough innovation within teams whose members often see the world through the lens of their own areas of expertise, knowledge or organizational affiliation, and who bring to the team different problem solving approaches. Current research has identified effects of demographic diversity (e.g., gender, race/ethnicity, age, tenure) and the mechanisms by which it works within groups. However, much less is known about how team dynamics and innovation are affected by the diversity of thought in teams (e.g., diversity in perspectives and in approaches to problem solving).

Corinne Post is assistant professor of management at Lehigh University, College of Business, Bethlehem, Pennsylvania. Her research interests center on gender and racial differences in individual work experiences, career trajectories, as well as on the effects of diversity on innovation and performance. Prior to academia, she worked for Accenture, first as an IT analyst and then as human resource specialist. Post’s publications have appeared in Administrative Science Quarterly, Journal of Applied Psychology, Annual Review of Sociology, and Journal of Family and Economic Issues. She received her Ph.D. in organization management from Rutgers Business School. corinne.post@lehigh.edu

Emilio De Lia is an executive coach in private practice serving business leaders and their teams, and an ABD Ph.D. candidate at Rutgers Business School. Previously in the course of his 35-year career, he has held numerous leadership positions in public and private corporations including company president, VP of strategy, director of computing services, and product director for international services. He received his M.B.A. with finance concentration from Rutgers University. edelia@rutgers.edu

Nancy DiTomaso is professor and chair of the Department of Management and Global Business at Rutgers Business School–Newark and New Brunswick, in New Jersey. Her research specialties include the management of diversity and change, the management of knowledge-based organizations, and the management of scientists and engineers. She has co-authored and co-edited five books and has had articles published in such journals as Administrative Science Quarterly, Academy of Manage-
This paper reports on our study of 28 innovation project teams at 14 Industrial Research Institute member companies. The goal of the study was to understand how a team’s thought diversity affects its innovation outcomes and interpersonal team dynamics (i.e., collaborative learning, psychological safety, and a shared mindset).

We drew on Scott Page’s work (1) and measured a team’s thought diversity by the variety of perspectives present on the team (e.g., the variety of educational and functional perspectives) and by the team’s reliance on two approaches to problem solving: sequential thinking (i.e., using logical and sequential thinking routines) and connective thinking (i.e., linking many previously unconnected ideas). Our results provide guidance on composing or re-composing teams to facilitate innovation and enhance skill development. At the same time, our results draw attention to how thought diversity may inhibit or enhance interpersonal team dynamics that foster innovation depending on the team composition. (See “How the Study Was Conducted,” page 18).

A Double-edged Sword

Thought diversity is best described as a double-edged sword for innovation. On one hand, diversity provides knowledge, expertise, problem-solving approaches, and other resources that, combined in novel ways, produce innovation. Thought diversity in a team (diversity in perspectives and in approaches to problem solving) helps members maintain multiple sets of assumptions as the team considers a problem. This, in turn, increases the number of alternatives that members consider. Teams that consider more alternatives produce more innovative outcomes (2). Thought diversity is especially beneficial in groups where minority views can be expressed and get due consideration (3,4).

On the other hand, diversity carries within itself the seeds of conflict. When team members have different values, priorities, communication styles, and incentives, they identify less with the team, are less cohesive, feel less comfortable voicing divergent opinions, and are more likely to develop negative feelings toward other team members. In order to understand one another and hence leverage their resources, team members with different backgrounds and perspectives tend to develop a shared mindset, that is, create a shared way of seeing and interpreting reality. Paradoxically, however, once a shared mindset develops, team members may be less likely to share unique points of view or knowledge that contradicts the shared mindset in the group. Hence the advantage of diversity may be lost in team members’ efforts to create a shared mindset.

Because thought diversity is a double-edged sword, the outcomes and the innovativeness of diverse teams are uncertain. The purpose of this study was to explore the relationships between team composition, team dynamics, and innovativeness in order to provide recommendations that help diverse teams innovate more consistently. To that end, we evaluated how innovation emerges from diverse teams and how team diversity affects critical team dynamics for innovation: collaborative learning (i.e., taking time to learn together and adjust to each other), psychological safety (team members’ belief that expressing oneself will not lead to negative evaluation or criticism from others), and shared mindset (agreement on how to value, interpret and use information).

The results presented here are part of a larger study about how leadership can resolve the paradox facing diverse innovation teams, as illustrated in the diagram, next page. The relationships on which we focus are illustrated by the full arrows in the model. The dashed arrows in the diagram indicate that leadership is likely to directly affect both team innovation and team dynamics. Future papers will discuss findings about the forms and distribution of leadership that shape team dynamics and cultivate innovation.

Rajendra Borwankar is director of analytical sciences for Kraft Foods and is based in Glenview, Illinois. Since 1987, he has led multiple assignments in basic research and in product development across multiple categories including cheese, cereals, dressings, and sauces. He is currently responsible for all analytical testing supporting Kraft’s product and process development across North America and advanced capabilities support globally, and has led several diversity initiatives at Kraft. He has four patents and numerous publications. He received his Ph.D. in chemical engineering from Illinois Institute of Technology and an M.B.A. from the University of Chicago. Raju.borwankar@kraft.com

Thomas Tirpak is a Distinguished Member of the technical staff in Motorola Home & Networks Mobility business in Schaumburg, Illinois. Since 1991, he has led R&D programs and productivity improvements in manufacturing, design, software engineering, and innovation. Currently responsible for 4G networks innovation strategy & process, he architects and manages an open framework for incubating ideas and mentoring innovators. He is a Motorola Science Advisory Board associate and certified Six Sigma Master Black Belt. He received a Ph.D. in electrical and computer engineering from the University of Illinois at Urbana-Champaign, and master of engineering management degree from Northwestern. T.Tirpak@motorola.com

ditomaso@business.rutgers.edu

Her Ph.D. is from the University of Wisconsin–Madison in sociology.
Thought Diversity

We consider two aspects of thought diversity: 1) variety in team members’ educational and functional perspectives and 2) predominance, among members, of two approaches to problem solving, which past research has identified as closely tied to innovation (5–7). Diversity in perspectives exists on a team when members represent a variety of learned perspectives, that is, learned ways of perceiving and interpreting the world that come from being trained in a particular field or from working in a given functional area. Lawrence and Lorsch argued that organizations must integrate the differences in ways of thinking across functions in order to be high-performing (8). For example, they noted that the differences in time orientation in sales versus research could cause misunderstandings and conflict that might impede performance.

Representation of various educational (e.g., engineering, science, business) and functional (e.g., marketing, engineering, basic research, production) backgrounds among its membership may provide a team with more knowledge and expertise from which to draw. Furthermore, team members from various backgrounds can also connect the team to more sources of ideas because the members collectively possess broader networks than teams composed of those with more homogeneous backgrounds. Finally, representation from a variety of organizational functions should also help teams comprehend a problem’s complexity as well as address the potential impact of a proposed innovation throughout the organization.

Heuristics—or, problem-solving approaches—provide a team with alternate, independent ways to resolve a problem or to innovate. Two problem-solving approaches in particular are of interest in the study of innovation: the sequential approach and the connective approach (5–7).

Table 1.—Sequential and Connective Thinkers Approach Problem Solving Differently

<table>
<thead>
<tr>
<th>Problem-solving Approaches</th>
<th>The Sequential Thinker . . .</th>
<th>The Connective Thinker . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is methodical in tackling problems.</td>
<td>Enjoying the challenge of making connections between apparently unrelated ideas.</td>
<td></td>
</tr>
<tr>
<td>Thinks things out before trying to do them.</td>
<td>Links ideas that stem from various areas of investigation.</td>
<td></td>
</tr>
<tr>
<td>Uses proven methods for problem solving. Is precise and exact about the production of results and reports.</td>
<td>Searches for novel approaches beyond what is required at the time.</td>
<td></td>
</tr>
</tbody>
</table>
and superimposing different interpretative frames on a given situation (7).

Table 1 presents important characteristics of each problem-solving approach. Team members are likely to take different approaches to problem solving. In addition, the approaches are independent from each other, e.g., using sequential thinking does not preclude also using connective thinking. Any given team member could favor sequential thinking, connective thinking, both, or neither. That is, while most individuals prefer using one approach over another, some versatile individuals utilize both approaches in their team interactions.

These two problem-solving approaches are closely tied to personality attributes and can therefore readily be measured with personality tests, such as the Kirton Adaptor Innovator (KAI) Inventory (9). Although personality is relatively stable, individuals can be trained in both sequential problem solving (e.g., by using a defined sequence of steps such as in Six Sigma or morphologic analysis) or connective thinking problem solving (by using analogizing or abstracting).

Neither the sequential nor the connective heuristic is universally preferable (10). However, the sequential problem-solving approach, with its emphasis on logical, sequential analysis within known parameters, is likely, to the extent that innovation emerges, to lead to incremental innovations. In contrast, connective problem solving is more likely to lead to radical innovation, because it underlies a preference for combining varied knowledge in novel ways and moving beyond existing boundaries and rules. A team’s aggregate preferences for sequential and connective thinking could help explain why some teams deliver radical innovations while others produce more incremental innovations.

Because these problem-solving styles are measured independently of each other, we do not assume that the prevalence of sequential thinking means the absence, on that team, of connective thinking or vice-versa.

**Thought Diversity and Innovation Outcomes**

Our findings suggest that a team’s functional diversity influences members’ and stakeholders’ evaluations of the team performance in different ways. Stakeholders in functionally diverse teams (individuals who are not on the team but care about, and have a stake in, the team outcomes) were more likely than those of functionally homogeneous teams to report that team members exhibited innovative behaviors and produced radical innovations. However, while stakeholders described functionally diverse teams as more innovative, members of such teams did not perceive themselves to be more or less innovative than members of functionally homogeneous teams (11).

It is possible that functional differences make it more difficult for team members to develop cohesion, which in turn clouds the way members evaluate their team’s work. In another study, for example, individuals who perceived themselves to be different from others in their team felt less satisfied about their work and evaluated their team’s creativity to be lower than was objectively measured by others (12).

In contrast to functional diversity, which affects stakeholders’ (but not team members’) evaluations of the team’s innovativeness, a team’s predominant problem-solving approach shapes its members’ (but not stakeholders’) perception of the team’s innovative behaviors and radicalness. The more a team relies on sequential thinking, the less likely members are to perceive innovative behaviors on the team (e.g., they were less likely to report that team members search out new technologies, processes, techniques, and/or product ideas).

In this regard, diversifying the problem-solving styles on a team either by changing its composition or by training the members to use alternative styles of thinking can enhance innovation. Personality assessments can help identify the thinking styles of team members.

On teams in our study that relied heavily on connective thinking, members were more likely to report producing radical innovation. Consequently, teams that desire to develop radical innovations should maintain and encourage connective thinking. This can be done by decreasing the proportion of sequential thinkers and increasing the proportion of connective thinkers on the team.

If changing the team composition is not feasible, team members can be trained to use connective thinking tools (e.g., analogizing, abstracting). Further, role-playing techniques (e.g., devil’s advocate or structured debates) may provide other avenues to reduce the reliance on sequential thinking. Some research has shown, however, that authentic disagreement is more valuable than role-
playing techniques in helping teams avoid developing a shared mindset (13). Increasing the educational diversity among team members is also associated with more diversity in their thinking styles.

Another way to promote connective thinking on a team is to purposely limit the use of proven methods for problem solving and to de-emphasize preciseness and exactness in team results and reports. For example, to reduce the likelihood that development teams commit to a single, well established process too quickly, Thompke recommends rapid parallel experimentation, that is, testing different concepts and ideas simultaneously and early rather than adhering to entrenched processes that commit the team to a particular way of thinking about an innovation challenge (14). Rapid parallel experimentation increases the chances that technologies can be combined and opens the door to different ways of addressing innovation challenges.

How the Study Was Conducted

Our sample consists of 28 innovation teams across 14 companies in a variety of industries. Member companies of a working group of the Industrial Research Institute (IRI), publisher of Research-Technology Management, were invited to participate in a pilot study on thought diversity and innovation by volunteering product, service, or process innovation teams from their organizations to participate in a 30-minute online survey. A team was eligible to participate if: it included R&D members and was cross-functional; it had at least seven members; its members had spent at least three months together; and if it was still operating or had disbanded no more than 60 days prior to the study.

Demographics

The mean team size was 11 members (Table 2), with a range from 4 to 28. The number of different functions present on teams ranged from 1 to 9, with an average of 4. The number of different educational backgrounds present on any given team ranged from 1 to 5, with an average of 3. About 40% of the teams had worked together for two years or more. While members and stakeholders perceived some teams as very innovative and others as less innovative, all four innovation scores were on average very similar and the standard deviation around those averages was small. This suggests that this sample of teams may be biased toward teams who are already quite innovative. Our sample represents the following industries: communications equipment, computers and peripherals, food products, household products, machinery, materials and chemicals, textiles, petrochemicals, and specialty retail.

<table>
<thead>
<tr>
<th>Table 2.—Team Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
</tr>
<tr>
<td>Team Size</td>
</tr>
<tr>
<td>Number of different functional areas present on team</td>
</tr>
<tr>
<td>Number of different educational backgrounds present on team</td>
</tr>
<tr>
<td>Teams with a majority of members with team tenure of 2 years or more</td>
</tr>
<tr>
<td>Innovative behaviors (as perceived by team members)*</td>
</tr>
<tr>
<td>Radicalness (as perceived by team members)*</td>
</tr>
<tr>
<td>Innovative behaviors (as perceived by stakeholders)*</td>
</tr>
<tr>
<td>Radicalness (as perceived by stakeholders)*</td>
</tr>
<tr>
<td>Team functional diversity (Blau’s index)</td>
</tr>
<tr>
<td>Team educational diversity (Blau’s index)</td>
</tr>
<tr>
<td>Mean thought diversity: preference for sequential thinking*</td>
</tr>
<tr>
<td>Mean thought diversity: preference for connective thinking*</td>
</tr>
<tr>
<td>Collaborative learning*</td>
</tr>
<tr>
<td>Psychological safety*</td>
</tr>
<tr>
<td>Shared mindset*</td>
</tr>
</tbody>
</table>

* Scale range from 1 (low) to 7 (high)

Team members’ response rate for the on-line pilot survey was 92% with a total of 283 usable surveys. Half of the teams achieved a 100% response rate. On the remaining teams, the response rate averaged 86% with a range from 75% to 96%. Our research design included team innovation evaluations from both team members and from one or more stakeholders for each team. In other words, stakeholders for each team completed a different 15-minute online survey to provide an outsider’s perspective on the team’s performance. The response rate among stakeholders was also high (89%) with a total of 33 stakeholders responding. The surveys included both established measures and measures stemming from a series of semi-structured interviews conducted in an earlier phase of the study.
Thinking about Innovation

Innovation can be conceptualized in different ways. For this study, we conceived of innovation as follows. First, we were interested in the extent to which teams engage in innovative behaviors, such as searching out new technologies, processes, techniques, and/or product ideas, or mobilizing support from outside the team to gain approval for the team’s ideas. We were also interested in the radicalness of a team’s work, that is, how new and different the innovation was relative to what already existed in the company and in the market.

Innovation Measures

Consistent with these two ways of thinking about innovation, we developed two measures of innovation. The extent to which teams engaged in innovative behaviors was measured with members’ level of agreement with five statements (Cronbach alpha = 0.84) such as: “In order to move ahead, the team takes the risk of advancing further than its current knowledge permits.” Radicalness was measured using team members’ agreement responses to five statements (Cronbach alpha = 0.80) pertaining to the nature of the innovation, such as: “From a technical perspective, the innovation would be best described as new and different from what has existed previously in the company.”

To assess innovative behaviors and radicalness, we relied on two sources of information: team members and team stakeholders (i.e., individuals who were not on the team but cared about, and had a stake in, the team outcomes). Cronbach alphas for the items composing the stakeholders’ measure of innovative behaviors (four items) and for those composing the radicalness measure (two items) are 0.81 and 0.62, respectively.

To measure a team’s diversity of perspectives, we computed an index of dissimilarity (28) using team members’ educational backgrounds (i.e., subject areas for highest degree attained). We computed another index of dissimilarity (28) using team members’ functional backgrounds, defined in terms of their primary job responsibility as the source of diversity. Educational diversity was not correlated with functional diversity among the teams in our sample. In some teams, there was high educational variety, but all members were in the same function. Conversely, some teams had high functional variety, but individuals on the team had similar educational backgrounds.

Team Heuristics

To measure team heuristics, we computed team means by aggregating individual styles for the sequential and connective problem-solving approaches. Teams with a high aggregate preference for sequential thinking did not necessarily reject connective thinking and vice versa. That is, if a team disliked or was indifferent to connective thinking, it does not necessarily follow that the team had a strong preference for sequential thinking (or vice versa). Cronbach alphas for the items comprising the sequential thinking scale (five items) and for those comprising the connective thinking scale (three items) are 0.73 and 0.74, respectively.

Our survey included established, reliable, multi-item measures for the three team dynamics of interest. Collaborative learning was measured with team members’ agreement to six statements (Cronbach alpha = 0.89) such as: “This team takes the time to have members learn each other’s perspectives.” We measured psychological safety with team members’ agreement to three statements (Cronbach alpha = 0.70) such as: “People on this team sometimes reject others for being different.” Shared mindset was measured with team members’ agreement to three statements (Cronbach alpha = 0.67) such as: “On this team, we all see things pretty much the same way.” Individual team members’ responses were aggregated to produce the team-level measures. Because of the greater likelihood that longer-standing teams perform better than teams with shorter tenure, in our analyses we controlled for the amount of time team members reported having been part of their team.—The Authors

Effects on Team Dynamics

While a team’s thought diversity directly affects the innovative quality of its work, it may also affect team dynamics that are critical to innovation, namely collaborative learning (learning together and from each other), psychological safety (a belief that expressing opposing views will not lead to rejection or other negative consequences), and shared mindset (a shared way of seeing and understanding things.). Among the teams in this study, we found that collaborative learning fosters innovation; on teams that reported more collaborative learning, team members also reported engaging in more innovative behaviors and producing more radical innovations.

Among the teams we surveyed, psychological safety was also beneficial for innovation; the more psychologically safe team members felt, the more they reported engaging in innovative behaviors.
Three Company Experiences

These mini-cases describe scenarios encountered by three IRI companies and communicated to co-author De Lia in one-on-one interviews with innovation team members, leaders and stakeholders. Respecting the anonymity promised to teams who participated in the interviews, each mini-case is an amalgam of actual conditions and paraphrases responses from multiple teams. The experiences are real, but no one team can be identified and the names have been changed.

Connective Thinking and Collaborative Learning: “The Creative Learning Team”

Albert Chin, senior V.P. of R&D, was speaking to Joe Johnson who had just successfully brought to market a breakthrough product, revolutionizing the company’s industry position. “Joe”, Albert began, “two years ago you came to me and asked for my most creative people in the specialties you needed, which, I think you agree, we provided. Doing so, we sacrificed other projects but thankfully it paid off for us all. I want to know how.”

Joe replied, “Albert, creative people are great at putting ideas together that were not related before and making connections between previously disconnected bits of knowledge. These folks found novel solutions that stretch well beyond what you were looking for. I wanted these kinds of people for my project so that collectively, more unexpected technical combinations would be created and new market ideas elaborated. But the big question is how to get the most when you get a bunch of these people together. I found that the trick was all in the interactions among the team members: there was a lot of learning among us. Everybody took turns being the teacher about their point of view, like the assumptions behind their ideas. We got to the point where if we changed our own minds we understood the implications for the others. We could anticipate what others needed from us. The interactions gave us the chance to build new ideas together and to include things that not one of us could have done alone. When the ‘aha’ moments occurred, they were usually the result of several people working together, bouncing ideas off each other and looking for connections. So, when I think about your question of how we did it, the answer is that we never stopped learning: learning from each other, from our experiments, from customers and from other sources outside the team.”

Sequential Thinking: “The Reluctant Engineer”

John Stevens was having a problem getting his innovation team going in the right direction. Randy Burns, the engineer assigned from Operations, kept sidetracking the discussion when the team tried to consider alternative ideas. Randy kept reminding everyone that there were set rules about how things are done in Operations. He would often kill the conversation by saying, “Why talk about different approaches that don’t follow the rules. It’s a waste of time.”

John asked Marge Sims from Product Development to have an off-line conversation with Randy. Marge, John and Randy met and Marge walked Randy through some approaches to technical problems that the company’s engineering folks had never really thought about. Randy replied, “I see where you are going. If we considered these new

Finally, a greater shared mindset was detrimental to innovation; in teams with a strong shared mindset, members were less likely to rate the team’s innovation as radical.

In summary, in teams where members reported more collaborative learning and more psychological safety, members generally reported more innovation, while in teams where members reported more of a shared mindset, team members evaluated their work as less radical (13). That is, teams whose thinking becomes too alike risk losing the value of the diversity of thought among their members. Consequently, the development of a shared mindset, which often emerges in teams over a short period of time, is a team dynamic that should be mitigated if innovation is to take place. While previous work has shown how problem-solving approaches affect innovation, we examine now the less-explored relationship between sequential thinking, connective thinking and team dynamics (i.e., collaborative learning, psychological safety and shared mindset) that facilitate or hinder innovation.

Collaborative learning

Innovation often requires the collaboration of competing, but interdependent, team members. Teams composed of task-related experts perform much better when members collaborate and integrate their expertise rather than when members accept the expertise of individual team members (16). Consequently, for a diverse team to innovate, members need to be committed to mutual, collaborative learning. Teams that organize their interactions so they can learn from each other are more likely to realize their innovation potential (17).
Janz and Prasarnphanich note that interactions in which team members mutually educate and encourage one another to accomplish tasks and to promote others’ successes are an important prerequisite for team learning (18). That is, to be successful, team members must not only focus on their own learning, but they must ensure that they enable others to learn from them.

Collaborative learning, which we define as careful, purposeful and attentive interactions around learning (19), is clearly important for achieving innovation on a team. Collaborative learning fosters innovation because it improves the chances that divergent views expressed by members with different knowledge and perspectives are understood and taken into consideration by others on the team.

Because members of educationally and functionally homogeneous teams “speak the same language,” they may find it easier to listen to and understand others. In contrast, when team members represent a variety of perspectives, they may expect others to have different knowledge and perspectives than their own. We found that more functionally diverse teams reported less collaborative learning.

One possible explanation for the negative relationship between functional diversity and collaborative learning is that members may treat each other as experts representing their own functions, rather than leverage the team diversity by seeking to integrate their different perspectives. In this case, in the way suggested by Katzenbach and Smith (20), the team doesn’t really behave as a team but as a working group, thereby sub-

Janz and Prasarnphanich note that interactions in which team members mutually educate and encourage one another to accomplish tasks and to promote others’ successes are an important prerequisite for team learning (18). That is, to be successful, team members must not only focus on their own learning, but they must ensure that they enable others to learn from them.

Collaborative learning, which we define as careful, purposeful and attentive interactions around learning (19), is clearly important for achieving innovation on a team. Collaborative learning fosters innovation because it improves the chances that divergent views expressed by members with different knowledge and perspectives are understood and taken into consideration by others on the team.

Because members of educationally and functionally homogeneous teams “speak the same language,” they may find it easier to listen to and understand others. In contrast, when team members represent a variety of perspectives, they may expect others to have different knowledge and perspectives than their own. We found that more functionally diverse teams reported less collaborative learning.

One possible explanation for the negative relationship between functional diversity and collaborative learning is that members may treat each other as experts representing their own functions, rather than leverage the team diversity by seeking to integrate their different perspectives. In this case, in the way suggested by Katzenbach and Smith (20), the team doesn’t really behave as a team but as a working group, thereby sub-

Psychological Safety and Absence of a Shared Mindset: “The Winning Team”

The Layering Process team had just won the company’s Best Innovation Award for the quarter, and Susan Norris, manager of Chemical Substrate Research, wanted to know why. She asked Manny Sanchez and Jake Saborski, the two reps she had on the team to explain. Manny said, “If I look at the success of this group, there was a tolerance for different opinions and for what people had to contribute. Sometimes we had a bumpy ride, trying to recognize that there’s just complete diversity of how people are approaching something, that each one of us had a different perspective and brought different, and sometimes conflicting, information to the table. We had to balance challenging each other, arguing points and being receptive to others in order to get us to a better place. So, there was a tolerance and there was an appreciation.”

Jake piped up, “It’s real easy to understand. We didn’t bazooka anybody. That’s just one ground rule we set. Don’t bazooka any idea, because that’s going to hinder the whole process. If you do, everybody thinks it’s not safe to say anything. I’ve been on teams and once somebody was bazooka’d, everybody shuts down or worse, everybody starts undermining each other. And one more big problem when people shut down is that nobody asks for help to try to figure out something new. We avoided all those problems on this team.”

Susan wanted to hear more and asked, “Was there anything else?” Jake replied, “Yes, we never got to the point where everybody thought the same way. Sure we had common goals which we all went for and we came to agreement on important decisions but we never stopped having our own perspectives. Even after we agreed on the theory behind why our approach would work, different people brought up different concerns or solutions because they still had in mind what they needed for their area.”

Manny added, “Jake is right. If we all tried to think alike, we never would have broken away from the company mold. We had all been around for a while and pretty much understood the common wisdom. In the beginning, we all thought there was only going to be one best way to solve the problem. The big breakthrough came when we realized that there were many ways and actually at every juncture, people had new ideas or information that opened up new possibilities.”

Susan said, “You two have learned important lessons on your team which would help us here in Chemical Substrates. I want you to tell the story at our next staff meeting.”

Psychological Safety and Absence of a Shared Mindset: “The Winning Team”

The Layering Process team had just won the company’s Best Innovation Award for the quarter, and Susan Norris, manager of Chemical Substrate Research, wanted to know why. She asked Manny Sanchez and Jake Saborski, the two reps she had on the team to explain. Manny said, “If I look at the success of this group, there was a tolerance for different opinions and for what people had to contribute. Sometimes we had a bumpy ride, trying to recognize that there’s just complete diversity of how people are approaching something, that each one of us had a different perspective and brought different, and sometimes conflicting, information to the table. We had to balance challenging each other, arguing points and being receptive to others in order to get us to a better place. So, there was a tolerance and there was an appreciation.”

Jake piped up, “It’s real easy to understand. We didn’t bazooka anybody. That’s just one ground rule we set. Don’t bazooka any idea, because that’s going to hinder the whole process. If you do, everybody thinks it’s not safe to say anything. I’ve been on teams and once somebody was bazooka’d, everybody shuts down or worse, everybody starts undermining each other. And one more big problem when people shut down is that nobody asks for help to try to figure out something new. We avoided all those problems on this team.”

Susan wanted to hear more and asked, “Was there anything else?” Jake replied, “Yes, we never got to the point where everybody thought the same way. Sure we had common goals which we all went for and we came to agreement on important decisions but we never stopped having our own perspectives. Even after we agreed on the theory behind why our approach would work, different people brought up different concerns or solutions because they still had in mind what they needed for their area.”

Manny added, “Jake is right. If we all tried to think alike, we never would have broken away from the company mold. We had all been around for a while and pretty much understood the common wisdom. In the beginning, we all thought there was only going to be one best way to solve the problem. The big breakthrough came when we realized that there were many ways and actually at every juncture, people had new ideas or information that opened up new possibilities.”

Susan said, “You two have learned important lessons on your team which would help us here in Chemical Substrates. I want you to tell the story at our next staff meeting.”

Because members of educationally and functionally homogeneous teams “speak the same language,” they may find it easier to listen to and understand others. In contrast, when team members represent a variety of perspectives, they may expect others to have different knowledge and perspectives than their own. We found that more functionally diverse teams reported less collaborative learning.

One possible explanation for the negative relationship between functional diversity and collaborative learning is that members may treat each other as experts representing their own functions, rather than leverage the team diversity by seeking to integrate their different perspectives. In this case, in the way suggested by Katzenbach and Smith (20), the team doesn’t really behave as a team but as a working group, thereby sub-
optimizing innovation potential. If this process is at work, it may explain why it is difficult for members of functionally diverse teams to evaluate the innovativeness of their own team’s work (21).

Among the teams in our study, we also found that collaborative learning was lower on teams with a high aggregate preference for sequential thinking, confirming our expectation that when team members (on average) exhibit a strong preference for taking a logical, sequential approach to innovation, they do not feel compelled to understand or question how they and others think. Because teams that learn collaboratively also perceive themselves to be more innovative, the shortage of collaborative learning in sequentially thinking teams may explain why members of these teams were less likely to report innovative behaviors than members of teams that were less reliant on sequential thinking.

In contrast, teams in our study with a strong proclivity toward connective thinking engaged in more collaborative learning. Connective thinkers enjoy searching for novel approaches beyond what is required at the time; such novel approaches cannot be communicated or understood without careful, purposeful, attentive interactions among team members. Because members of teams made up primarily of connective thinkers may find it difficult, at the outset, to understand one another, they apparently engage in collaborative learning to help themselves understand other members’ approaches. In turn, because collaborative learning fosters innovation, the collaborative learning that occurs in connective-thinking teams may explain why members of such teams are more likely to report producing radical innovations than members of teams with less of an emphasis on connective thinking.

**Psychological safety and shared mindset**

Psychological safety fosters innovation; when individuals fear they will suffer criticism, rejection or other negative consequences for disagreeing with other team members, they are less likely to contribute unique information or to offer divergent perspectives that are essential if the team is to learn and innovate (22). In teams dominated by one educational discipline or functional area (i.e., teams with limited diversity in perspectives), the dominant educational discipline or functional area may also be perceived by those with divergent perspectives as being more powerful, that is, as having more influence in the organization.

Power asymmetries can reduce feelings of psychological safety (22). Hence, individuals from a minority educational or functional perspective may think twice before expressing an opinion that is contrary to that of the majority or before contributing information contradictory to that proposed by the majority. As they silence themselves, team members can also develop negative emotions toward the team (23). In contrast, in teams with a wide diversity in perspectives, the absence of a majority may lead to a feeling of more psychological safety.

A shared mindset is another possible explanation for lack of creativity in innovation teams. While teams with a shared mindset may find it easier to move organizational members to action, they are also likely to distort information and data to fit the mindset that the team already developed. Groups with a shared mindset may, therefore, find it especially difficult to produce frame-breaking innovation, since such innovation requires moving beyond assumptions and beliefs held in common by the team. Furthermore, individuals often construe a team’s shared mindset as correct (24). Hesitant to challenge the team’s assumptions, methods and processes, members may be reluctant to share unique information, perspectives, or interpretations that deviate from the existing consensual way of thinking (4).

In contrast, teams without a shared mindset invite alternative interpretations of information and data. And alternative interpretations provide a basis for team learning. Information that is held in common by all members holds undue influence on the team’s creativity process. A shared mindset will often arise when a majority of team members hold similar views or have access to similar information. In contrast, when team diversity increases, a shared mindset becomes more difficult to achieve.

In our study, more functionally diverse teams reported less psychological safety and less of a shared mindset than teams with members from similar functional backgrounds. That is, members of functionally diverse teams are perhaps more anxious about voicing divergent opinions and may choose to silence unique and contradictory viewpoints rather than risk being perceived as “rocking the boat.” However, our observation that functionally di-
verse teams are less likely to have a shared mindset suggests that having a wide diversity of perspectives blocks the development of a shared way of interpreting information. It appears from our analysis that even though functionally diverse teams were able to avoid creating a shared mindset, members of such teams still felt apprehensive about voicing divergent opinions or sharing information that conflicted with that already held by the team. Neither sequential thinking nor connective thinking influenced the team’s psychological safety or shared mindset in any statistically significant way.

Implication for Managers

Organizations face a dilemma in managing thought diversity on innovation teams. Not only must they ensure that team members represent a wide variety of functions but they must also create the conditions for innovation in their diverse teams such that: 1) members help each other learn from one another (i.e., encourage collaborative learning); 2) members with unique perspectives feel comfortable voicing their own opinions (i.e., cultivate psychological safety); and 3) team members maintain divergence in their ways of thinking (i.e., they are able to avoid developing a shared mindset that impedes new ways of thinking).

Organizations that create environments where members on functionally diverse teams are willing to learn collaboratively, feel safe to voice divergent opinions, and are able to avoid a shared mindset may gain considerable competitive advantage in developing breakthrough innovation. The mini-cases that accompany this article provide illustrations of how these issues played out in three IRI member company innovation teams (see “Three Company Experiences,” page 20).

The more teams engage in collaborative learning, the more likely they are to realize their innovation potential (17,18). Because members of functionally diverse teams tend not to learn collaboratively, they are missing out on an opportunity to provide more innovative work. Hence, the lack of collaborative learning on functionally diverse teams may explain why team members do not perceive their work to be innovative even when their stakeholders do. To capitalize on the value contributed by functional diversity, attention must be given to ways to enhance collaboration so that team members can learn from one another and mutu-

Five Steps to More Innovative Teams

- **Increase functional diversity.** Stakeholders perceive functionally diverse teams to be more innovative, both in terms of the behaviors they exhibit and in terms of the radicalness of their work.

- **Break away from sequential thinking and promote connective thinking** by increasing the educational variety among team members by: adding connective thinkers to the team; discouraging over-reliance on existing methods; and by encouraging rapid parallel experimentation and broader thinking. Sequential thinkers should also be kept on the team, because they help members consider the concrete steps required to bring ideas to fruition.

- **Encourage collaborative learning, especially on functionally diverse teams.** To cultivate collaborative learning, encourage team members to ask questions, seek feedback, experiment, reflect on results, and discuss errors (29). Because functionally diverse teams tend to rely on the expertise of individual members rather than undertaking the more difficult task of learning from one another, collaborative learning on functionally diverse teams should be encouraged as a way to boost innovation on such teams.

- **Foster psychological safety** by clearly articulating to team members the importance of voicing any opinions that diverge from the team’s ways of thinking and sharing data that may contradict information already held by the team.

- **Discourage the development of a shared mindset** by asking team members to question the assumptions held in common by the team, by encouraging them to continue contributing new information and knowledge, even when the team seems to have developed a shared way of interpreting information, and by encouraging the team to search and discuss all the information held by team members and to avoid focusing only on the information that everyone shares.—The Authors
ally educate and encourage their colleagues to accomplish tasks and to promote one another’s success.

In our analyses, the degree of educational diversity among team members had no detectable influence (above and beyond the influence of functional diversity, and of sequential and connective thinking) on the teams’ dynamics, innovative behaviors or radicalness. Even so, our findings suggest that increasing educational diversity on a team increases the degree of connective thinking reported by team members, so educational diversity appears to have an indirect positive effect on innovativeness. Hence, increasing the educational diversity of team members may foster innovation through the effects on the team’s repertoire of problem-solving approaches.

The relationships among dominant problem-solving approaches in innovation teams, collaborative learning, and innovation outcomes (innovativeness and radicalness) form a consistent pattern in our data. Teams composed primarily of connective thinkers report more collaborative learning and perceive their work to be more radical. In contrast, teams composed primarily of sequential thinkers report less collaborative learning and fewer innovative behaviors.

Our findings are consistent with anecdotal evidence that highly structured programs like Six Sigma risk being detrimental to radical, breakthrough innovation (25,26). An implication of our findings is that for a team tasked with radical, breakthrough innovation to succeed, members must approach the innovation challenge with connective thinking, because such thinking tends to promote collaborative learning, which, in turn, fosters innovation. Our findings also suggest that introducing or increasing the number of team members with a connective approach to problem solving may be beneficial to the innovation of otherwise sequentially-thinking teams, especially if radical innovation is sought.

We also found that stakeholders and team members evaluated the team members’ behavior differently: stakeholders evaluated functionally diverse teams as more innovative (than homogeneous ones), whereas members of those teams did not perceive themselves to be especially innovative. At the same time, members of functionally diverse teams were more likely to report adverse team dynamics, such as lower collaborative learning, less psychological safety and, surprisingly, more of a shared mindset. Team members may be more sensitive to the team dynamics than to the functional composition of the team per se (27), especially if functionally diverse teams tend to divide their work rather than learn collaboratively.

We did not find that members of educationally diverse teams reported the same effects, and we did not find any direct effects of educational diversity on team member perceptions of innovation, but we did find that educationally diverse teams tended to have a broader mix of problem-solving styles, and these were associated with greater innovation. Overall, our study suggests that both the problem-solving styles within a team and the team dynamics can affect innovation in either a positive or a negative way. We further find that there are steps that organizations can take to enhance the innovative outcomes of diverse teams by attending to the mix of problem-solving styles and by working on generating team dynamics that enhance innovative outcomes (see “Five Steps to More Innovative Teams,” page 23).

In Conclusion

Managers have become increasingly aware of the need to leverage diversity as a means of increasing innovation. At the same time, the multiple and often contradictory team dynamics that arise in diverse teams present technical organizations with major challenges. In light of these challenges, the goal of this study was to develop an understanding of how an innovation team’s thought diversity affects its team dynamics and innovation outcomes. While research to date has mapped out the effects of demographic diversity (e.g., gender, race/ethnicity, age, tenure) and the mechanisms by which it works within groups, our study has contributed new insights about the interrelated nature of diversity of thought in teams (e.g., diversity in perspectives and in approaches to problem solving), team dynamics and innovation. Our findings also suggest the “better management practices” on page 00 for composing or re-composing teams or providing training that enhances broader thinking to facilitate innovation and for fostering interpersonal team dynamics conducive to innovation.  

Acknowledgements

This work was supported in part by the Technology Management Research Center (TMRC) at Rutgers University and in part by the National Science Foundation (NSF) under award # SES-0852671. We also recognize the support of the Industrial Research Institute (IRI) in
providing access to member companies for the purpose of this study. Any opinions, findings or conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect those of the TMRC, the NSF or the IRI.

References and Notes
9. While the KAI inventory helps differentiate between sequential thinkers and cross-disciplinary thinkers, one caveat is that it assumes individuals use either the sequential or the cross-disciplinary approach in all situations, even though other research has shown that individuals can be flexible in their problem-solving styles, and use them interchangeably.
11. We regressed both innovation variables on team tenure, educational diversity, functional diversity, sequential thinking and connective thinking. Reported effects are all statistically significant, with p ≤ 0.10 and in many cases with p ≤ 0.05.
15. We regressed both innovation variables on all three team dynamics and controlled for team tenure. Reported effects are statistically significant, with p ≤ 0.10 and in many cases with p ≤ 0.05.
21. We regressed each team dynamic on team tenure, educational diversity, functional diversity, sequential thinking and connective thinking. Reported effects are statistically significant, with p ≤ 0.10 and in many cases with p ≤ 0.05.

Information for Authors
RESEARCH • TECHNOLOGY MANAGEMENT welcomes manuscripts that deal with enhancing the effectiveness of technological innovation.

Manuscripts are reviewed by the Board of Editors, which looks for ideas and information to help industrial R&D/technology leaders run their operations more effectively. This means an emphasis on “real-world” experience that can be put to use by practitioners across a spectrum of industries.

Articles based primarily on research studies should, therefore, de-emphasize methodology in favor of explaining: 1) what the investigators learned, and 2) why those findings could be useful to industry managers.

Manuscripts may be submitted for review electronically to mwolf3877@aol.com or on good paper (not faxed), double-spaced and paginated. References should be numbered in the order in which they are cited, and listed together at the end of the manuscript.

Illustrations should be individually numbered, furnished one per page on 8-½ × 11-inch white paper, and be suitable for black-and-white reproduction, without redrawing.

Mail manuscripts to the Editorial Office, RESEARCH • TECHNOLOGY MANAGEMENT, Industrial Research Institute, Suite 1102, 2200 Clarendon Blvd., Arlington, VA 22201-3331.