LEARNING STRATEGIES AND PERFORMANCE IN ORGANIZATIONAL TEAMS

by

P. HENRIK M. BRESMAN

M.Sc., Stockholm School of Economics, 1994

Submitted to the Sloan School of Management
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

February 2005

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Abstract

This dissertation addresses the subject of team learning strategies and their performance effects in three independent but related chapters. A common theme is the notion that theorizing about team learning as constituted by a set of distinct strategies can improve our understanding of how teams learn, and how it influences performance.

The first chapter explores team learning in an inductive study of six teams in one large pharmaceutical firm. I find that many of these teams engage in vicarious team learning — the activities by which a team learns key aspects of its task from the similar experiences of others outside the team — rather than experiential team learning. I detail the nature of vicarious team learning in a model including three component processes: identification, translation, and application.

The second chapter reviews the literature on team learning and concludes that it has largely been treated as a uniform construct. Drawing on organizational learning theory, social learning theory, and the literature on the management of innovation and entrepreneurship, I propose that teams learn by deploying at least three different strategies: experiential learning, contextual learning, and vicarious learning. I use the example of a team facing a particularly difficult learning environment to illustrate the significance of viewing team learning as a multi-dimensional construct.

The final chapter examines different team learning strategies, and vicarious learning in particular, as a means to understanding learning and performance differences across teams. Vicarious learning is conceptualized as an integral part of how teams learn. A field study of 43 teams in the pharmaceutical industry is used to develop and test the construct and shows that vicarious learning is positively associated with performance. I argue that vicarious team learning is an under-explored dimension of what makes teams and organizations competitive. The chapter concludes by pointing toward a contingency theory of team learning in which the effectiveness of a team learning strategy depends on characteristics in the team's task environment.

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Acknowledgements

In a letter penned in 1676, Isaac Newton famously wrote, "If I have seen further it is by standing on the shoulders of giants." Although it is debatable whether I have seen further, there is no doubt that I have stood on the shoulders of giants.

First among the giants is Deborah Ancona, my chair. She was tough when she needed to be, but had an uncanny talent for believing in me when I needed it the most. Add to this warmth, wit, and the ability always to find time in a tight schedule for an early morning coffee talk at Peet's. Deborah is the best advisor anyone could have. Amy Edmondson provided another pair of giant shoulders. Her energy, enthusiasm, insight and commitment to students are legendary. High in demand at Harvard she nevertheless agreed to be a dedicated member of my committee, and I have pinched myself ever since. Jonathon Cummings joined later, but took on the advisor role with great generosity. Without his patience in sorting out the nuts and bolts of measurement and analysis, this would have been a lesser dissertation.

To borrow the words of a more recent thinker, Jerry Garcia of Grateful Dead fame, this has been a long strange trip indeed. So many have supported me throughout. It all started with a phone call from a misguided expatriate manager holed up in a Surabaya suburb. Örjan Sölvell, the taker of that call and a professor at the Stockholm School of Economics, gave me a hospitable welcome at the Institute of International Business (IIB). While my time at IIB would be short, I am proud to join in the tradition of IIB dissertations to acknowledge the people of this wonderful place: Niklas, Julian, Lotte, Christian, Jerker, Vanja, Malin, Carl, Henrik, Peter, Stefan, Lin, Kjell, Robert, Patrick, Jonas, Laurence, Örjan, Robin, Omar, Jan-Erik, Kerstin, Lena W, Ivo, Lena Z, and Udo. For planting the seed, for reckless parties and great fun, and for a continuing friendship, thank you. Particularly deep feelings of gratitude are for Gunnar Hedlund, the spirit of IIB, whose untimely passing deprived us all of a real giant. It is only fitting that I spent the last few months of my doctoral studies where I started, at the Stockholm School of Economics — an opportunity generously offered to me by Niclas Adler at FENIX.

Among my faculty friends at MIT, I am deeply grateful to Eleanor Westney without whom I would have never found my way to MIT in the first place, and whose capacity for seeing the big picture will always be an inspiration. Special thanks also go to Rebecca Henderson who introduced me to the gold standard of how to mix academic excellence with practical relevance, and who helped me immeasurably in getting access to pharmaceutical companies; to Paul Carlile whose example of academic curiosity, rigor and integrity I will always try to live up to; to John Carroll who always found time for me on short notice; to JoAnne Yates whose caring for doctoral students is unsurpassed; and to Tom Allen who has forgotten more than I will ever know. On the other side of the river, the thoughtful and generous feedback from Teresa Amabile, John Gourville, Robin Ely and the other members of the ARG group at Harvard influenced my thinking in ways impossible to overstate.

The students who shared the journey with me are phenomenal. Jean Jacques DeGroof, Jeff Furman, Wendy Guild, Sachi Hatakenaka, and Mike O'Leary were among the trail blazers who showed me the ropes and who have provided great support and fun all along. And of course, my fellow travelers of the Slump Management Group, without whom I would surely still be in the slump: Matthew Bidwell, Forrest Briscoe, Sarah Kaplan, Andrew von Nordenflycht, Isabel Fernandez-Mateo, and Sean Safford. Finally, it is good to know that the fifth floor now rests in the hands of that great generation of Brian Rubineau, Alice Xu, Maria Quijada, Mara Hernandez, Ruthanne Huising, and Melissa Mazmanian.

Life as a Sloanie would have been much more difficult to navigate, and far less enjoyable, were it not for Jamilah Allen, Cher Hugus, Carrie O'Brien, Pam Liu and all the other staff members who did the real work. Birger Wernerfelt, with the assistance of Sharon Cayley and Hillary Ross, has been a steady steward of the doctoral program.

Eric Rebentisch, George Roth, Debbie Nightingale, Tom Shields and the great students of the Learn Aerospace Initiative at MIT (the *real* rocket scientists) provided financial support, a second home, and a fascination for everything flying that I will carry with me. Stan Finkelstein and the Program on the Pharmaceutical Industry offered the financial assistance necessary to finish up my field work. Tekn. Dr. Wallenbergs Stiftelse provided critical funding for which I am deeply grateful.

Others who have made this journey remarkable include Syd Peterson who introduced me to the wonders of drug development, and became a close friend; Murray Aitken and his colleagues at McKinsey & Co who taught me about the strategy and execution of pharmaceutical in-licensing; Bob Myers, Emmeth Murtha and all the other generous and helpful members of the Licensing Executive Society; and of course, all the dedicated and incredible people of the pharmaceutical companies, who will have to remain unnamed, without whom there would be no dissertation.

I have an unbelievable group of friends. Daniel, Marco, and Erik whisked me away to undisclosed locations whenever I was in danger of taking my work too seriously. Jarl and Sophie literally gave me the keys to their home in a time of need. Roland, Dan, Bille, and Niclas pulled off brilliant maneuvers in the Poker Den that truly made me feel like a poor graduate student. Charlie's house in Ogunquit provided an invaluable breathing-space and an abundance of unforgettable memories. To Andy and Nicola, Anna and Petter, Björn, Denise, Fredrik and Annette, Joy and Klaus, Olof, PO, Ragnar, Soki, Susan and Bruce, Thomas K and Johanna, Thomas L and Camilla, Torild and to all of whom I may clumsily omit right now, thank you.

My family has been a rock of support. Karin and Bertil, Martin and Ellen, Katarina, Mats, Erik, and Johan — yes, I am done now. I would also like to thank my wonderful new family, Kathy, Big Pete, and Little Pete, who made me feel right at home away from home. Last, but really first, Annie, thank you for being there, for being patient, and for being simply miraculous!

Finally: to Dr. Derald Brackmann and Dr. William Hitzelberger of the House Institute and the dedicated staff of St. Vincent Medical Center in Los Angeles who saved my life and my dreams. There are no words.

I dedicate the dissertation to the memory of my grandmother, a true giant who was with me for most of this journey. Her talent for happiness and example for how to live life to its fullest will always stay with me.

Cambridge, Massachusetts
November 20th, 2004

Introduction

This dissertation is about teams that learn, and those that do not, how they learn and why. Learning and its effects on performance is drawing increasing interest from scholars studying organizational teams (Senge, 1990; Edmondson, 1999; 2002; Argote, Gruenfeld, & Naquin, 2000a; Bunderson & Sutcliffe, 2003; Gibson & Vermeulen, 2003). While students of individual and organizational level learning have long engaged in a discourse about different learning strategies, such theorizing has until now remained in the background of interest among team researchers. In particular, it has long been recognized that individuals learn both from direct experience and from the experiences of others, typically referred to as "vicarious learning" (Bandura & Walters, 1963). The same observation has often been made at the organizational level (e.g., Levitt & March, 1988; Huber, 1991). While researchers have expressed an interest in this distinction at the team level (Argote, Ingram, Levine, & Moreland, 2000b; Edmondson, Winslow, Bohmer, & Pisano, 2003), systematic theoretical and empirical work is still lacking.

Yet as pointed out by a number of scholars (Szulanski, 1996; Argote & Ingram, 2000), learning from the experiences of other groups within an organization may be a key source of innovation and competitive advantage. This research, therefore, examines the distinction between experiential and vicarious learning at the team level, but it also explores alternative team learning strategies.

Team learning is not only a multi-faceted construct, but it also involves numerous contingencies and complex interactions among different learning strategies. This research attempts to move beyond simple typologies to shed light on a multi-dimensional model of team learning.

Dissertation overview

In this spirit, my dissertation explores team learning in the context of pharmaceutical drug development. Specifically, I study learning strategies among in-licensing teams within the drug development operations of large pharmaceutical firms. These are project teams

charged with the task of researching all aspects of a molecule discovered by an external source, typically a small biotechnology firm, with the objective of acquiring and developing this molecule into a marketable drug. The process ends with the decision to acquire or not to acquire the molecule. For pharmaceutical firms, this has become a strategically critical task in the wake of the molecular biology revolution (Aitken, Lamarre, & Silber, 1998; Longman, 2001).

In-licensing of drugs in the pharmaceutical industry is an attractive research setting. Focusing on pharmaceuticals removes any industry-related variance from the sample and therefore reduces unobserved heterogeneity. Furthermore, drug development is a high technology operation dependent on complex state-of-the-art knowledge. Teamwork in this task environment requires a high level of interdependence and intense interpersonal interaction. Hence, it is a context in which team learning is exceptionally important. In-licensing teams are particularly suitable for a study of learning because they have to work with a technology for which they typically have little intuitive understanding at the outset — notably, the molecule originates outside their own research organization. As a consequence, they have to climb a steep learning curve in a relatively short time in order to succeed. Drug in-licensing teams are not representative of all organizational teams. However, salient in the task environment faced by these teams are many of the difficult challenges faced by teams operating in fast-paced, innovation-driven organizations today.

My multi-method research project uses two studies to explore both the qualitative and quantitative aspects of team learning. The dissertation itself consists of three chapters, which I describe briefly next.

I. A process model of vicarious team learning. The first study started with the observation that while it has often been stated that team learning is important, there is still more to be understood about the process itself. This observation led to two years of in-depth inductive field work of team learning among in-licensing teams in a pharmaceutical firm, which I refer to as PHARMACO.

The heart of this study was a multiple-case research design used to explore six project teams (Eisenhardt, 1989a; Yin, 1989; Brown & Eisenhardt, 1997). The primary data source was semi-structured interviews with individual respondents. Altogether I

conducted 92 interviews, not including numerous follow-up conversations, a majority of which were taped. In addition to the interviews, I attended management meetings, project team meetings, presentations by management consultants, conferences and workshops. Furthermore, I had access to secondary sources from PHARMACO such as internal newsletters, project reports, email correspondence, strategy documents, and process manuals. As is typical of exploratory research, I started the analysis by building individual case histories with the view to leave further analysis until all cases were completed (Brown & Eisenhardt, 1997). I then revisited the case stories to identify similarities and differences across cases. For each emerging insight I revisited the original field notes, interview notes and tapes to further refine my understanding of events.

Three general findings emerged from this process. First, team members made a clear distinction between learning to perform their task based on their own experiences, on the one hand, and learning from others outside the team, on the other. The collection of contextual knowledge, such as market information and technical detail, was seen as yet another distinct activity. Second, operating with low internal task experience, team members invariably preferred vicarious learning to experiential learning for reasons of both efficiency and quality of their work. Third, teams that engaged in high levels of vicarious learning were rated as better performers according to external raters than those that did not. Specifically, evidence suggested that vicarious team learning enabled the teams to avoid repeating mistakes and "re-inventing the wheel," to shortcut the process and save time, to innovate, and to start at a higher level of competence overall.

Vicarious team learning at PHARMACO involved a range of different kinds of activities. At times it involved team members observing members of other teams operating a piece of equipment before using it themselves. At times it involved adopting checklists on how to execute tasks developed by other teams. Sometimes the learning was more abstract, such as when teams drew on lessons learned by other teams in one context, extracted common attributes, and applied them in their own context. At other times, learning vicariously allowed teams to skip steps. The centerpiece of this chapter is a process model detailing how teams learn vicariously, and how this process is different from experiential learning. The model consists of three component processes: identification, translation, and application. Identification processes determine what

experiences teams attempt to learn from vicariously. Teams cannot learn from these experiences unless they translate them into a vernacular that makes sense in their own context. This occurs through translation processes. Finally, application processes convert the experiences of others into action.

II. A theoretical exploration of team learning strategies. How does the concept of vicarious learning fit within existing theories of team learning? The findings from my study at PHARMACO challenge the notion of team learning as a uniform construct. Recent work has made impressive headway in establishing learning as a theoretically and empirically important construct at the team level. However, a relatively young field of inquiry, until now team learning research has not systematically addressed vicarious learning or other alternative learning strategies. This chapter analyzes existing theories of team learning, and links them with the separate tradition of boundary spanning research found in the literature on the management of technological innovation and entrepreneurship (MTIE), to identify a set of distinct team learning strategies.

I find that existing definitions of team learning tend to either omit or subsume the notion of vicarious learning, and argue that existing conceptualizations largely imply "experiential" learning. Drawing on the MTIE literature, I then discuss the notion of experiential learning as based both on the application of team members' past experiences, which has been referred to as "learning-before-dong" (Pisano, 1996), and "learning-by-doing" (von Hippel & Tyre, 1995) involving concurrent experiences.

Importantly, vicarious team learning by its very definition involves going beyond team boundaries to examine what others are doing and have been doing in the past. In MTIE and related literatures we find a substantial body of research on boundary spanning, although it has seen little cross-fertilization with the team learning literature (Allen & Cohen, 1969; Allen, 1977; Tushman, 1977; Tushman, 1979; Hansen, 1999; Cummings, 2004). Particularly pertinent to a discussion of vicarious team learning is Ancona & Caldwell's (1992) research on external activities through which teams learn about aspects of its context important to its task, such as technical and commercial data — I refer to this set of activities as "contextual" learning behavior.

Based on the literature review, I compare and contrast the different team learning strategies. Then, I illustrate how they matter through the lens of one team that faced a particularly challenging learning environment. Finally, based on the concepts of the framework I identify a number of areas that hold particular potential as fruitful venues of future research.

III. An empirical test of team learning strategies and performance. In the final chapter, I introduce the second empirical study, which pulls together the empirical findings from the first chapter and the theoretical argument from the second. The two-fold empirical objective of this chapter is to assess the distinctiveness of vicarious team learning compared to the established learning constructs discussed in the previous chapter, and to test the performance effects of different learning strategies.

The data for this study come from the drug licensing departments of six large pharmaceutical firms. Access was largely negotiated through the members of the Healthcare division of the Licensing Executive Society, an international professional association. Within each firm four to ten project teams were randomly sampled for study. The final sample size was 43 teams. For each team, I interviewed the team leader about the project and then distributed a questionnaire instrument to the team leader and at least two other team members, randomly sampled (Libby & Blashfield, 1978; Hauptman, 1986). Three external performance raters for each team were randomly sampled from the permanent high-level board that pharmaceutical firms retain to review their project teams' progress.

The key measurement instruments were a team questionnaire and an external rater questionnaire. Most key measures included in the questionnaires were developed with the Likert scaling technique (with scale item responses running from 1 = "strongly disagree" to 7 = "strongly agree"). As far as possible, I utilized scales already established as having high levels of reliability. When a pre-existing scale did not exist, which was the case of vicarious team learning behavior, such a scale was constructed through a meticulous process (DeVellis, 1991; Hinkin, 1998).

A factor analysis shows that the data support the view of vicarious learning as a set of team level behaviors distinct from experiential learning as well as contextual learning.

Furthermore, a set of random effects regression models suggests that vicarious team learning as well as experiential team learning are significantly associated with performance. The chapter concludes with a discussion about the boundary conditions associated with each learning construct and a need to understand how the different learning strategies relate.

Extensions

An important conclusion of my work is that we have only just begun to understand how teams learn and how it influences performance. Specifically, this dissertation points toward three separate but interrelated strands of research as particularly promising venues for further research. First, vicarious team learning has conceptual and empirical relationships with other learning constructs that are explored in this research. Qualitative data from the exploratory phase of this study suggest that all three learning strategies investigated here should be seen as complements rather than substitutes. The nature of this complementarity is an important area of further research.

Second, this study does not systematically address the sources of variance in different learning strategies among teams. For example, the data indicate that the ability to learn vicariously involves the ability to recognize the right lessons to learn from, the ability to translate lessons into a vernacular that spans boundaries, and the ability to translate vernacular into action. How these capabilities are developed is an important subject of future research.

Third, limiting the study to a particular kind of team in one industry means that generalizations to other kinds of teams in other settings should be made cautiously. A venue of further research is to explore the boundary conditions of different team learning strategies. More broadly, this study points the way toward contingency thinking in team learning research, in which the most effective learning strategy — or mix of strategies — depends on the task environment in which the team operates.

Summary

The contribution of this research lies in the identification and examination of a number of related but distinct team learning strategies, and particularly in demonstrating the empirical and theoretical importance of vicarious team learning. This dissertation furthers the notion of team learning as a nuanced construct with a powerful impact of processes and outcomes in organizational life.

In recent years, team learning has moved to the forefront of interest among academics as well as practitioners. Flattening organizational hierarchies combined with rapid advances in the state of knowledge and increasingly complex task structures, will ensure that it stays there for the foreseeable future. My hope is that the research presented here will offer a useful springboard to further progress in this important field of inquiry.

Chapter 1.

Learning from the Experiences of Others: A Process Model of Vicarious Team Learning

> *To do this job right, learning from the experiences of others outside the team is imperative.*
> *—Team leader, PHARMACO*

This chapter examines how organizational teams learn key aspects of its task from the similar experiences of others outside the team. Drawing on social learning theory (e.g., Bandura, 1977), I refer to this process as "vicarious team learning."

The team has been singled out as the organization's most important unit of learning (Senge, 1990; Leonard-Barton, 1992), and recently a number of influential papers have put the team front and center of learning research (Edmondson, 1999; 2002; Argote et al., 2000a; Bunderson & Sutcliffe, 2003; Gibson & Vermeulen, 2003). The reason for the renaissance in team learning research may be traced to a shift in organizational life toward a more dynamic task environment. This is an environment characterized by fast and discontinuous change in which knowledge and information is often interdependent, inaccurate, incomplete, unavailable and obsolete. It is also a context of flattened hierarchies, complex task structures, and intense competition (Ancona, Bresman, & Kaeufer, 2002). This notion of a dynamic environment is consistent with that described by

Burgelman (1994), but it is also similar to what others have called "high-velocity" (Eisenhardt & Bourgeois, III, 1988; Eisenhardt, 1989b), "hyper-competitive" (D'Aveni, 1994), and "knowledge-intensive" environments (Hedlund, 1994).

In this environment, the demands have increased on teams' ability to learn, and in particular, their ability to learn from the experiences of others (Argote et al., 2000a). For teams operating in a dynamic environment, time is a scarce resource. For these teams there is often little time to learn every task directly through their own experience. Instead, to save time they have to identify other teams that have performed similar tasks and learn from them. Furthermore, such teams regularly face a situation in which they are fundamentally dependent on knowledge and task experiences that are found outside the team itself. When facing such a situation, relying on experiential learning processes alone is often not realistic. Instead, learning from the experiences of other teams may be the only path to task completion. Indeed, scholars have not only pointed to learning from the experiences of others as an important team strategy, but also as a potential source of competitive advantage (Szulanski, 1996; Argote & Ingram, 2000). Yet our understanding of learning processes across boundaries is still limited (Edmondson, 2002). In particular, little is known about the team processes involved in learning from the experiences of others outside the team and how these processes differ from other kinds of learning.

In psychology and sociology (e.g., Bandura & Walters, 1963; Elder, 1971; Bandura, 1977), and to some extent in organizational behavior (Davis & Luthans, 1980; Manz & Sims, Jr., 1981; Gioia & Manz, 1985), learning a task from the experiences of others has been referred to as "vicarious learning." More specifically, it has been defined as learning a task "by watching others... or talking to them about their experiences" (Pitcher, Hamblin, & Miller, 1978: 25). Vicarious learning at the individual level has obvious value. As Bandura (1977) has pointed out, we do not teach kids how to swim, adolescents how to drive, or doctors how to perform surgery solely based on their own experiences of success and failure. Similarly, in the organizational learning literature the significance of vicarious learning among organizations is widely recognized (Levitt & March, 1988; Huber, 1991; Haunschild & Miner, 1997; Baum, Xiao Li, & Usher, 2000; Denrell, 2003), and empirical organizational learning research has convincingly shown that

experiences accumulated in one organization can have a positive impact on performance in a related organization (Darr, Argote, & Epple, 1995; Ingram & Simons, 2002).

By contrast, scholars focused on the subject of team learning have tended to focus on experiential learning inside the team, while the role of team members spanning boundaries in the team learning process has stayed in the background (e.g., Edmondson, 1999; Moreland, 1999). Significantly, research in the tradition of boundary spanning in teams tells us that organizational teams often need to go outside their boundaries in order to obtain critical knowledge (e.g., Allen & Cohen, 1969). While this literature addresses a range of different kinds of information exchange across team boundaries, it does not address the exchange associated with vicarious learning. More than obtaining contextual information and understanding what is "out there" (Ancona & Caldwell, 1992), vicarious team learning is about figuring out how to do a task, and what has and has not worked in the past. Furthermore, different from retaining scientific "stars" in the team's network (Allen, 1977), vicarious team learning is about knowing who has "done it before."

This chapter reports on an inductive study of vicarious learning in teams for which the characteristics of a dynamic environment are particularly salient, namely in-licensing teams in two units of a pharmaceutical firm. Based on this study I explicate the differences between vicarious team learning and other team learning constructs in the literature. I then detail a process model of vicarious team learning. The chapter starts out with a review of what we know, and do not know, about vicarious team learning from the literature.

LITERATURE REVIEW

Organizational learning researchers have long taken an interest in organizations learning from the experiences of other organizations (Levitt & March, 1988; Cohen & Levinthal, 1990; Huber, 1991; Haunschild & Miner, 1997; Baum et al., 2000; Denrell, 2003). Particularly significant to the research presented here, Argote and colleagues (Argote et al., 2000b) have argued that empirical evidence from the organizational learning literature suggests that learning between groups within organizations can have significant performance effects (Epple, Argote, & Devadas, 1991; Epple, Argote, & Murphy, 1996).

For example, in a study of pizza stores, Darr and colleagues (Darr et al., 1995) found that the unit cost of production declined significantly at individual pizza stores as stores owned by the same franchisee gained experience in production as a collective, but did not explicate behavioral processes through which this occurs. Similarly, Ingram & Simons (2002) found that the profitability of individual kibbutz agricultural operations improved as a function of the experience accumulated in other operations within the group of kibbutzim to which they belonged. The studies both indicate the significance of vicarious learning activities among organizational subunits. Implications for the team level may only be deduced from what is essentially organizational level research, however, and furthermore, this work does not systematically address what learning activities are actually involved (Darr et al., 1995; Argote et al., 2000a). Consequently, I turn to the literature on team learning, which has focused more explicitly on learning activities.

Team Learning

How does the concept of vicarious team learning fit within existing theories of team learning? Team learning has been defined as the activities through which a team obtains and processes knowledge that provide opportunities for it to improve (Edmondson, 1999; 2002; Gibson & Vermeulen, 2003). The definition focuses on activities as opposed to outcomes (Argyris & Schon, 1978) — a distinction that is theoretically important since it is quite common in the organizational learning literature to view learning as an outcome (e.g., Levitt & March, 1988). It is also empirically consequential since it allows processes and outcomes of learning to be investigated separately. Following Edmondson (1999), I use the term "learning behavior" to avoid confusion with learning outcomes.

A key contribution of existing team learning research is the theoretical distinction between individual level and team level learning. Traditionally, many scholars believed that learning was only meaningful at the individual level, not at the team level (Hunt, 1968); after all, as some pointed out, only people have brains (Douglas, 1986). In the wake of recent work, however, agreement has emerged that learning at the team level is not only conceptually meaningful, but also empirically important (Edmondson, 2002; Bunderson & Sutcliffe, 2003). A linchpin in this view is task interdependence, and perhaps the most important theoretical concept is the "transactive memory system" (Wegner, 1987). In short,

when a team task encompasses a set of interdependent subtasks, the sharing, storing and retrieval of knowledge involved in learning must transcend individual members in order to be effective — a notion that has recently received strong empirical support (Austin, 2003; Lewis, 2003).

Learning, therefore, involves not only individual skill sets, but also interpersonal patterns of communication and coordination. Important team learning behaviors in this view include asking questions, seeking feedback, sharing information, and talking about errors (Edmondson, 1999; Gibson & Vermeulen, 2003). One significant strand of research addresses the importance of team psychological safety — a shared belief held by members that the team is safe for interpersonal risk taking — as an antecedent to team learning (Edmondson, 1999). Team members have a tendency to share only information that they already know and agree on (Stasser, Vaughan, & Stewart, 2000), and Edmondson (1999) showed that psychological safety helps overcome this tendency. Another strand examines whether teams may sometimes learn the wrong things. In their work on habitual routines, Gersick & Hackman (1990) showed that teams sometimes run the risk of harmful learning, and how this may become catastrophically apparent when the task environment suddenly changes. More recently, Gibson & Vermeulen (2003) have demonstrated the importance of subgroups as a stimulus for team learning behavior.

Importantly, until now team learning research has largely been based on an internal processing view of team learning. Explicitly or implicitly, conceptual and empirical work has mainly focused on the internal team interaction activities through which individuals acquire, share and combine knowledge (Nemeth, 1986; Stasser, 1992). Furthermore, students of team learning have primarily been concerned with learning from direct experience, or experiential team learning, with some exceptions (Edmondson et al., 2003). In other words, they have addressed activities related to the direct experiences of team members — whether contemporaneous or stemming from past tasks. For conceptual clarity, and to make the distinction with vicarious learning behavior more salient, I refer to this learning behavior as "experiential" team learning behavior. Importantly, these behaviors have been found to be positively related to performance (Edmondson, 1999; Gibson & Vermeulen, 2003). Through such behaviors teams are able to detect and correct errors (Argyris & Schon, 1978), and to improve team members' collective understanding

of a situation or discover unexpected consequences of previous actions (Edmondson, 1999).

By largely leaving out vicarious team learning, this research does not address instances in which teams would not choose to learn how to complete their tasks chiefly by relying on internal team competencies and trial and error. This approach is quite appropriate in some settings — and indeed many antecedents of team learning research are rooted in a controlled setting of experimental teams in which alternative modes of learning are effectively excluded — but not necessarily in others. For example, relying on internal competencies may not be appropriate when important task experiences are lacking within the team itself, and the patient use of trial and error may not be a realistic option for a team operating in an organizational setting characterized by intense time pressures. In such a dynamic task environment, as suggested by Argote and colleagues (2000a), learning from the experiences of others may be quite a productive learning strategy.

Boundary Spanning in Teams

Vicarious team learning by its very definition involves going beyond team boundaries to examine what others are doing and have been doing in the past. There is a substantial body of research on boundary spanning, although it has seen little cross-fertilization with the learning literature. One stream in this research, starting with the seminal work by Allen and colleagues (Allen & Cohen, 1969; Allen, 1977), has focused on the amount of information exchanged between teams and their environment. This research shows that spanning boundaries to access information can be crucial to team performance. It also demonstrates that teams must match their information processing capability to the information-processing demands of the environment (Tushman & Nadler, 1979). This research has also identified the importance of boundary roles. Notably, Allen (1977) found that R&D teams benefited from having "stars" or "gatekeepers" channeling critical technical information into the team, and Tushman (1977) showed that the number of members taking such boundary roles depends on the task environment. More recently, research has shown that under certain conditions team structural diversity — differences in member locations, functions and other features that characterize team structure — is associated with productive information transfer across boundaries (Cummings, 2004). This

boundary spanning research has contributed greatly to our understanding of the importance of external communication in teams, but the primary focus has been the frequency of communication and who is doing the communicating, not its content or purpose.

Other researchers have noted this gap. Focusing on the characteristics of knowledge, Hansen (1999) asked how the complexity of knowledge involved affects boundary activities. Drawing on social network theory, Hansen found that weak ties help teams' search for useful knowledge in general but impede the transfer of complex knowledge, which tends to require a strong tie between the two parties to a transfer. Others have set out to investigate what team members do when they span boundaries (Ancona, 1990; Ancona & Caldwell, 1992). In work particularly relevant to the present research, Ancona & Caldwell (1992) identified a number of strategies a team can adopt to manage the external environment and found that choice of strategy has a significant impact on team performance. Particularly pertinent to a discussion of vicarious team learning is what Ancona & Caldwell referred to as "scouting" activities, through which a team learns about what is "out there" in its context, such as technical and commercial data. Although the authors themselves do not use the terminology of team learning, in agreement with Argote and colleagues (2000a), I believe that scouting activities may appropriately be included in a model of team learning. To maintain symmetrical terminology with the other team learning constructs discussed so far — *vicarious* and *experiential* learning behavior — I refer to this set of activities as "contextual" learning behavior. By engaging in such learning behavior teams have been found to learn about technical and commercial demands and to detect changes in the task environment (Ancona & Caldwel, 1992), and in that way to improve team performance.

Related Concepts

There are a few other areas of research that have investigated concepts related to vicarious team learning, which merit discussion. Brown and Duguid (1991) introduced the notion of "communities of practice" in which stories and insights are shared across organizational unit boundaries. As pointed out by Edmondson (2002) though, these communities involved loosely tied networks rather than teams. Furthermore, communities of practice are typically organized around disciplines rather than tasks. Both practitioners and academics have also

paid considerable attention to "best practice" and the related concept of "benchmarking." In the practitioner realm, best practices and benchmarking have typically been non-prescriptive in that the used frameworks indicate what should be done, but leaves it up to the organization to provide the implementation. Scholars, while paying attention to implementation, have focused on the difficulties of best practices implementation and have tended to investigate best practices at the organizational level (Szulanski, 1996). Vicarious team learning can be viewed as a useful complement adding insights to the activities driving benchmarking and best practices implementation.

A broad but important concept that has a long history of research is "knowledge transfer." The stream of research that I find most relevant to this discussion is the careful set of empirical studies by Argote and colleagues referred to earlier (Darr et al., 1995; Argote & Ingram, 2000). Although they do not measure the different kinds of knowledge involved in knowledge transfer, they do point to the learning from the experiences of others as a particularly important part of knowledge transfer. Research on vicarious team learning may be usefully seen as building on this work by explicating the activities involved in this kind of knowledge transfer.

While they may share some properties, hence, vicarious team learning is either qualitatively different from or subsumed by these concepts. But they are by no means mutually exclusive. In fact, introducing the notion of vicarious team learning to the discourse may help shed light on important theoretical and practical aspects of communities of practice, best practice, benchmarking, and knowledge transfer.

The Need for a Fuller Understanding of Vicarious Team Learning

In sum, the learning literature has convincingly demonstrated the importance of experiential learning as a team level construct, but it has not systematically addressed vicarious team learning, which involves learning directly from the experiences of others outside the team. The boundary spanning literature has demonstrated the importance of going outside the team itself to obtain information from others, but it has not addressed the role of vicarious team learning, which involves learning how to perform tasks from others.

Yet a number of researchers have pointed to the importance for teams to learn from the experiences of other teams within an organization (Argote, 1999; Argote et al., 2000a;

Edmondson, 2002). Although the term *vicarious team learning* may not have been used in the past, hence, the general concept is not new. Furthermore, different strategies of team learning are not substitutes but complements with complex interrelationships. The argument I make here is not that vicarious team learning is a brand new concept with clear boundaries. Rather, I build on existing research and argue that while vicarious team learning has been acknowledged as important, it has not been given scholarly attention that corresponds to this importance. In particular, systematic research is lacking on what processes are involved in vicarious team learning. Explicating those processes can help us better understand how teams learn, which in turn can help us consider ways to improve the efficiency and effectiveness of learning in teams. The objective of the empirical research presented in this chapter, hence, is to situate vicarious team learning in the context of our knowledge on team learning, and to theorize about how it works and how it matters.

METHODS

Research Design and Empirical Setting

I used an inductive multiple-case research design. This enabled a replication logic in which the cases are treated as a series of independent experiments (Eisenhardt, 1989a; Yin, 1989). Multiple cases also serve the purpose of augmenting external validity. The research presented here is the result of a two-year study of in-licensing teams at a firm referred to as PHARMACO, a pharmaceutical firm. A product of a recent merger, PHARMACO was particularly attractive since the setting provided an opportunity for in-depth research at two sites which were as different as two independent companies. The sites are referred to here as Sigma and Beta. Access to the sites was granted by the newly hired Senior Vice President of Licensing as part of a drive at PHARMACO to expand its network in academia.

In-licensing teams are project teams charged with the task of identifying and researching all aspects of a molecule discovered by an external source, typically a biotechnology firm, with the objective of acquiring and developing this molecule into a

marketable drug. For pharmaceutical firms, this has become a strategically critical task in the wake of the molecular biology revolution (Aitken et al., 1998; Longman, 2001).

In-licensing of drugs in the pharmaceutical industry is an attractive research setting for the purposes of this study. Drug development is a high technology operation dependent on complex state-of-the-art knowledge. Teamwork in this task environment requires a high level of interdependence and intense interpersonal interaction. Hence, it is a context in which one would expect team learning to be important. In-licensing teams are particularly suitable for a study of learning because they have to work with a technology for which they typically have little intuitive understanding at the outset, since the molecule originates outside their own research organization. As a consequence, they start out with little task experience of their own and have to climb a steep learning curve in a relatively short time in order to succeed. Drug in-licensing teams are not representative of all organizational teams. However, salient in the context faced by these teams are many of the difficult challenges faced by teams operating in fast-paced, innovation-driven organizations today.

Data Collection

The primary source of data was semi-structured interviews with individual respondents. Altogether I conducted 92 interviews, not including numerous follow-up conversations. Of the interviews, 54 were taped. In a number of cases I was asked not to tape interviews due to confidentiality concerns. Interviews lasted between 30 minutes and three hours, but were typically 90 minutes. The first six interviews may be characterized as familiarization interviews. Mainly conducted with top management, these interviews' purposes were to gain mutual trust and understanding as well as to establish an infrastructure for the research project. Some main features of the latter were a confidentiality agreement, a sponsoring letter from top management explaining the importance of my research at PHARMACO, my own corporate telephone number, and an R&D director who became my internal research partner with time allocated to work with me. Having selected a set of six project teams for in-depth study (see below for details), I conducted team specific interviews to build case histories of the teams' work. In total, 58 of the 92 interviews were specific to the six teams. I attempted to interview every core member of each team and was largely successful (see Table 1 for details). The top line manager who was ultimately in charge of

any given project was also interviewed. Due to the high level of detail desired, I did two to three follow-up conversations for each case and had interviewees review case descriptions and add some details. A team member interview guide was used that contained open-ended questions related to the team process, and some probing questions about how the team engaged in learning (including "How did the team obtain and process knowledge needed to complete its task?" and "Who was involved?".)

I used a questionnaire with the purpose of assessing outcomes (measures described below). To complement my understanding of the phenomenon, I also engaged in real-time observation. Specifically, I attended management meetings, project team meetings, presentations by management consultants, conferences and workshops. Furthermore, I had access to secondary sources from PHARMACO such as internal newsletters, project reports, email correspondence, strategy documents, and process manuals. Finally, at the end of each day on site I wrote field notes with general observations.

The sampling frame used to select cases included three criteria designed to facilitate comparison: that samples of teams within the two sites should be in the same therapeutic program; that samples of projects across sites should be in therapeutic programs that are comparable in terms of the kinds of processes and technologies involved; and, that all the sampled projects involved molecules at a similar stage of development. Settling on these criteria involved a rather technical assessment that was done in collaboration with a panel of experts from PHARMACO's R&D board. The Senior Vice President of Licensing added the criterion that the projects had recently been concluded. Specifically, he felt strongly that for the study to be useful, it should neither focus on ongoing projects nor on projects concluded more than 15 months ago. With assistance of the internal research partner, a total of six project teams that fit the sampling frame were identified, all of which were researched in depth for the purposes of this study. Descriptions of the six cases, including the data collected for each, are listed in Table 1. There was no overlap in membership between any of the teams, with one exception (a member of Barracuda also worked with Bass). The names used (Shark, Snapper, Snook, Barracuda, Bass and Bluefin) are pseudonyms for internal labels, also fish names, attached to the teams at PHARMACO. They are chosen so that the first letter of each team name corresponds with the first letter of the organizational unit to which it belongs. Furthermore,

the alphabetical order of the team names within each site corresponds to their chronological order.

Table 1. Team Data

Unit	Team name	Therapeutic area *	Phase of ** development	Duration *** (months)	Interviews **** per project
Sigma	Shark	Infectious diseases	Phase III	10 (June Year 1-March Year 2)	9
	Snapper	Infectious diseases	Phase III	12 (Dec Year 1-Nov Year 2)	12
	Snook	Infectious diseases	Phase III	5 (Dec Year 2-April Year 3)	11
Beta	Barracuda	Oncology	Phase III	6 (Nov Year 1-April Year 2)	9
	Bass	Oncology	Phase II	5 (Sept Year 2-Jan Year 3)	8
	Bluefin	Oncology	Phase III	6 (Dec Year 2-May Year 3)	9

* At the request of PHARMACO, I disguise the therapeutic programs and mechanisms of action of the molecules. Instead, I refer to the less specific therapeutic area to which the molecules belong.

** The phases of drug development:

Pre-clinical: Trials with the goal to gather sufficient data on the candidate drug to warrant the step into clinical trials.

Phase I: Clinical trials with healthy volunteers. Focus on safety.

PhaseII: Clinical trials with afflicted patients. Focus on efficacy.

Phase III: Large scale trials with the goal to find proof of efficacy and safety in long-term use.

Approval: Documentation submitted to the authority responsible for drug approval.

*** The exact years during which the projects took place have been disguised at the request of PHARMACO.

**** Not including numerous phone calls and follow-up conversations.

Data Analysis

As is typical of exploratory research, I started out by building individual case histories with the view to leave further analysis until all cases were completed (Brown & Eisenhardt, 1997). This way the independence of the replication logic was maintained (Yin, 1989). Once the case stories were written up, I checked with a number of informants for each project that the stories I had crafted corresponded with facts. As a further check on the stories, two researchers with no prior exposure to the research were asked to read the original interviews to form independent views of team processes in general and how the teams engaged in learning in particular. Once differences were reconciled, I revisited the case stories to identify similarities and differences across cases. For each emerging insight I revisited the original field notes, interview notes and tapes to further refine my understanding of events. I also created tables and graphs to facilitate cross-case comparisons (Brown & Eisenhardt, 1997).

When working with interviewees' recollection of past events — a significant component of this data analysis — retrospective bias is an issue. This may involve recall problems, i.e. respondents may forget past events. The main concern is that this may deny

the researcher interesting data, not that it may cause false conclusions — research has generally shown that recall inaccuracies tend to be biased toward the mean, and hence are unlikely to result in "false positives" (Freeman & Romney, 1987). A related and potentially more serious concern is halo error, i.e. the risk that general feelings about the outcome of a process may color judgment of the process itself. Recent reviews have revealed inconclusive evidence of halo (Balzer & Sulsky, 1992), and importantly, research on teams has found that retrospective judgments about team process that are quantitative in nature (e.g., quantity of communication) are not significantly affected by halo even if knowledge of team outcome is widely shared among team members (Staw, 1975). In the present study, formal assessments of team performance were neither made nor shared with team members prior to this study, and the concepts in focus were typically of a kind less likely to be affected by halo — for example, frequencies and kinds of team activities were primarily explored rather than their perceived quality.

Even so, steps were taken to partly mitigate concerns about retrospective bias. First, data were collected prior to market launch, before a firm organization-wide consensus about project outcome had taken hold. Second, I observed two ongoing project teams and interviewed members. This enabled me to track causal relationships in the process, which enhanced the internal validity of the study (Leonard-Barton, 1990). This part of the study revealed no inconsistencies between real time and retrospective accounts that raised concerns about retrospective bias. Finally, I gained access to internal newsletters, project reports, email correspondence pertaining to Shark, Snapper, and Snook. No such documents were available from Barracuda, Bass, and Bluefin. The records were not complete and not focused on aspects of team learning specifically. These accounts, therefore, should not be viewed as comprehensive. They were produced in real time, however, and are thus useful for purposes of triangulation. As shown in Table 2, retrospective responses assessing aspects of vicarious team learning correspond well with the archival records. Specifically, the number of initiatives to search for vicarious learning opportunities recalled by interviewees approximates the pattern in the archival records.

Although the primary focus of this research is team learning processes, I was also interested in how these processes relate to outcomes. For this purpose, I developed a team performance measure based on previous research in comparable settings (Hauptman, 1986;

Ancona & Caldwell, 1992). I then asked three people within PHARMACO who were not members of the team, a number that has been considered both sufficient and cost-efficient (Libby & Blashfield, 1978), to rate each team: the senior executive in charge of the product development function and two members of the high level committee that reviewed the progress of the project. All three raters rated all six teams. Analysis of the final six-item scale yielded one single variable with satisfactory validity, internal consistency reliability and inter-rater reliability.[1]

A TALE OF TWO TEAMS

The rich data provided detailed accounts of the histories of the studied teams. The stories told of hard work and tough challenges, they told of teams frustrated by problems but also of teams proud of overcoming adversity. Significantly, what emerged from this data were big differences in how teams engaged in learning. Evidence points to the set of teams from the Sigma unit that drew far more on the experiences of others outside the team as compared to the set of teams from Beta. The Beta teams, by contrast, relied more on experiential learning. In the following sections I explore these differing team learning strategies, and I start by telling the story of two very different ways of managing

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[1] Developed with the Likert scaling technique (from 1 = "strongly disagree" to 5 = "strongly agree"), the six-item scale asks respondents to rate each team's efficiency and quality of work along three dimensions: scientific and technical aspects, financial and commercial aspects, and overall. The performance items were subjected to a common factor analysis (principal axis) to identify underlying patterns. The analysis yielded a single factor, and a scree test strongly supported the one factor solution. Inter-item correlations ranged from .7 to .96 and reliability (Cronbach's alpha) of the single scale was very high (.97). Finally, responses collected from multiple external raters to assess team performance must converge so that the intraclass correlation is greater than zero (cf. Edmondson, 1999). To generate the intraclass correlation coefficient, ICC (1), one-way ANOVA was conducted with the team to which the performance rating referred as the independent variable and the team performance rating as the dependent variable. The intraclass correlation coefficient for the performance variable, measuring the extent to which raters' responses pertaining to a team agree with each other and differ from those pertaining to other teams, was significant at the $p < .01$ level.

pharmaceutical in-licensing teams focusing on the team learning aspect. Specifically, I detail the experiences of Snapper and Barracuda — both the second project of its kind completed at their respective units — that together represent many of the observed differences in team learning across the studied teams.

The Snapper Team

Snapper was charged with identifying, evaluating, acquiring, and developing a molecule into a new anti-inflammatory drug. The project was very important to the firm, but the team also faced major challenges. In particular, none of the team members had prior experience involving the kind of molecule that they were now charged with working on. How did the Snapper team rise to the challenge to complete its task? From the outset it turned to a strategy of vicarious learning.

The first team meeting was devoted to finding out who on the team knew what, what they did not know as a team, and where to find out. Since the task was radically new for all team members, figuring out how to complete the task on their own by trial and error seemed an enormous challenge. They did not even know where to start. Hence, one of the first things the team decided to do was to identify teams and individuals from whom they could learn. Soon they found another internal team, referred to here as the Shark team, which had recently concluded a project involving a molecule of a similar kind. As it turned out, Shark came to play a significant role in the Snapper team's story. Numerous times during the project Snapper invited the Shark team to discuss and reflect on how to complete the task, and when face-to-face meetings were not feasible, the team set up phone conferences.

The first major impact that Shark had was that its advice on how to identify promising molecules led Snapper to the source of the specific molecule that became the raison d'etre of the project — a mid-sized biotech firm. Having decided that this molecule looked interesting enough to pursue, the team needed to assess its scientific quality and commercial potential. Members assembled available information from internal and external sources, but again, their inexperience was painfully obvious, and they needed help. Shark came to the rescue once more. This time they referred Snapper to a team of two external clinical expert consultants who helped sift and sort through the available

information to figure out what conclusions could and could not be drawn based on available information. They also helped Snapper figure out what additional technical data was needed to make a reasonable judgment about how the project would unfold if the team were to acquire the molecule. Team members went on to obtain this data from the potential seller, from academic sources, and from an independent research firm. On reflection, the team concluded that toxicology was an area of concern, and that an elaborate series of tests needed to be designed and carried out.

Shark had acquired equipment for a similar series of tests not long ago, and Snapper realized that it would be a good idea for them to use the same instrumentation. Hence, equipment was shipped to Snapper's lab where they observed a demonstration by Shark team members of how to use it. Shark members also noted steps that they could have skipped and mistakes that they wished had been avoided. For example, they were told about one expensive set of clinical tests that Shark had deemed necessary to fulfill the regulatory requirements, which turned out not to be. Once Snapper mastered the essentials of the new equipment, they were also able to use a checklist of tasks to perform and questions to ask handed down by Shark. All tests came out positive, and Snapper was very excited about the prospect of acquiring and developing the drug.

First, however, they had to negotiate a deal. Team members were particularly nervous about this since the potential seller had a reputation as a tough negotiator. In preparation, therefore, Snapper held a weekend workshop with a team of seasoned PHARMACO negotiators. Every Snapper team member I talked to agreed that this was critical. Although the tutors' experiences emanated from projects that in many ways were different, Snapper was able to extract valuable lessons and apply them to their own negotiation. They even came up with innovative deal structures that, although based on the templates discussed in the workshop, the tutors themselves had not seen before. In the end, they acquired the molecule. It passed clinical trials, received FDA approval, and is now on the market.

The Barracuda Team

The challenge faced by Barracuda was similar, yet its story is different. The objective was to identify a molecule and turn it into a blockbuster drug for a common side effect of

cancer treatment. As in the case of Snapper, an in-licensing project pertaining to a molecule of the same class had recently been conducted at Beta. Also similar, the first team meeting was devoted to finding out who on the team knew what, what they did not know, and what to do about it. And just as Snapper had, the team members of Barracuda found themselves lacking in experience. Yet the choices this team made to meet the challenge were quite different. In particular, Barracuda decided to lean heavily on experiential learning processes.

Pressed for both requisite experience and time, Barracuda went with a strategy of specialization combined with trial and error. Specialization was manifested in having responsibility for each area rest in the hands of one individual with authority to complete the component tasks associated with that area. Assignment of responsibility was based on prior experience, although in many cases this experience was thin. The characteristic of unambiguous accountability resting with one person in the Barracuda team was similar to how things were done in Snapper, but Snapper's use of specialization was less strict. The argument for this strategy was that it allowed every person to focus on learning and completing one component of the task, which was believed to be important in an environment of intense time pressure. Integration was achieved in team meetings run by the team leader, in which team members could ask questions and seek advice.

The molecule that the team decided to focus on was quickly identified in a journal article available in PHARMACO's electronic library. The team gathered all non-confidential data available in the public domain. Except from the contacts with the source organization, a mid-sized biotech firm, no interactions external to the team took place during the early stages of the project. Team members were focused on completing lab tests and other investigations. Based on the results and the strategic plan approved by top management, the team concluded that the strategic fit was very good. A confidentiality agreement was signed.

Entering the later more resource-intensive stages, the fundamental issues faced by the Barracuda team were the same as in Snapper. The team's response was to concentrate ever more intensely on internal learning processes. It continued to be a largely compartmentalized effort combined with team meetings. There were some instances of external interaction. For example, the team member responsible for the commercial side of

the project needed to gather information on the competitive environment, and for this purpose turned to a senior marketing manager who pointed him to a proprietary marketing database. When completing their tasks, however, the team members invented most of the procedures themselves based on their direct experiences, the past experiences of their fellow team members, and trial and error. The experience of Barracuda's pre-clinical representative is a case in point. When she concluded that some important pre-clinical information was missing, and that she did not have the experience of running the kind of tests needed herself, she turned to other team members. None of them had the requisite task experience either. In the end, she completed the tests based on some input from a fellow team member, but mostly by trial and error.

At a team meeting, results of the research were consolidated. The team felt good enough about the molecule's prospects to recommend an acquisition to top management. The team was given the go ahead for trying to reach a deal. The negotiation was handled by three of the team members. A deal was reached in record time, and after some twists and turns, the molecule reached the market as a prescription drug.

Vicarious, Experiential and Contextual Team Learning

The experiences of the members of Snapper differed significantly from those of Barracuda, and as the ensuing analysis will suggest, the divergent patterns were representative of the experiences of the other teams at Sigma and Beta respectively as well. Importantly, the stories of Snapper and Barracuda put the different learning strategies identified earlier in sharp relief.

Snapper engaged in a range of different kinds of vicarious team learning behaviors. At times it involved team members observing members of other teams operating a piece of equipment before using it themselves. At times it involved adopting checklists on how to execute tasks developed by another team. Sometimes the learning was more abstract, such as when the team drew on lessons learned by another teams in one context, extracted common attributes, and applied them in their own context. At other times, learning vicariously allowed teams to skip steps that had proved unnecessary in the past.

Barracuda, by contrast, engaged primarily in experiential learning behavior. Team members leaned on their past experiences as far as they could. In team meetings they

figured out who knew what and assigned tasks to the most experienced person. When team members still did not know enough, they asked questions and sought feedback from other team members. Since the level of task experience was generally low in the team, however, this was often not enough. Instead, team members relied heavily on trial and error processes to research and evaluate the molecule.

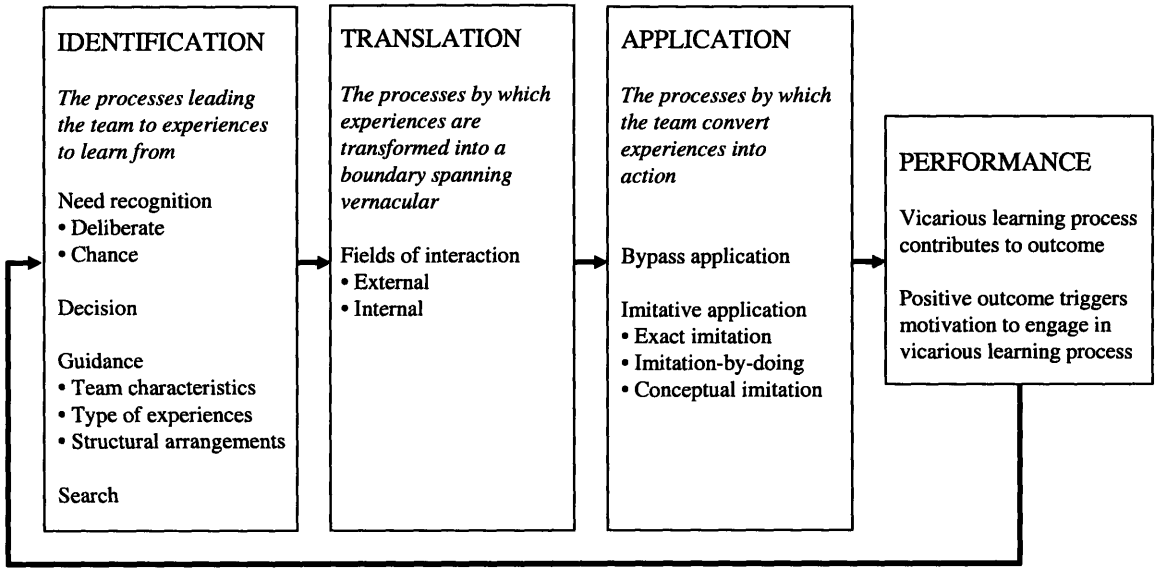
Both teams, meanwhile, engaged in contextual learning. Technical data with bearing on the medical potential of the molecules were solicited form other parts of the organization as well as from outside sources. Furthermore, both Snapper and Barracuda scanned the external context for market information that were used to evaluate the molecules' commercial viability.

The process by which a team learns vicariously is related to both experiential and contextual learning. For example, to be effective the vicarious learning processes of Snapper had to be combined with experiential processes of reflection, and an arena for this was provided by the frequent team meetings. Through experiential processes, furthermore, the team learned of needs and opportunities for vicarious learning. Similarly, vicarious learning activities uncovered opportunities for contextual learning, and vice versa. While related, however, vicarious team learning is also qualitatively different in important ways from team learning constructs in the literature. Next, I describe this process in detail, grounded in the contrasting data from Sigma and Beta.

THE PROCESS OF VICARIOUS TEAM LEARNING

Data analysis uncovered three component processes though which the studied teams learned vicariously. In this section I develop a process model based on these components: identification, translation, and application. Identification processes determine what experiences a team attempt to learn from vicariously. Teams cannot learn from these experiences unless they translate them into a vernacular that makes sense in their own context. This occurs through translation processes. Finally, application processes convert experiences of others outside the team into action. The process model is shown in Figure 1.

Figure 1. A Process Model of Vicarious Team Learning



Identification

A team cannot learn from the experiences of others unless it identifies significant features of such experiences. This process starts with the recognition by the team that the experiences of others may be helpful when learning aspects of its task and the decision to search for vicarious learning opportunities. This search effort is guided by characteristics of the team, characteristics of the experiences to be learned from, and structural features of the team context. Importantly, data suggest that these identification processes are generally proactive, and more rarely reactive.

Needs for vicarious learning in the Sigma teams were typically recognized through a deliberate process of discussion, often in a team meeting. In these meetings, lack of skill sets would be discovered as the team members took turns to discuss what they knew and what they did not know about their respective areas of responsibility. Then, the team would assess whether these gaps were serious enough to constitute a need to find out more. Sometimes needs would be recognized by chance. For example, a member of the Shark team recalled how she sat by the computer one day in the lab and discovered how the scientist sitting next to her had recently concluded a similar task pertaining to a separate project. His experiences turned out to be highly relevant to her project, and he drew her

attention to a number of issues that she did not have the experience to deal with herself. "You make your own luck though" this team member was quick to add, "...these things don't just happen unless you are open for them to happen."

At Beta, by contrast, need recognition processes were largely internally focused. That is, when needs for knowledge were recognized, the Beta teams tried to satisfy them by internal processes of specialization and trial and error. Because of the internal focus, in turn, chance events of discovering vicarious learning opportunities were rare.

Once a knowledge gap had been discovered, the team needed to agree on what to do about it. For example, if a team member brought up a concern about toxicity, and it was decided that the concern needed to be addressed, the team had to decide whether it should be most appropriately addressed by internally designed laboratory work or by seeking designs from other teams that had worked on similar tasks. The Sigma teams, in case of such a toxicity issue, more often than not decided that if external sources were available those should be pursued. A commonly cited reason was time pressure. "We wanted to avoid [long set up times] as much as we could" was a comment from one member of Snapper that was echoed by most members of the teams at Sigma. The decision to rely on experimental designs and other knowledge generated by the experiences of other teams was not an easy one. First, the team members needed to know where to find what they needed. Second, it meant that the team had to give up a certain amount of control, a sentiment commented on by another member of Snapper:

> We decided that there was no time to design our own toxicity tests and that we would have to rely on the designs of other teams. This was a tough call and so we spent quite a bit of time agonizing over it before deciding to move ahead. After all, if something should be wrong with their design, we would be the ones to hang.

Even though the learning process occurred at the team level, not all decisions to learn from the experience of others were taken by committee. In particular, when the issue at hand was of less significance than a comprehensive toxicity test, individual team members would decide on their own to seek input from outsiders. For example, a member of Snook incorporated a list of "dos and don'ts" in a presentation on clinical trials to senior management that he had obtained from a member of Shark, which was adopted throughout

the team. Yet another approach was when the team leader decided to invite two former members of Snapper to a meeting on how to plan a series of animal studies.

The ways in which needs were addressed at Beta were very different. Specifically, in the team meetings held in the Beta teams decisions were not taken to actively seek relevant experiences from outside sources. Instead, whenever a knowledge gap was discovered, it typically resulted in a decision to allocate responsibility to a member who would complete the task experientially.

Often the decision to attempt to draw on relevant experiences externally was a function of the fact that a team or an individual team member already knew of a source of such experience. The extent to which the team's search for valuable sources of vicarious learning was well guided, hence, was an important predictor of the extent to which the team decided to engage in vicarious learning activities. Such guidance, determining what experiences of others outside the team were paid attention to, was often concurrent and iterative with decisions to engage in vicarious learning. It rested on team characteristics, such as whether team members knew of useful sources outside the team with experiences to learn from. It also rested on characteristics of the experiences themselves — in particular whether aspects that could be translated and applied productively were salient. Finally, guidance was a function of structural arrangements. At Sigma, institutionalized integrative team meetings provided the most important opportunity for guidance processes to take place at the team level. Another important structural aspect at Sigma was that teams had a tier of members that was only loosely tied to the core team with the mandate to spend time specifically searching for vicarious learning opportunities and scouting for other useful information. At Beta, no such tier of externally oriented team members was available.

How did the teams search for opportunities to learn vicariously? At Sigma, search for vicarious learning opportunities started once team members had a sense of where to go. These initiatives could be ambitious, such as the hiring of expensive external consultants who had worked on similar projects before, but often they were less costly both in terms of time and other resources. For example, team members would seek out former colleagues from graduate school with relevant experiences together with whom they explored issues

pertinent to the task. Consistent with the lack of externally oriented guidance processes at Beta, the teams at this site searched hardly at all for opportunities to learn vicariously.

Table 2 presents data that illustrates the identification phase of the vicarious team learning process model as it played out among the Sigma teams. Data from the Beta teams provide a contrasting portrait of a set of teams that learned primarily through experiential processes.

Table 2. Identification Processes

Activities	Teams Engaging In Vicarious Learning	Teams Not Engaging In Vicarious Learning
Recognition	The key thing in that meeting was figuring out what we needed. The pharmacokinetics issue turned out to be big. (Member, Shark) We realized that we didn't have a handle on quality assurance. (Member, Snapper) We were in pretty good shape, but in that meeting we still found we needed to know more about how to deal with supply before our site visit. (Leader, Snook) I sat down by the lab computer and it turned out that the efficacy issue the guy next to me had worked on was as relevant to me as to him. (Member, Shark) Do you know what really happen is... you go down the hallway and you hear someone saying something and you go 'Oh my god, we did not even realize.' (Member, Snook)	In the meeting it was clear we sat on some things from the licensor, but we had to know much more about how to do this. (Member, Barracuda) After that [meeting] it was pretty clear that we needed to know more about the efficacy. (Member, Bluefin) We found [in that meeting] that they had taken it to Phase II in Japan. In other words we had very limited data and needed additional know-how to get more. (Member, Bass)
Decision	So we decided to try to find good practices in pharmacokinetics, and there are some guys around here who have done that. (Member, Shark) We decided that there was no time to design our own toxicity tests and that we would have to rely on the designs of other teams. (Member, Snapper) [We] decided to bring in two experienced guys to brief us on how to deal with supply. (Leader, Snook) I realized that we needed to find someone to help me find a good road map for how to do the valuation and so I decided to talk to some old friends of mine. (Member, Shark) I needed more data and so I went out there to find someone who knew more. (Member, Snapper) The rule was 'If you need it, go out and get someone who knows' and I decided to do that (Member, Snook)	The data from the licensor was clearly not enough, but we decided there was no time to find out more... We had to do it ourselves. (Member, Barracuda) We decided to set up this complicated efficacy test... and we didn't know how to do it really... we had to figure it out... (Member, Bluefin) It was decided to proceed quickly with trying to produce more of the data we needed... Since we did not have much experience we needed to start early. (Member, Bass)
Guidance	[The team leader] knew who had been the clinical rep on a team that had conducted a toxicity study a year ago. He emailed her to say that I was going to contact her and about what. (Member, Snook) The project reports from Snapper and Shark also had a lot of information on where we could find more... who to ask about how to do this, and so on. (Member, Snook) In the meetings we had, we learned a lot more about where we could go [to get] so much experience we didn't have. (Member, Shark) My boss put me in contact with people who are previously experienced... Especially if you are new to the company, you have no idea... And the other thing is the boss knows who did well on those previous teams and who represented our area... Somebody who would have done the same thing that I was being asked to do. (Member, Snapper)	The target product profile was difficult to assess... We debated and generated data, and brought them to another [team member] who sent us to another who he thought might know more. (Member, Barracuda) Others in the team knew this used to be a very common model [of testing the particular molecule], but I think global developments have made it relatively unusual. Anyway, that is where we started since that was all [team members] knew.

continued

Table 2. Identification Processes (Continued)

	And then I say [to the team leader] 'Are you aware of any people who did a comparable function to me?' (Member, Snapper) There was a document retrieval system that was pretty good... And I could get all the reports written for the last five years... so that I could at least see when I was new to the team... you need to know who had done this before. (Member, Snook) And it was very helpful to have those other documents and they are based on who the authors on the documents were. You then had another whole set of people that you could go back to. (Member, Snook)	(Member, Bass) Instead, [the team leader] asked me to go to [another team member] who he thought might know more (Member, Bluefin) There is a hell of a lot of arrogant PhDs who think they know everything and they are not going to learn anything from anybody. (Member, Bass)
Search		
Counts *	Shark: 5 (2) Snapper: 19 (9) Snook: 18 (13)	Barracuda: 0 Bass: 0 Bluefin: 2
	[We] went out there to put together an intelligence database.. and it required [finding] tons of people who had done this kind of thing before. (Member, Shark) [Team members] were trying to seek out people they had heard had the experience we needed to actually do what we needed to do. (Member, Shark) I always want to have a couple of researchers fresh out of graduate school on my team... [This] is great when you need to look for a lot of new knowledge. This is particularly important in in-licensing... old road maps don't always work... the team doesn't have the experience it needs... These guys know a lot of people I don't and so they can go out there and find stuff that I can't... People that know things that we don't. (Member, Snapper) To find external experts to help you out is always important in in-licensing... If you don't know a lot you need them for technical and regulatory knowledge... [you need it] from experienced people. We did a lot of searching for those people. (Member, Snapper) More often than not the knowledge required [to do] a... high-quality evaluation is found in the team members' network. The more team members, the larger the network and the bigger the chance that we get the knowledge that we need... that we find someone with experience... You've got to get to those guys... So you spend a good deal of time searching for them. (Member, Snook) Sometimes the licensor won't give you what you want. You have to go with your gut feeling... Is information withheld? You have to go out to put the puzzle pieces together... [and] to find people who have done it before who can help you do that. (Member, Snook)	I searched to team for someone who would know how to do it... I searched our binders and databases. (Member, Barracuda) There was a big debate about whether the compound really met a medical need... I asked around a lot in the team to find out how to know. (Member, Bass) We didn't have time to look for the information we needed [outside]... I just asked around the team (Member, Bass) During the [research phase] we focused on the information we had... We really didn't leave the building. (Member, Bluefin) Ultimately it comes down to the people in the team... that the chemistry is going to work. It is through people interaction in the team that you search for knowledge about how to do something. (Member, Bluefin)

* Number of search initiatives related to vicarious learning from interview transcripts. For triangulation: number of initiatives from archival sources (newsletters, project reports, email correspondence) in brackets. Only available for the Sigma teams.

Translation

A team cannot take action based on identified experiences of others unless team members are able to re-contextualize them in a way relevant to their own task. They need to translate the experiences into a vernacular that makes sense in their own context. In his influential work, Nonaka (1994) suggests that what is required for successful transfer of complex knowledge into product development teams is the generation of mutual comprehension through "fields of interaction" where differences in vernacular can be worked through and tacit knowledge can be made explicit. This concept of fields of interaction offers a useful key to the second component process of vicarious team learning. Specifically, the

translation processes that I discovered involved two such fields, one internal and one external.

At Sigma, the internal field was provided by the frequent integrative team meetings. As just described, the meetings were an integral part of the identification phase. In particular, information exchange in these meetings helped guide the teams' search for vicarious learning opportunities. The internal field has a key role in the translation processes as well, but first, the external field comes into play. One illustrative example is the weekend workshop that Snapper members organized with a team of experienced PHARMACO deal makers. This forum provided team members with a field of interaction with the external party whose experiences the Snapper team would try to learn from. The deal makers started with recounting their experiences, the Snapper members countered with probing questions, which yielded clarifying responses. Throughout the weekend, then, this back-and-forth translated the deal makers' experiences into a concrete language that the Snapper team members could use to describe their own context. After the workshop, the team turned to their internal field of interaction, the integrative team meeting. Here they thrashed out what they had learned and what was applicable to their own task. In this field the lessons learned was refined and parts that were deemed particularly important were extracted and formulated.

Numerous examples of how iterations between interaction in internal and external fields produced concretely formulated aspects of the experiences of others that the teams at Sigma could learn from emerged from the data. Many of them are found in Table 3.

Table 3. Translation Processes

Activities	Teams Engaging In Vicarious Learning	Teams Not Engaging In Vicarious Learning
External Field of Interaction	I had left academia three years ago and it is hard to come back, to understand the results, how it is done, the language. So getting together with old colleagues from school helped to remember the language and figuring out how things should be done. (Member, Shark) So it's basically getting in touch with people who have been working in previous teams... who have done similar things... Trying to find a common thread... to talk about their experiences in a way that is helpful for us... what has and hasn't worked what's similar and what's different. They [Shark members] were very very available to us and this project to talk about this. (Member, Snapper) I might go through [with Shark members]... 'How did you get this data, why did you come up with this conclusion? (Member, Snapper) And we said [to members of the Shark team] how do you measure these things, and they told us what instruments they used and they told us the procedures they used and we talked about whether we could do the same, if it was valid for us. (Member, Snapper) So then you can go back to [the Shark team] and say, look, here are the assumptions that were made in this case, and some of them are valid and some of them are not, and they might be valid at a certain level, but not at another level. What say you? (Member, Snapper) Every decision on how to do something should be based on data, but sometimes you don't understand the data. We needed to spend time with [Snapper] talking about what it really meant, and what it meant to us. (Member, Snook) I sat down with my scientists, and then we had a conference call about patent issues. We knew that Shark had done some related work, but we didn't know how it made sense to us so we talked to them about that... And they made us understand the lingo. (Leader, Snook)	NO INTERACTION IN EXTERNAL FIELD
Internal Field of Interaction	I need to interpret [what I learn from previously experienced teams]... They give me their analysis, but I need to bring it back to the team to figure out how it fits. (Member, Shark) And in other cases, I might sit down with the other team members and in that case I do not know until afterwards how applicable it [what I learned from old university colleagues] is. (Member, Shark) I remember that I was evaluating what they [the experienced negotiators] had said, and I brought it up in a few team meetings... We tried to talk everything through before instituting the new process to make sure what was valid really... (Member, Snapper) So, I feel the need to go back and ask them again, but first we discuss in the team. (Member, Snapper) It was not concrete. I could not really understand this, you know... I don't know if it is this they are referring to, and so on. It is certainly something we discussed in the team. (Member, Snapper) And sometimes the lessons learned are great and sometimes they are not. And it is difficult to know what assumptions to make... We talked a lot about this in the team... What it actually meant for us. (Member, Snook) [The lessons learned from Shark] were really good for us, but some things didn't really translate... I brought up their [manufacturing] procedures, and we talked about it and someone say, oh no, we should not use that color on that pill. Apparently, some colors are more soothing than other colors. (Member, Snook)	And so here is the case where we ask each other in the team meeting if anyone had been working on this. And so we find this out and work based on those experiences... In this case, no one had worked in this class of compound, and then you just have to make sense of it anyway in your own language. (Member, Barracuda) We had regular meetings to exchange information, making sure everyone understood what we were doing, what's going on. (Member, Bass) We asked each other for a lot of feedback in the team. (Member, Bluefin)

By contrast, the Beta teams can best be described as largely active in one kind of field only, namely, the internal field. Often this resulted in desirable outcomes. For example, in team meetings it was discovered who was best suited to complete a certain task. But these internal interactions were very much part of the experiential learning model. They did not result in the teams interacting in external fields and engaging in translation processes.

Application

The data suggest that if identified opportunities for vicarious learning were translated into a meaningful vernacular and judged to be valuable, then they were applied to the task at hand. I discovered two different application modes, "bypass" and "imitative" application. Detailed data are shown in Table 4.

Table 4. Application Processes

Bypass application	*Imitative application --Exact imitation*	*Imitative application --Imitation-by-doing*	*Imitative application --Conceptual imitation*
Teams Engaging In Vicarious Learning			
Skipped lab test found unnecessary by previous team. (Member, Snapper)	So, we bought the exact equipment they had and used their procedure exactly... we did not have enough experience to second-guess. (Member, Snook)	We were given the instrumentation used by a previous team, and a guy from that team even took time to show us how to use the equipment. But still it took quite a while before we had learned how to operate it. This is something of an art... One we had learnt how to use it, it was great. (Member, Snapper)	Marketing makes all kinds of assumptions... and one of the sets of assumptions they make is how much of this potential drug can re-sell outside of the US... And sometimes the assumptions are better and sometimes worse. So, we had to throw out some... For example, in some communities you would never put something underneath your tongue. (Member, Snapper)
People from Shark came and suggested that certain people at that company were slimy. And so that was taken at face value... about what he says and she says, and I am going to check confirmation on those things. (Member, Snook)	The team before us had developed this check-list of criteria to use when evaluating the propietary position of a compound. It was great. We used a copy of that list. (Member, Snook)	With permission of the licensor we sent them to the lab at Stanford to do similar experiments. We used their method exactly, but we were doing it in an evaluatory way. (Member, Snook)	So for example such assumptions about how to structure milestone payments are valid, but they have to be revisited (Member, Snapper)
Commenting on decision not to do a formulation evaluation based on the experience of another team: "the only thing I take is their conclusion because I trust them." (Member, Snook)	I carried this card in my wallet that I got from a Shark member with the buckets that go into the 'heads of agreement' . Upfront payments, milestone payments, royalty, and so on. I don't have enough experience myself... but when I followed those point by point, people thought that I was smarter than I am. (Member, Snapper)	You can get this learning curve going, so that you don't have to reinvent the wheel... But at some point you have to learn yourself... get your hands dirty. Otherwise you can't... do it [a test] (Member, Shark)	We scientists took information from what Shark had done and from our lawyers and trying to mix it all together to come up with something that was better and better for us. (Member, Snook)
We try to make original mistakes here, not repeating old ones... We try to find show-stoppers by talking to people who has done this before, instead of finding them ourselves. (Member, Snook)			

continued

Table 4. Application Processes (Continued)

Teams Not Engaging In Vicarious Learning			
I [had] to do these animal models... And I haven't touched a monkey in years. I'm sure we could have used what others had done. (Member, Bass)	We came up with our own criteria... We learned as we went along [through] doing it. (Member, Bass)	So I had to do all the tests... This involved a lot of new equipment... An intense process of trial and error (Member, Barracuda)	We didn't have much [experience to go on... So we learned a lot from our own sucesses and failures (Member, Bluefin)

Bypass application. This process involves the team taking an important piece of knowledge, generated through the experiences of another team, at face value without engaging with it. The team thereby bypasses learning, in a sense, since it does not actually process the experiences in such a way that it produces know-how for the team. The most salient instance of bypass application involves applying knowledge that allows the team to avoid making costly mistakes or to waste time. In other words, it allows the team to bypass learning experientially that something was not worthwhile learning. For example, by learning from Shark that a series of planned lab tests had not yielded useful information in the past, the Snapper team decided to skip running the tests altogether and thus they avoided spending time and other resources on something that in all likelihood would have proved a dead-end. Importantly, they knew close to nothing about the details of the studies they relied upon, but instead accepted them at face value. In contrast, all planned tests at Beta — as well as all other laboratory work — were carried out by the teams.

Imitative application. This application process is typically associated with a particular practice successfully adopted in past situations, and in contrast to bypass application it requires various degrees of understanding of the experiences involved. I identified three different imitative processes, which are referred to here as exact imitation, imitation-by-doing and conceptual imitation.

Process 1: exact imitation. Some knowledge can be imitated exactly. Typically, such knowledge is template-like in form, such as important points to bring up in a negotiation or a list of the kind of tests to run to satisfy the regulatory authorities. The following quote from a member of Snook captures the common occurrences of exact imitation at Sigma: "The team before us had developed this checklist of criteria to use

when evaluating the proprietary position of a compound. It was great. We used a copy of that list."

Process 2: imitation-by-doing. Some practices are applied through a two-step process. Often a close approximation of a successful practice may be achieved simply by imitation, but perfection may require trial and error. There were a number of examples of this application process in the Sigma teams, as exemplified by this quote from an Snook team member:

> We were given the instrumentation used by a previous team, and a guy from that team even took time to show us how to use the equipment. But still it took quite a while before we had learned how to operate it. This is something of an art... Once we had learned how to use it, it was great.

Process 3: conceptual imitation. Some practices have little leeway for improvisation, such as operating a piece of equipment, but in many practices sub-skills have to be improvised to suit varying circumstances. Through a process of conceptual imitation teams extract concepts that are common between a practice they learn from and their own specific circumstances. Based on these concepts they then formulate rules and develop skills that they can use in their own work. This way teams may acquire — among other things — judgmental standards, negotiating styles, and information processing procedures. A process of conceptual imitation proved critical to the Sigma teams. Consider a comment regarding the complex issue of the valuation of molecules from an Sigma team member:

> There are certain assumptions that drive the valuation and the target product profile. These assumptions are not static but evolve over time. They also have to be adapted to every specific case. It is very important that we can draw on the assumptions used by the teams before us.

Conceptual imitation can be incremental, as in the example above, but it can often be quite creative. Teams can combine aspects of various practices that they have imitated into constellations that differ substantially from the individual practices. The example of contract structures explained by another Sigma team member is illustrative of this practice:

> The contracts that we write are becoming more and more sophisticated. We have this library of old contracts from past project teams that we sift through constantly. And we combine different clauses and techniques that have been used in the past into a new and better structure.

The adoption of one application process over another appears to depend on a number of conditional factors. For example, in order for bypass application to work, the knowledge involved must have a low level of interdependency with other components of the team's work. The team further needs a high level of trust in the source to accept the knowledge at face value. Another issue is knowledge equivalence — that is, the experience from which the team learns needs to originate from a task that is sufficiently similar to the task at hand. Taken together, these conditional factors compelled the teams at Sigma to adopt a mosaic of application processes, which was a crucial element of the vicarious team learning that I found at this site.

Vicarious Team Learning and Performance

The teams that engaged in high levels of vicarious team learning behavior were given high performance ratings by the external raters (Table 5). One observation is that all the teams at Sigma were rated better than all the teams at Beta. Another observation is that every new team at Sigma was rated better than the previous one. No such inter-generational improvement is evident among the teams at Beta.

Table 5. Team Ratings and Rankings

Team Name	Score (1-5) *	Rank
Snook	4.8	1
Snapper	4.2	2
Shark	3	3
Bass	2.5	4
Barracuda	2	5
Bluefin	1.5	6

* Calculated as the average across items and raters.

The fate of the drugs developed by Snapper and Barracuda, which unfolded after the conclusion of data collection for this study, reinforces the performance ratings given to the teams. Snapper's drug ended up PHARMACO's best selling drug, and was the main

reason for a subsequent takeover by a larger rival. The end result of the Barracuda team's efforts was less positive. Although the drug reached the market, it was discovered that the drug's very expensive active ingredient was needed in a much larger quantity per dosage than was initially estimated. This made it virtually impossible to make the drug profitable, and it is currently being phased out.

The purpose of this study is not to explain variance in outcome, but even so, the data do suggest a link between vicarious team learning processes and performance that is highly consistent with propositions made in prior research (Darr et al., 1995; Argote et al., 2000a). As argued by Ingram & Simons (2002), learning from the experiences of others is likely to be related to performance since it expands the space of learning opportunities. The data from PHARMACO suggest that by avoiding reinventing the wheel through their own trial and error processes, vicarious team learning processes can save time and thereby improve efficiency. By avoiding repeating mistakes and drawing on lessons learned to come up with innovative solutions, vicarious team learning processes can improve quality. Both processes are likely to contribute to overall performance. Importantly, teams that have experienced beneficial effects of vicarious learning are likely to exhibit a greater motivation to continue engaging in a process of vicarious learning. Therefore, there is a feedback loop between positive outcomes and identification processes in the model. One enthused team member of Snapper remarked:

> There are risks involved in relying on what others have done. We were a bit wary about going to [Shark] initially. But the lead they helped us find was a hit, and they were impressive with the toxicology... Results were great. We kept coming back for more.

DISCUSSION

This research describes vicarious team learning as involving a range of distinct processes. The differentiation between experiential learning and vicarious learning, well established in theories on learning at individual and organizational levels of analysis, is important since it reveals distinct patterns of team behavior that have not been systematically

addressed until now. It also highlights vicarious team learning as a potentially under-explored dimension of team performance.

The research presented here represents a first step in establishing vicarious team learning behavior as a construct, but more work is needed before its implications can be fully understood. Importantly, vicarious team learning has conceptual and empirical relationships with other learning constructs that are not fully explored here. Qualitative data suggest that all three sets of learning behavior highlighted here should be seen as complements rather than substitutes. The nature of this complementarity is an important area of further research. My hope is that this research will have provided a conceptual stepping stone toward a fuller and more fine-grained model of team learning based on the recognition that teams learn by engaging in a number of different strategies.

A limitation of this study is its retrospective design. The steps taken to mitigate and test for recall problems and halo effects notwithstanding, future research should seek to replicate the findings of this study in a setting not vulnerable to retrospective bias.

Another limitation of this study is that it does not systematically address the sources of variance in vicarious learning behavior among teams. The literature points to two possible sources, namely, lack of motivation and lack of ability (Szulanski, 1996). Interviews at PHARMACO indicate that ability was the most important factor — a finding consistent with Szulanski's (1996) research on the difficulties of transfer of best practices. In general, moreover, variance in vicarious team learning was greater across Sigma and Beta than within these units. This indicates that at least some of the ability to engage in vicarious team learning may rest at the organizational level rather than at the team level. These observations are highly speculative, however. Further research is needed both to identify possible sources of variance in vicarious learning behavior among teams and to investigate them empirically.

Limiting the study to a particular kind of team in one industry means that generalizations to other kinds of teams in other kinds of settings should be made only cautiously. A central venue of further research is to explore the boundary conditions of vicarious team learning. This would include questions about where and when vicarious learning is a productive learning strategy for organizational teams. Importantly, if no pioneering teams exist in a team's task environment, vicarious team learning behavior is

not possible. On the other hand, if the task environment is characterized by perfectly codified and readily available task knowledge, vicarious learning may well be a good learning strategy, but it would be an unlikely source of variance among teams. More broadly, this study points the way toward contingency thinking in team learning research, in which the most effective learning strategy — or mix of strategies — depends on the task environment in which the team operates.

CONCLUSION

This chapter described how teams learn key aspects of its task from the similar experiences of others outside the team. I presented data suggesting that such *vicarious team learning* is qualitatively different from other forms of team learning found in the literature, and I developed a process model of vicarious team learning involving three steps: identification, translation, and application.

Chapter 2.

The Many Faces of Learning in Organizational Teams: A Multi-Dimensional Model of Team Learning

INTRODUCTION

Learning at the individual level has a long tradition of research in the social sciences and management literatures (e.g., Skinner, 1938; Dollard & Miller, 1950; Bonoma & Zaltman, 1981). Similarly, over the last couple of decades the body of research concerned with learning at the organizational level has reached a considerable breadth and depth (e.g., Cyert & March, 1963; Argyris & Schon, 1978; Cohen & Sproull, 1996). Yet although some have pointed to the team as the most important unit of learning in the organization (Senge, 1990; Leonard-Barton, 1992), research on learning at the team level has remained sparse. This is changing, however, and over the last few years a number of influential papers have put the team front and center of learning research (Edmondson, 1999; 2002; Argote et al., 2000a; Bunderson & Sutcliffe, 2003; Gibson & Vermeulen, 2003). Importantly, the increased interest has also begun to highlight that team learning theory is still in its infancy. In this chapter, I draw attention to one aspect of team learning that is particularly ripe for conceptual exploration; namely, its behavioral underpinnings. Specifically, I argue that scholars have largely treated team learning as a uniform construct when in fact it is comprised of many distinct sets of learning behaviors of different kinds

with different purposes. The overarching objective of the chapter is to uncover the different faces of team learning in organizations and to make the case for the importance of viewing team learning as a multi-dimensional construct. Thereby, I hope to provide a conceptual springboard for this important field of inquiry.

Team learning is a protean concept. Similar to the Greek sea-god, it seems to at any moment show a different side and take a different form. This multi-faceted nature of team learning is reflected in the various foci of the academic discourse. For example, some scholars have investigated whether team learning is always good (Gersick & Hackman, 1990; Zellmer-Bruhn, Waller, & Ancona, 2004). Notably, Bunderson and Sutcliffe (2003) found that teams can engage in too much learning behavior, hurting performance in the short term. Others have debated the validity of learning as a team level construct. Teams, some say, are merely constructs and cannot do anything (Hunt, 1968). They have no properties other than those that channel through people and there is no such thing as a supra-individual knowledge repository (Douglas, 1986). Yet teams that work and learn are hardly controversial in everyday life, and recent theoretical and empirical research has added validity to this notion. Perhaps the most solid theoretical case for learning as a team level construct is provided by Wegner's "transactive memory system" (1987). In short, when a team task encompasses a set of interdependent subtasks, the sharing, storing and retrieval of knowledge involved in learning must transcend individual members in order to be effective — a view that has recently received strong empirical support (Austin, 2003; Edmondson et al., 2003; Lewis, 2003).

This chapter is based on the premise that learning occurs at the team level. Furthermore, drawing on recent empirical work (Edmondson, 1999; Gibson & Vermeulen, 2003), team learning is seen here as a set of behaviors, leaving outcomes as an empirical issue to be investigated separately. The focus in this chapter, hence, is on learning behaviors and I lay out the argument that standard conceptualizations have often been both too broad and too narrow, muddying our path to understanding how teams learn. The definitions have been too broad in that they have tended to obscure that there are different kinds of team learning rooted in different sets of behavior. These different kinds of learning have often been implied but seldom explicitly examined. At the same time definitions have been too narrow in its focus on a few mechanisms by which team learning

influence performance, thereby blurring the need for a more fine-grained conceptualization of team learning. In fact, there are a range of mechanisms at work, which when included in the analysis put the many faces of team learning in sharper relief.

Based on work related to learning in organizational teams I begin this chapter by identifying, comparing and contrasting three broad sets of team learning behavior: experiential learning, contextual learning, and vicarious learning. I refer to these different sets of behaviors as "team learning strategies" to signal that they involve active choices on part of the team (cf. Ancona & Caldwell, 1992). Then, I introduce the example of a team from the pharmaceutical industry that faced a particularly difficult learning environment to highlight the differences between learning strategies, and to illustrate the significance of these differences. Finally, based on the concepts of the framework I identify a number of areas that hold potential as fruitful venues of future research.

THREE STRATEGIES OF LEARNING IN ORGANIZATIONAL TEAMS

In this section, I identify and discuss different strategies of team learning. Given the potential ambiguities of the team learning construct itself, however, it is important to start with a definitional foothold. In the only comprehensive review of research on learning in organizational teams that I know of, Argote, Gruenfeld & Naquin (2000a) noted that team learning has been defined in a number of different ways pertaining to a number of different kinds of teams and contexts. My focus here is on one particular kind of team, namely, organizational teams. Consistent with empirical research on organizational teams (Bunderson & Sutcliffe, 2002; 2003; Gibson & Vermeulen, 2003), and Edmondson's (1999) work in particular, team learning is seen here as consisting of *activities carried out by team members through which a team obtains and processes knowledge providing it with opportunities to improve.* This definition, in turn, begs for a working definition of knowledge. According to the well received conceptualization by Kogut & Zander (1992), which I use in this chapter, knowledge stretches from simple information to more complex know-how. Another significant distinction provided by Kogut & Zander (1992) is that between tacit and codified knowledge (see also Polanyi, 1962; Hansen, 1999). Knowledge

as information involves codified knowledge, while know-how typically involves both tacit and codified knowledge.

As discussed in the introduction, recent empirical work has brought an increasing clarity to the way in which students of organizational teams think of learning, but our understanding of different learning strategies teams can adopt is still limited. Yet a careful read of the literature provides the contours of a multi-dimensional team learning model consisting of different learning strategies rooted in different behavioral foundations and different performance mechanisms.

Experiential Learning

An obvious way for a team to learn a task, or aspects of a task, is through direct experience. Through behaviors such as experimenting, seeking feedback, and asking questions (Edmondson, 1999), team members can pool and combine their experiences. These behaviors, in turn, help teams to detect and correct errors — the primary mechanism pointed to in the literature by which experiential team learning allows teams to improve performance (Argyris & Schon, 1978).

Most students of team learning have focused their research, explicitly or by implication, on experiential learning (e.g., Edmondson, 1999; Bunderson & Sutcliffe, 2003; Gibson & Vermeulen, 2003). Experiential learning can involve both learning from concurrent experiences, or learning-by-doing, and by applying past experiences. Typically, team learning research has not differentiated between the two, but there are related strands of research that have.

The concept of learning-by-doing has long been used in the literature on learning curves (Wright, 1936; Arrow, 1962; Alchian, 1963). Although scholars have later expanded the boundaries of the concept (Abernathy & Wayne, 1974; Argote & Epple, 1990), it basically amounts to a simple hypothesis: as workers learn to perform a task by accumulating experience in doing it, efficiency will increase and costs go down. While the concept was first explored among groups of factory workers, it has since been expanded to more knowledge intensive environments (Pisano, 1996; Mukherjee, Lapre, & Van Wassenhove, 1998), and the basic hypothesis has received significant support across contexts. In his work on pharmaceutical drug development, Pisano (1996) focused on the

importance of experiential learning as the application of past experiences, and referred to this as "learning-before-doing." In a drug development environment this may mean designing a template for a series of animal tests based on team members' prior experiences of similar projects, as opposed to figuring out an appropriate test series by trial and error.

Nonetheless, while learning-by-doing and learning-before-doing differ in the temporal dimension, they are both parts of an experiential learning strategy. They both have the primary purpose of improving team performance by detecting and correcting errors.

Contextual Team Learning

Team learning is about more than detecting and correcting errors, however. It is also about connecting with the task environment to learn about what the context look like. This is important since it can help the team adapt to changing circumstances, and to make sure that it learns tasks that are worthwhile learning. I refer to this kind of learning as "contextual team learning." If the primary mechanism connecting experiential learning to performance is the detecting and correcting of errors, then the primary mechanism of contextual learning is detecting change in the task environment and adapting to it.

In an innovation-driven organization, the behavioral underpinnings of contextual team learning may include activities such a scanning the environment inside and outside the organization for important data about the market. It may also include collecting information about technological trends from people outside the team and finding out what competing firms and teams are doing on similar projects.

Contextual learning has until now not been in focus among team learning researchers. A research program on external activities in organizational teams by Ancona & Caldwell (1992), however, has convincingly demonstrated its importance. It showed that over time teams appear to develop distinct strategies, or mix of strategies, toward their environment. Importantly, Ancona & Caldwell found that engaging in contextual learning, or what they refer to as "scouting activities," was important to the teams in the study, particularly early on in their tenure. In the very competitive environment in which the studied teams operated, a strategy of contextual learning ensured that the teams worked on products that were leading-edge once they were launched. The research also pointed to the

potential perils of contextual learning — in particular, the risk of getting stuck in contextual learning mode at the expense of task completion. Ancona & Caldwell (1992) illustrate this finding in a story of a product development team charged with developing a revolutionary new product. The project was set up to "take the company into a new sphere." It was given top priority and plenty of resources. Naturally, a lot of learning about the context was needed to make sure that the team was ahead of the competition and the technology was in the front of the field. Soon, however, it was clear that the team was stuck in contextual learning mode. They continued to come up with new "amazing applications," but implementation lagged. Top management started to voice their concern, but the project continued to be behind schedule. Finally, the project was killed.

In sum, contextual learning is about learning about the context in which the team is embedded from external sources. By contrast, experiential learning is about learning tasks based on the experiences of members in the team. The primary purpose of contextual learning is to help team performance by detecting contextual change and making sure that work is done on correct assumptions about the task environment. The primary purpose of experiential learning is to help team performance by detecting and correcting errors. Hence, both strategies are important, but they have different purposes and are rooted in different behaviors.

Vicarious Team Learning

What if the most useful task experiences do not reside inside the team itself? Or even more dramatically, what if the team does not have sufficient experiences to even do their task? Then, experiential learning may not be possible. For this strategy to make sense, a minimal threshold of team experience is needed. On the other hand, a contextual learning strategy is not likely to help much either. Adapting a task to a changing context does not make sense if the team is unable to do the task in the first place. In this situation, the only viable strategy may be what I will refer to as "vicarious team learning." This is when a team learns to do a task, or aspects of a task, from the experiences of others outside the team. Vicarious learning is a label that has been used in many different fields and at many different levels of analysis (e.g., Elder, 1971; Huber, 1991; Haunschild & Miner, 1997; Baum et al., 2000; Denrell, 2003). I mean to invoke the tradition of vicarious learning

research found in social learning theory (e.g., Bandura, 1977; Bandura, 1989), which is focused on the activities involved in learning tasks from others.

The mechanisms connecting vicarious team learning to performance, similar to the case of experiential learning, include the detection and correction of errors. But it can also involve learning a fundamentally new task that would not have been possible to learn from experiential learning alone. In addition, vicarious learning can help teams avoid repeating mistakes and saving time by skipping steps that have proved to be unnecessary in similar past tasks. At a general level, vicarious learning can increase the space of opportunities for a team to learn.

The behavioral underpinnings of vicarious team learning may involve such activities as identifying previously experienced teams and people, and discussing past successes and failures with them to extract useful lessons. It may also involve observing experienced people outside the team doing important tasks on which the team's own actions can be modeled (cf. Bandura, 1989).

While researchers have expressed interest in learning from experiences across teams (Argote et al., 2000a; Edmondson et al., 2003), most empirical antecedents are found in the body of research on organizational learning. A series of careful empirical studies on organizational learning curves are particularly informative (Epple et al., 1991; Epple et al., 1996). For example, in a study of pizza stores, Darr and colleagues (Darr et al., 1995) found that the unit cost of production declined significantly at individual pizza stores as stores owned by the same franchisee gained experience in production as a collective. Similarly, Ingram & Simons (2002) found that the profitability of individual kibbutz agricultural operations improved as a function of the experience accumulated in other operations within the group of kibbutzim to which they belonged. Taken together, these studies convincingly show that experiences accumulated in one organization can have positive and significant effects on performance and productivity in related organizations. The studies do not explicate the activities involved, and implications to the team level need to be deduced from what is essentially organizational level research. Nevertheless, as pointed out by Argote (1999), these studies give us strong reasons to believe that the same effects would be found at the team level.

In sum, vicarious learning is about learning a task based on the experiences of others outside the team itself. This is different from experiential learning, which is about learning a task based on the experiences of team members. Contextual learning is similar to vicarious learning in that it involves learning from external sources, but the purpose of vicarious learning is different. While contextual learning has the purpose of learning about the context, the purpose of vicarious learning is to learn about the task. In addition, knowledge contents differ. Vicarious learning primarily involves know-how, but also information, and it stretches the whole spectrum from very tacit to highly codified knowledge. This is similar to experiential learning. Contextual learning, by contrast, primarily draws on codified information.

Toward a Multi-Dimensional Model of Team Learning

Research on team learning has made impressive strides recently, and we understand far more about this important phenomenon than we used to. This is a young field of inquiry, however, and there are still areas ripe for further empirical and theoretical work.

In particular, I have argued that team learning research, explicitly or implicitly, has focused on experiential learning based on direct experiences, and aimed at performing better by detecting and correcting errors. I have suggested that by casting the net a bit wider, we can deduce from research in related areas that other learning strategies are important too. From research on team's external activities we can infer the importance of a contextual learning strategy based on information from external sources, and aimed at improving team performance by detecting and adjusting to changes in the task environment. Furthermore, from organizational learning research we can infer the importance of a vicarious learning strategy based on the task experiences of others outside the team, and aimed at improving team performance by learning tasks, avoiding mistakes, and skipping unnecessary steps.

These strategies are related, but distinct, and when taken together they constitute a multi-dimensional model of team learning. I will return to the theoretical implications of viewing team learning through this lens, but first I will illustrate its significance in practice by telling the story of a team facing a particularly difficult learning environment.

A MULTI-DIMENSIONAL MODEL OF TEAM LEARNING IN ACTION

What is the significance of moving beyond the notion of team learning as an essentially uniform construct toward a multi-dimensional model with different learning strategies? I believe that a more fine-grained view of team learning helps us better understand how teams really learn. To make this point, I will now turn to the experiences of the Snapper team. This is a team that I know well having spent two years doing research at the firm of which it was part. The story of the Snapper team is one of success. Before reaching the pinnacle, however, its members faced a hard climb through often treacherous terrain. Key to the eventual success was a deft use of different learning strategies at different times to different ends.

Snapper is a pseudonym for a project team — also named after a fish — at a large pharmaceutical firm, referred to here as PHARMACO. Snapper was a so-called in-licensing team charged with identifying, researching, and negotiating an acquisition of an early stage "candidate drug," with the objective to turn it into an approved marketable drug. The task constituted a tremendous challenge for the team since none of its member had worked on this particular class of drugs — an anti-inflammation treatment — before. In fact, many of the team members found it unfair to have been given this responsibility since they had so little experience of their own to draw on. Nevertheless, they had no choice but to get to work.

The first step was to identify a candidate drug that fit the profile of the strategic plan laid out by top management. The plan stipulated that PHARMACO would become a leader in the field of anti-inflammatory drugs, and Snapper would be one of the pioneering teams whose efforts were meant to spear-head the initiative. Since PHARMACO had neither any patented drugs nor recent drug discoveries in this area, it fell to Snapper to identify an external object for a possible acquisition.

The market that PHARMACO was about to enter is very lucrative, but it is also a crowded space and highly competitive. Therefore, the first order of business for the Snapper team was to map the competitive landscape. What were the unmet medical needs in the anti-inflammatory area? In other words, what did the customers demand? What were

competitors doing? What drugs were they working on? In what stage of development were they? To answer all these questions team members fanned out to scan marketing databases, to attend conferences, to hear from the industry grapevine, and to make phone calls to a range of experts and other contacts. They sifted through a great number of different candidate drugs, but the information the team gathered about the market place led them to discard all of these early leads. They found either that the competition was too intense already, or that the commercial potential was not good enough, or both. In the end, however, the efforts paid off. The team honed in on one particular category of drugs that appeared very promising. Within this category, in turn, and with the help of colleagues from a foreign subsidiary, they identified one drug that appeared to fit the target profile perfectly. They contacted the company that had discovered the drug, a mid-sized biotechnology firm, and found that the company was willing to negotiate a deal. PHARMACO's top management gave Snapper the go-ahead to pursue the deal.

The next stage of the project was to research the candidate drug to make sure that it met expectations. This phase involves a painstaking process of analyzing existing data as well as running additional complex experiments in a range of areas. The problem was that none of Snapper's members had any meaningful research experience related to the category of drugs to which the candidate drug belonged. They hardly even knew were to start the research process. In a team meeting, therefore, the members decided that they had to track down others who knew more. After a determined effort, they identified a number of teams and people, both outside and inside PHARMACO, who had some of the task experience that the Snapper team sorely lacked. In particular, they tracked down members of another team at PHARMACO, the Shark team, who had recently concluded a project similar to the one Snapper was now charged with. The Shark team members were invited over, and they generously shared their lessons learned. Importantly, they told the story about how concerns about toxicology had caused them big headaches. They had spent a lot of time and resources trying to convince the regulatory authorities that the drug they worked on would not harm the patients it was meant to heal. The Snapper team came away from the meeting with a realization that toxicology was a key issue for them as well, and importantly, with a roadmap of how to deal with the issue. Having talked to the Shark team they had a clear idea of what needed to be done, and what needed not to be done, to

manage this challenge. The Shark team would continue to be an invaluable sounding board for the Snapper team throughout their project. In the end, however, there was only so much that the Shark team could do. When it came to running a complex series of experiments specific to the candidate drug, the Snapper team would ultimately have to rely on their own skills. Because of their lack of experience, this took a lot of effort, and they had to lean heavily on an often challenging trial and error process. Relying on the advice from the Shark team allowed them to concentrate on the areas that were most important, however, and in the end the research phase was concluded both effectively and efficiently. Top management was impressed with the results, the findings were very positive, and Snapper was given the mandate to pursue an acquisition.

The acquisition phase presented another monumental challenge to the members of Snapper. The seller of the candidate drug had a reputation as a tough negotiator, and meanwhile, the Snapper team had limited experience of negotiation in general, and pertaining to the particular drug in particular. Once again Shark came to the rescue by pointing Snapper to a team of negotiation experts they knew. Snapper ended up spending a weekend workshop with this negotiation team discussing strategy and tactics of the negotiation process. They also practiced by running negotiation exercises. All team members agreed that this weekend was crucial. The next step in preparing for the big negotiation was to scan for benchmark data on recent deals in the industry to give the team a notion of contractual arrangements, price levels, and so on. In the end, it came down to rolling up their sleeves and sit down at the negotiation table. Throughout the process the team relied on their experiences from the negotiation workshop and the data about deals they had collected, but they also had to improvise and make things up as they went along. Importantly, the outcome was regarded a huge success. After a number of additional twists and turned, the candidate drug was acquired and it is now PHARMACO's best selling drug.

In sum, the story of Snapper is the tale of a team operating in a tough task environment that succeeded in no small part by using different learning strategies at different times to different ends. The first phase was characterized by an intense contextual learning strategy that ended with the identification of a candidate drug of great promise. The research phase started out with heavy reliance on a vicarious learning strategy which

set the stage for a focused and efficient experiential learning strategy. The final stage, the acquisition phase, involved all the three learning strategies at critical junctures. A vicarious learning strategy was used to learn the state-of-the-art tools of negotiation, a contextual learning strategy was used to make sure that the negotiations were conducted on correct assumptions about the competitive environment, and at the negotiation table the team leaned heavily on experiential learning to close the deal.

DISCUSSION

Learning as a Multi-Dimensional Model: Why It Matters

The Snapper team's experiences make salient some of the reasons why viewing team learning as a multi-dimensional model matters. Should we view Snapper's efforts simply as a matter of learning or not learning, then we would miss some of the critical keys to how this team learned to master its task.

Consider the early identification stage of the process during which a careful contextual learning effort landed the team a first-rate candidate drug. Along the way a string of other potential leads were discarded. Importantly, had the team been less careful about mapping the competitive context, then they might have ended up with a drug of less potential. Then it would not have mattered how well the next phase of the task was learned and executed, because the assumptions on which it rested would have been flawed. In other words, a team may be great at experiential learning, but if team members do not engage in an effective contextual learning strategy, then they risk learning how to do the wrong things well.

Similarly, consider the research stage during which a reliance on a vicarious learning strategy helped the team hone in on the most important issues. Had the team not done this, then its team members may have spent valuable time and resources on less important issues or they may have been left to re-invent the wheel or repeating mistakes already committed by others. In other words, a team may be great at experiential learning, but if team members do not engage in an effective vicarious learning strategy, then they risk learning things they do not need to learn, and doing so less efficiently.

Finally, consider the last stage of the project during which Snapper combined all learning strategies at its disposal to come up with a highly favorable outcome. An important implication is that a team may be excellent at one of the three — or even two of the three — learning strategies discussed here, and still end up failing. Should we apply a one-dimensional view of team learning, we would have a much shallower view of how this team really learned how to master its task so well. In addition, by using a multi-dimensional lens we can get insights into how the means and ends of learning change over the course of a team's life.

In sum, theorizing about different kinds of learning strategies is important since it furthers our understanding about how learning matters, when it matters, and when it may not matter. Recent research has shown that teams can be inefficient and ineffective at learning (Bunderson & Sutcliffe, 2003), and considering ways in which teams can learn more efficiently and effectively is therefore important, both theoretically and practically. Viewing team learning as a multi-dimensional model consisting of many different learning strategies is one step on that path.

Future research

The argument I make in this chapter is a theoretical one, and our understanding of team learning can only be advanced to a certain point through theorizing. To truly put progress in motion, careful empirical work is called for. I identify a few areas of particular promise for field research next.

Experiential learning and contextual learning have solid empirical antecedents in the team literature. Vicarious learning as a team strategy remains under-explored. Future research should attempt to establish what activities a vicarious team learning strategy involves and how they differ from those of other learning strategies.

I have argued that different learning strategies have different pathways to performance. Until this argument is put to the test empirically, however, its validity is unknown. Furthermore, the argument made here is probably simplistic. Exploratory work on team learning holds the promise of uncovering more subtle relationships between various team learning strategies and performance.

Other complex relationships that have remained largely unexplored in this chapter are those between different learning strategies. Yet it is not only likely that such relationships exist, but also that they are very important for the ultimate performance effects of any one of the learning strategies discussed here. For example, vicarious learning is likely to be combined with a level of experiential learning as the lessons learned from the outside are applied to the team task. On the other hand, experiential learning is likely to make a team realize the need for vicarious learning. Similarly, contextual learning is likely to lead to the identification of vicarious learning opportunities, and the other way around. In order to explicate the realities of these interactions, empirical work is needed.

Finally, the effects of different learning strategies on performance are likely to be moderated by the task environment. To design and test a contingency model of team learning in which the most effective learning strategy — or mix of strategies — depends on the task environment would be an important goal of future research.

CONCLUSION

In this chapter, based on existing literature I outlined a multi-dimensional model of team learning consisting of three related but different learning strategies: experiential, contextual, and vicarious learning. I described the three strategies and discussed how they differ and how they matter.

Importantly, conceptualizing learning as a multi-dimensional construct can help us identify ways in which teams may learn more effectively and more efficiently. To get there, however, careful empirical work is needed.

Chapter 3.

Lessons Learned and Lessons Lost: Vicarious Learning Behavior and Performance in Organizational Teams

INTRODUCTION

The ability of teams to learn from the experiences of other teams within an organization has been pointed to as an important source of renewal and competitive advantage (Szulanski, 1996; Argote & Ingram, 2000). In building on lessons learned by other teams, a team can avoid "reinventing the wheel" and improve efficiency and innovation (Darr et al., 1995; Ingram & Simons, 2002). Yet our understanding of learning processes across team boundaries is still limited (Edmondson, 2002).

Learning has recently moved to the forefront of interest among scholars studying organizational teams (e.g., Senge, 1990; Edmondson, 1999; 2002; Edmondson, Bohmer, & Pisano, 2001; DeSanctis, Fayard, Roach, & Jiang, 2003; Gibson & Vermeulen, 2003; Philips, Mannix, Neale, & Gruenfeld, 2004). While students of individual and organizational level learning have long engaged in a discourse about different strategies by which individuals and organizations learn, such theorizing has until now remained in the background of interest among team researchers. In particular, going back to Isocrates 390 B.C., it has long been recognized that individuals learn both from direct experiences and from the experiences of others (Rosenthal & Zimmerman, 1978). The same observation

has often been made at the organizational level (e.g., Levitt & March, 1988; Huber, 1991). While a number of researchers have expressed interest in this distinction at the team level (e.g., Argote et al., 2000a; Edmondson et al., 2003; Zellmer-Bruhn, 2003), systematic theoretical and empirical work is still scarce. We have only just begun to understand the team behaviors involved in learning from the experiences of others outside the team and how these behaviors may differ from other kinds of learning. Importantly, learning from the experiences of others is a way to learn more efficiently (Edmondson et al., 2003), and theorizing about how the process works can help us understand when it matters most (cf. Bunderson & Sutcliffe, 2003).

In psychology and sociology (e.g., Bandura & Walters, 1963; Elder, 1971; Bandura, 1977), and to some extent in organizational behavior (Davis & Luthans, 1980; Manz & Sims, Jr., 1981; Gioia & Manz, 1985), learning a task from the experiences of others has been referred to as "vicarious learning." More specifically, it has been defined as learning a task "by watching others... or talking to them about their experiences" (Pitcher et al., 1978: 25). Vicarious learning at the individual level has obvious value. As Bandura (1977) has pointed out, we do not teach kids how to swim, adolescents how to drive or doctors how to perform surgery solely based on their own experiences of success and failure. Similarly, in the organizational learning literature the significance of vicarious learning among organizations is widely recognized (Levitt & March, 1988; Huber, 1991; Haunschild & Miner, 1997; Baum et al., 2000; Denrell, 2003), and empirical organizational learning research has convincingly shown that experiences accumulated in one organization can have a positive impact on performance in a related organization (Darr et al., 1995; Ingram & Simons, 2002).

By contrast, scholars focused on the subject of team learning have tended to focus on experiential learning inside the team, while the role of team members spanning boundaries in the team learning process has stayed in the background (e.g., Edmondson, 1999; Moreland, 1999). Significantly, research in the tradition of boundary spanning in teams tells us that organizational teams often need to go outside their boundaries in order to obtain critical knowledge (e.g., Allen & Cohen, 1969). While this literature addresses a range of different kinds of information exchange across team boundaries, it does not address the exchange associated with vicarious learning. More than obtaining contextual

information and understanding what is "out there" (Ancona & Caldwell, 1992), vicarious team learning is about figuring out how to do a task, and what has and has not worked in the past. Furthermore, different from retaining scientific "stars" in the team's network (Allen, 1977), vicarious team learning is about knowing who has "done it before." Drawing directly on the established definition of vicarious learning at the individual level, vicarious learning at the team level is defined as the activities by which a team learns key aspects of its task from the similar experiences of others outside the team through observation and discussion.

This chapter analyzes team learning behaviors among organizational project teams in the pharmaceutical industry. First, I draw on an exploratory field study to describe different aspects of vicarious team learning. Then, I build on existing literature to argue that while it is related to previous conceptualizations of learning in teams, vicarious team learning is qualitatively different in important ways. I suggest that by viewing vicarious team learning as a significant and integral part of a model of team learning, we can reach a greater understanding of how teams learn and how it influences performance. Finally, using a separate data set, I assess the distinctiveness of vicarious team learning, and test the relationship between vicarious team learning behavior and performance.

THE MANY FACES OF TEAM LEARNING

An Exploratory Field Study

Although the term *vicarious team learning* may not have been used in the past, the general concept is not new (Argote, 1999; Edmondson, 2002). Furthermore, as discussed in detail below, different strategies of team learning are not substitutes but complements with complex interrelationships. The argument I make here, hence, is not that vicarious team learning is a brand new concept with clear boundaries. Rather, I build on existing research and argue that while vicarious team learning has been acknowledged as important, it has not been given scholarly attention that corresponds to this importance. Consequently, systematic research is lacking on what activities are involved in vicarious team learning, how they relate to other strategies of team learning, and what the performance effects are

of vicarious team learning behavior. My goal, hence, is to situate vicarious team learning in the context of our knowledge on team learning, and to theorize about how it works and how it matters.

To build this argument a conceptual foothold is needed. Therefore, I start by anchoring the notion of vicarious team learning in descriptive detail from a two-year exploratory field study of team learning in a pharmaceutical firm, referred to here as PHARMACO (see Chapter 1 for details.) At the time, PHARMACO was facing a particularly challenging task environment of high external demands combined with low internal task experience.

The heart of this study was a multiple-case research design used to explore six project teams (Eisenhardt, 1989a; Yin, 1989; Brown & Eisenhardt, 1997). The primary data source was 92 semi-structured interviews with individual respondents, 54 of which were taped (confidentiality concerns prevented me from taping all interviews). In addition, I attended management meetings, project team meetings, presentations by management consultants, conferences and workshops. I also had access to secondary sources from PHARMACO such as internal newsletters, project reports, email correspondence, strategy documents, and process manuals. As is typical of exploratory research, I started the analysis by building individual case histories with the intention of leaving further analysis until all cases were completed (Yin, 1989; Brown & Eisenhardt, 1997). I did two to three follow-up interviews with informants for each case and had them review case descriptions and add details. I then reviewed the case stories again to identify similarities and differences across cases. For each emerging insight I revisited the original field notes, interview notes and tapes to further refine my understanding of events.

Three general findings emerged from this process. First, team members made a clear distinction between learning to perform their task based on their own experiences, on the one hand, and learning from others outside the team, on the other. The collection of contextual knowledge, such as market information and technical detail, was seen as yet another distinct activity. Second, operating with low internal task experience, team members invariably preferred vicarious learning to experiential learning for reasons of both efficiency and quality of their work. Third, teams that engaged in vicarious learning behavior were rated as better performers according to external raters than those that did

not. Specifically, evidence suggested that vicarious team learning enabled the teams to avoid repeating mistakes and "re-inventing the wheel," to shortcut the process and save time, to innovate, and to start at a higher level of competence overall.

For a representative example, consider the story of the Pike team. Pike is a pseudonym for a team — named after a fish like other teams at PHARMACO — charged with identifying, evaluating, acquiring, and developing a molecule into a new anti-inflammatory drug. Since PHARMACO had patented no molecules of this particular kind, the team knew from the start that it would have to pursue this molecule from an outside source, most likely a biotech firm. The project was extremely important to the firm, but the team also faced major challenges. In particular, none of the team members had prior experience involving the kind of molecule that they were now charged with working on — an increasingly common situation for drug development teams in the pharmaceutical industry. How did the Pike team rise to the challenge to complete its task? From the outset it turned to a strategy of vicarious learning.

The first team meeting was devoted to finding out who on the team knew what, what they did not know as a team, and where to find out. Since the task was radically new for all team members, figuring out how to complete the task on their own by trial and error was simply not an option. They would not even have known where to start. Hence, one of the first things the team decided to do was to identify teams and individuals from whom they could learn. Soon they found another internal team, referred to here as the Tarpon team, which had recently concluded a project involving a molecule of a similar kind. As it turned out, Tarpon came to play a significant role in the Pike team's story. Numerous times during the project Pike invited the Tarpon team for discuss and reflect on how to complete the task, and when face-to-face meetings were not feasible, the team set up phone conferences.

The first major impact that Tarpon had was that its advice on how to identify promising molecules led Pike to the source of the specific molecule that became the raison d'etre of the project — a mid sized biotech firm. Having decided that this molecule looked interesting enough to pursue, the team needed to assess its scientific quality and commercial potential. Members assembled available information, but again, their inexperience was painfully obvious, and they needed help. Tarpon came to the rescue once

more. This time they referred Pike to a team of two external clinical expert consultants who helped sift and sort through the available information to figure out what conclusions could and could not be drawn based on available information. They also helped Pike figure out what additional data was needed to make a reasonable judgment about how the project would unfold if the team were to acquire the molecule. In particular, on reflection the team concluded that toxicology was an area of concern, and that an elaborate series of tests needed to be designed and carried out.

Tarpon had acquired equipment for a similar series of tests not long ago, and Pike realized that it would be a good idea for them to use the same instrumentation. Hence, equipment was shipped to Pike's lab where they observed a demonstration by Tarpon team members of how to use it. Tarpon members also noted steps that they could have skipped and mistakes that they wished had been avoided. For example, they were told about one expensive set of clinical tests that Tarpon had deemed necessary to fulfill the regulatory requirements, which turned out not to be. Once Pike mastered the essentials of the new equipment, they were also able to use a checklist of tasks to perform and questions to ask handed down by Tarpon. All tests came out positive, and Pike was very excited about the prospect of acquiring and developing the drug.

First, however, they had to negotiate a deal. Team members were particularly nervous about this since the potential seller had a reputation as a tough negotiator. In preparation, therefore, Pike held a weekend workshop with a team of seasoned PHARMACO negotiators. Every Pike team member I talked to agreed that this was critical to their eventual success. Although the tutors' experiences emanated from projects that in many ways were different, Pike was able to extract valuable lessons and apply them to their own negotiation. They even came up with innovative deal structures that, although based on the templates discussed in the workshop, the tutors themselves had not seen before. In the end, they acquired the molecule, which went through the development process in record time. More importantly, it ended up as PHARMACO's best selling drug.

In sum, vicarious team learning at PHARMACO — as illustrated by Pike's experience — involved a range of different kinds of behaviors. At times it involved team members observing members of other teams operating a piece of equipment before using it themselves. At times it involved adopting checklists on how to execute tasks developed by

other teams. Sometimes the learning was more abstract, such as when teams drew on lessons learned by other teams in one context, extracted common attributes, and applied them in their own context. At other times, learning vicariously allowed teams to skip steps that had proved unnecessary in the past. Based on the taped interviews, I transcribed quotes that suggested the presence and the range of vicarious team learning behaviors. A selection of these quotes is presented in Table 1.

The study at PHARMACO served to clarify the notion of vicarious team learning by exploring its various aspects and grounding it in descriptive detail. Next, I examine how the concept fits within existing theory.

Table 1. Examples of Vicarious Team Learning Behavior

Construct	Example
Finding out who has experience from similar tasks	"We still found that we had a need for input on supply before our site visit... so we spent some time figuring out who out there [in the organization] had done this kind of thing before." "So we decided to try to find good practices in pharmacokinetics, and there are some guys around here who have done that in [similar] projects before... and we went out and found them."
Observing the work of others to extract lessons applicable to the task at hand	"To have the chance to actually watch those who are doing similar stuff [in the lab] is gold. Some things are very difficult to describe in words." "We were given the instrumentation used by a previous team, and a guy from that team... took time to show us how to use the equipment... This is something of an art."
Inviting people with relevant task experience to discuss lessons learned	"We realized that we didn't have a handle on quality assurance... we ended up inviting these guys over who had been on a team that had also looked at [a similar molecule]... The team learned a lot from those guys... about how to do this." "You go down the hallway and you hear someone saying something and you go 'Oh my god, we did not even realize'... and then you ask him to come over and share what he did when he was in the trenches... how they completed their project."
Discussing what has and has not worked in the past with teams and team members having experience from similar tasks	"We needed a good road map for how to do the valuation and so I decided to talk to some old friends of mine... they walked us through how they had done it... the mistakes that they made." "[We] went out there to put together an intelligence database... and it required speaking to tons of people who had done this before... drawing on their experience." "This [lack of knowledge] spurs creative search that will hopefully give you a proxy... You have to go out to put the puzzle pieces together, like a detective... to talk to people who have done it before who can help you do that."
Gathering data on how to do the task generated by past teams to bypass producing it again	"The team before us had developed this check list of criteria to use when evaluating the proprietary position of a compound [of the same class]. It was great. We used a copy of that list." "The most important thing you can learn from other teams is what questions to ask... They handed down an entire binder of critical questions organized by discipline."

Positioning Vicarious Team Learning in the Literature

Organizational learning researchers have long taken an interest in organizations learning from the experiences of other organizations (Levitt & March, 1988; Cohen & Levinthal, 1990; Huber, 1991; Haunschild & Miner, 1997; Baum et al., 2000; Denrell, 2003). Particularly significant to the research presented here, Argote and colleagues (Argote et al., 2000b) have argued that empirical evidence from the organizational learning literature suggests that learning between groups within organizations can have significant performance effects (Epple et al., 1991; Epple et al., 1996). For example, in a study of pizza stores, Darr and colleagues (Darr et al., 1995) found that the unit cost of production declined significantly at individual pizza stores as stores owned by the same franchisee gained experience in production as a collective, but did not explicate behavioral processes through which this occurs. Similarly, Ingram & Simons (2002) found that the profitability of individual kibbutz agricultural operations improved as a function of the experience accumulated in other operations within the group of kibbutzim to which they belonged. The studies both indicate the significance of vicarious learning activities among organizational subunits. Implications for the team level may only be deduced from what is essentially organizational level research, however, and furthermore, this work does not systematically address what learning activities are actually involved (Darr et al., 1995; Argote et al., 2000a). Consequently, I turn to the literature on team learning, which has focused more explicitly on learning activities.

Team learning. How does the concept of vicarious team learning as illustrated in the story about Pike fit within existing theories of team learning? Team learning has been defined as the activities through which a team obtains and processes knowledge that provide opportunities for it to improve (Edmondson, 1999; 2002; Gibson & Vermeulen, 2003). The definition focuses on activities as opposed to outcomes (Argyris & Schon, 1978) — a distinction that is theoretically important since it is quite common in the organizational learning literature to view learning as an outcome (e.g., Levitt & March, 1988). It is also empirically consequential since it allows processes and outcomes of learning to be investigated separately. Following Edmondson (1999), I use the term "learning behavior" to avoid confusion with learning outcomes.

A key contribution of existing team learning research is the theoretical distinction between individual level and team level learning. Traditionally, many scholars believed that learning was only meaningful at the individual level, not at the team level (Hunt, 1968); after all, as some pointed out, only people have brains (Douglas, 1986). In the wake of recent work, however, agreement has emerged that learning at the team level is not only conceptually meaningful, but also empirically important (Edmondson, 2002; Bunderson & Sutcliffe, 2003). A linchpin in this view is task interdependence, and perhaps the most important theoretical concept is the "transactive memory system" (Wegner, 1987). In short, when a team task encompasses a set of interdependent subtasks, the sharing, storing and retrieval of knowledge involved in learning must transcend individual members in order to be effective — a notion that has recently received strong empirical support (Austin, 2003; Lewis, 2003; Edmondson et al., 2003).

Learning, therefore, involves not only individual skill sets, but also interpersonal patterns of communication and coordination. Important team learning behaviors in this view include asking questions, seeking feedback, sharing information, and talking about errors (Edmondson, 1999; Gibson & Vermeulen, 2003). One significant strand of research addresses the importance of team psychological safety — a shared belief held by members that the team is safe for interpersonal risk taking — as an antecedent to team learning (Edmondson, 1999). Team members have a tendency to share only information that they already know and agree on (Stasser et al., 2000), and Edmondson (1999) showed that psychological safety helps overcome this tendency. Another strand examines whether teams may sometimes learn the wrong things. In their work on habitual routines, Gersick & Hackman (1990) showed that teams sometimes run the risk of harmful learning, and how this may become catastrophically apparent when the task environment suddenly changes. More recently, Gibson & Vermeulen (2003) have demonstrated the importance of subgroups as a stimulus for team learning behavior.

Importantly, until now team learning research has largely been based on an internal processing view of team learning. Explicitly or implicitly, conceptual and empirical work has mainly focused on the internal team interaction activities through which individuals acquire, share and combine knowledge (Nemeth, 1986; Stasser, 1992). Furthermore, studies of team learning have primarily been concerned with learning from direct

experience, or experiential team learning, with some exceptions (Edmondson et al., 2003). In other words, they have addressed activities related to the direct experiences of team members — whether contemporaneous or stemming from past tasks.[2] For conceptual clarity, and to make the distinction with vicarious learning behavior more salient, I refer to this learning behavior as "experiential" team learning behavior. Importantly, these behaviors have been found to be positively related to performance (Edmondson, 1999; Gibson & Vermeulen, 2003). Through such behaviors teams are able to detect and correct errors (Argyris & Schon, 1978), and to improve team members' collective understanding of a situation or discover unexpected consequences of previous actions (Edmondson, 1999).

By largely leaving out vicarious team learning, this research does not address instances in which teams would not choose to learn how to complete their tasks chiefly by relying on internal team competencies and trial and error. This approach is quite appropriate in some settings — and indeed many antecedents of team learning research are rooted in a controlled setting of experimental teams in which alternative strategies of learning are effectively excluded — but not necessarily in others. For example, relying on internal competencies may not be appropriate when important task experiences are lacking within the team itself, and the patient use of trial and error may not be a realistic option for a team operating in an organizational setting characterized by intense time pressures. In such a dynamic task environment, as my research on the teams of PHARMACO suggests, learning vicariously may be quite a productive learning strategy.

Boundary spanning in teams. Vicarious team learning by its very definition involves going beyond team boundaries to examine what others are doing and have been doing in the past. There is a substantial body of research on boundary spanning, although it has seen

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[2] In the tradition of learning curve research, mainly represented by the work of Tyre and von Hippel (von Hippel & Tyre, 1995; Tyre & von Hippel, 1997), scholars have been particularly explicit about different kinds of experiential learning. This work differentiates between behaviors involved in contemporaneous "learning by doing" and those involved in drawing on past task experiences, which has been referred to as "learning before doing" (Pisano, 1996).

little cross-fertilization with the learning literature. One stream in this research, starting with the seminal work by Allen and colleagues (Allen & Cohen, 1969; Allen, 1977), has focused on the amount of information exchanged between teams and their environment. This research shows that spanning boundaries to access information can be crucial to team performance. It also demonstrates that teams must match their information processing capability to the information-processing demands of the environment (Tushman & Nadler, 1979). This research has also identified the importance of boundary roles. Notably, Allen (1977) found that R&D teams benefited from having "stars" or "gatekeepers" channeling critical technical information into the team, and Tushman (1977) showed that the number of members taking such boundary roles depends on the task environment. More recently, research has shown that under certain conditions team structural diversity — differences in member locations, functions and other features that characterize team structure — is associated with productive information transfer across boundaries (Cummings, 2004). This boundary spanning research has contributed greatly to our understanding of the importance of external communication in teams, but the primary focus has been the frequency of communication and who is doing the communicating, not its content or purpose.

Other researchers have noted this gap. Focusing on the characteristics of knowledge, Hansen (1999) asked how the complexity of knowledge involved affects boundary activities. Drawing on social network theory, Hansen found that weak ties help teams' search for useful knowledge in general but impede the transfer of complex knowledge, which tends to require a strong tie between the two parties to a transfer. Others have set out to investigate what team members do when they span boundaries (Ancona, 1990; Ancona & Caldwell, 1992). In work particularly relevant to the present research, Ancona & Caldwell (1992) identified a number of strategies a team can adopt to manage the external environment and found that choice of strategy has a significant impact on team performance. Particularly pertinent to a discussion of vicarious team learning is what Ancona & Caldwell referred to as "scouting" activities, through which a team learns about what is "out there" in its context, such as technical and commercial data. Although the authors themselves do not use the terminology of team learning, in agreement with Argote and colleagues (2000a), I believe that scouting activities may appropriately be included in a model of team learning. To maintain symmetrical terminology with the other team

learning constructs discussed so far — *vicarious* and *experiential* learning behavior — I refer to this set of activities as "contextual" learning behavior. By engaging in such learning behavior teams have been found to learn about technical and commercial demands and to detect changes in the task environment (Ancona & Caldwell, 1992), and in that way to improve team performance.

In terms of performance, experiential learning behavior has the potential to produce positive results in ways similar to contextual learning — such as helping to detect environmental change — but contextual learning behavior is distinct since it captures effects of boundary spanning and direct contact with external sources. Similarly, while vicarious learning behavior is a kind of boundary spanning, and as such it is likely to yield positive results in ways overlapping with contextual learning, its purpose is different. It involves spanning boundaries in pursuit of experiences related to how to master specific tasks, rather than in pursuit of information about context.

Toward a fuller understanding of team learning. In sum, the learning literature has convincingly demonstrated the importance of experiential learning as a team level construct, but it has not systematically addressed vicarious team learning, which involves learning directly from the experiences of others outside the team. The boundary spanning literature has demonstrated the importance of going outside the team itself to obtain information from others, but it has not addressed the role of vicarious team learning, which involves learning how to perform tasks from others.

While the three learning strategies described here — experiential, contextual, and vicarious learning — are different, they are also highly complementary. For example, vicarious learning behavior will in all likelihood be more effective when combined with experiential learning behavior inside the team. Experiential learning also tends to help teams recognize opportunities to learn vicariously (cf. Cohen & Levinthal, 1990). Similarly, contextual learning is likely to yield opportunities for vicarious learning and vice versa.

So far, experiential and contextual learning have not been jointly considered, however, and vicarious learning behavior has tended to be either excluded from or subsumed by existing concepts. The conceptualization of team learning as consisting of at

least three different but interrelated modes provides a springboard to a fuller understanding of how teams really learn and how it influences performance.

The first step toward such a fine-grained model of team learning is to establish empirically that while related, the three strategies of learning described here are also different. This is the first objective of the empirical part of this chapter. Since experiential and contextual team learning already have empirical antecedents, the focus will largely be on vicarious team learning. The second objective, therefore, is to test the link between vicarious team learning behavior and performance.

Related Yet Different

As the discussion above suggests, team learning is a multi-faceted construct encompassing many different sets of behaviors. Importantly, these differences should manifest themselves empirically. While it is certainly true that there are teams in organizational life that could score high on all kinds of learning behaviors, as well as those that could score low on all dimensions, most are likely to display a repertoire of learning behaviors, greatly moderated by characteristics in the specific task environment.

Consider a team characterized by high levels of experiential learning behavior. The same team may well engage in little context learning if the team has few gatekeepers who know their way around the external information environment. Furthermore, a team that engages in high levels of contextual learning may display little vicarious learning, if there are few pioneering teams around that possess relevant task experiences. The point is that there are a number of combinations of behaviors related to learning that a team may engage in, many of which we are likely to find naturally occurring in organizational teams. The focus here is specifically on vicarious learning, leading to the following hypothesis.

Hypothesis 1 (H1): *Vicarious team learning behavior is distinct from both experiential team learning behavior and contextual learning behavior.*

Performance Effects of Vicarious Team Learning Behavior

The findings from PHARMACO, coupled with the findings from organizational learning research described earlier, give us strong reasons to expect that vicarious team learning behavior is positively associated with team performance, particularly in settings where there are pioneering teams to learn from (Edmondson et al., 2003). Some of the mechanisms linking vicarious learning behavior and performance are the same as those found in research on experiential learning behaviors discussed earlier. Both concepts involve detecting and correcting errors and improving team members' collective understanding. There are additional mechanisms at work, however. As suggested by Ingram & Simons (2002), learning from the experiences of others is likely to be related to performance since it expands the space of learning opportunities. Similarly, while some of the performance benefits of vicarious learning behavior are akin to those identified in research on contextual learning behavior, the purpose of the two sets of activities are distinctly different; one purpose is to learn how to perform a task from others, and the other is to obtain contextual information from others.

My own research at PHARMACO suggests that vicarious learning behavior can provide opportunities to improve the efficiency and the quality of team outcomes as well as overall performance. By avoiding reinventing the wheel through their own trial and error processes, team members can save time and thereby improve efficiency. By avoiding repeating mistakes and drawing on lessons learned to come up with innovative solutions, team members can improve quality. Both processes are likely to contribute to overall performance.

Hypothesis 2 (H2): *Vicarious team learning behavior is positively associated with performance in organizational teams.*

METHODS

To test the hypotheses, I studied learning behavior among in-licensing teams within the drug development operations of large pharmaceutical firms. These are project teams

charged with the task of researching all aspects of a molecule discovered by an external source, typically a small biotechnology firm, with the objective of acquiring and developing this molecule into a marketable drug. The process ends with the decision to acquire or not to acquire the molecule. For pharmaceutical firms, this has become a strategically critical task in the wake of the molecular biology revolution (Aitken et al., 1998; Longman, 2001).

In-licensing of drugs in the pharmaceutical industry is an attractive research setting. Focusing on pharmaceuticals removes any industry-related variance from the sample and therefore reduces unobserved heterogeneity. Furthermore, drug development is a high technology operation dependent on complex state-of-the-art knowledge. Teamwork in this task environment requires a high level of interdependence and intense interpersonal interaction. Hence, it is a context in which one would expect team learning to be important. In-licensing teams are particularly suitable for a study of learning because they have to work with a technology for which they typically have little intuitive understanding at the outset, since the molecule originates outside their own research organization. As a consequence, they have to climb a steep learning curve in a relatively short time in order to succeed. Drug in-licensing teams are not representative of all organizational teams. However, salient in the task environment faced by these teams are many of the difficult challenges faced by teams operating in fast-paced, innovation-driven organizations today.

Data

The data for this study come from the drug licensing departments of six large pharmaceutical firms. All firms in the sample retain in-house drug discovery as well as pre-clinical and clinical development capabilities. Access was largely negotiated through the members of the Healthcare division of the Licensing Executive Society, an international professional association. Within each firm, using the sampling frame described next, four to ten project teams were randomly sampled for study. The final sample size was 43 teams. Among the sampled projects, 30 ended in an agreement to acquire the molecule and 13 did not. This distribution was random and not part of the sampling frame.

The selected project teams had concluded their work no longer than one year ago — and typically no more than six months ago — at the time of data collection. The focal technologies were all molecules at the early stage of development (pre-clinical stage or very early clinical stage) and although they were not all in the same therapeutic class, they were similar in the sense that the set of issues confronting the teams were highly comparable.[3]

The retrospective collection of team data was a design selected for practical reasons encountered in the field. A number of the senior executives who agreed to have their firms participate in the project felt strongly that for the study to produce useful results it should not focus on ongoing projects. Furthermore, the risks of substantial delays as well as informants leaving and firms being reconstituted during the course of a project are quite high in the turbulent pharmaceutical industry. An important advantage of this design for the researcher, therefore, was that data collection was less vulnerable to disruptions and delays.

Since many measures in this research depend on team member responses, a limitation of the design is that it may involve recall problems — that is, respondents may forget past events. Research has generally shown that recall inaccuracies tend to be biased toward the mean, and hence are unlikely to result in "false positives" (Freeman & Romney, 1987). Yet they remain a concern. A related issue is halo error, that is, the risk that general feelings about the outcome of a process may color judgment of the process itself. Reviews have revealed inconclusive evidence on halo effects (Balzer & Sulsky, 1992), and research on teams has found that quantitative retrospective judgments about team process (e.g., quantity of communication) are not significantly affected by halo effects, even if knowledge of team outcome is widely shared among team members (Staw, 1975). In the present study, formal assessments of team performance were neither made nor shared with team members prior to administration of the instrument, and measures were typically of a kind less likely to be affected by halo error — for example, frequencies and kinds of

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[3] This rather technical assessment was done in consultation with a panel of industry experts from the Licensing Executive Society.

behaviors were assessed rather than their perceived quality. Furthermore, should halo bias indeed be a problem, it would manifest itself in rejection of H1 although true, not in support of it although false. A necessary condition for H2 to be supported, in turn, would be that H1 is upheld.

Even so, steps were taken to partly mitigate concerns about retrospective bias. First, data were collected prior to market launch, before a firm organization-wide consensus about project outcome had had the chance to take hold. Second, I observed two ongoing project teams and interviewed members. This enabled me to track causal relationships in the process, which enhanced internal validity (Leonard-Barton, 1990). This part of the study revealed no inconsistencies between real time and retrospective accounts that raised concerns about retrospective bias. Finally, I gained access to folders of email correspondence pertaining to four of the 43 teams. These records, produced in real time in one firm, were obtained opportunistically. The records included only emails involving the team leaders, and they covered all aspects of the projects, not aspects of learning specifically. Therefore, these accounts of learning activities should not be viewed as comprehensive. Nevertheless, they can be used for triangulation. As shown in Table 2, retrospective responses assessing vicarious team learning behavior correspond well with the archival records. This supports the view that while it should be thoughtfully considered, the retrospective component of the research design does not carry significant risks of accepting hypotheses that should have been rejected.

Table 2. Retrospective Self-Reports v. Archival Records

	Self-report		Archival records	
	Score *	Rank	References **	Rank
Team 1	5.9	1	13	1
Team 2	5.1	2	7	2
Team 3	4.3	3	5	3
Team 4	2.8	4	0	4

* Team level score from six-item scale (rated from 1 = "strongly disagree" to 7 = "strongly agree") measuring vicarious team learning. Details in methods section.

** Number of references to vicarious team learning activities in team leaders' email correspondence.

An in-licensing team has a large and often changing membership. The drug development environment is further characterized by its intense time pressures. Therefore, it is not practical to approach every member of a team. Instead, I chose to interview each team leader about the project, and then to distribute a questionnaire instrument to the team leader and at least two other team members, randomly sampled from the pool of members who had been involved throughout the duration of the project. Consistent with previous research on organizational teams, the number of three respondents is judged to be both sufficient and cost-effective (Libby & Blashfield, 1978; Hauptman, 1986). The response rate was high at 90 percent.

Three external performance raters for each team were randomly sampled from the permanent high-level board that pharmaceutical firms retain to review their project teams' progress. The raters were asked to assess team performance after the conclusion of the project. The time lag between the time the project ended and the time of assessment was typically six months, and never longer than one year. Extracting responses from high level executives proved harder than from team members, but nevertheless the response rate was 70 percent.

Measures

The key measurement instruments were a team questionnaire and an external rater questionnaire. Most key measures included in the questionnaires were developed with the Likert scaling technique (with scale item responses running from 1 = "strongly disagree" to 7 = "strongly agree"). When possible, I utilized scales already established as having high levels of reliability. When a pre-existing scale did not exist, which was the case with vicarious team learning behavior, such a scale was constructed (DeVellis, 1991; Hinkin, 1998). Having generated an initial pool of items, based largely on my research at PHARMACO, I had them reviewed by a panel of experts spanning several organizations in the research setting. I then pre-tested the scales in a small sample, which resulted in a reduction of items. The final scales were analyzed in terms of their internal consistency reliability and discriminant validity. The results of this analysis are presented below. In addition, important team specific information was collected in an interview with the leader of each team and important organization specific information was collected in an interview

with a high-ranking representative of each participating firm. As far as possible, I also obtained archival records for purposes of triangulation.

Dependent variable. In previous research, the performance of project teams in product development settings has been measured by sales revenue and speed (Hansen, 1999), neither of which is valid in the setting studied here. Specifically, not all projects ended with an acquisition, and even those that did had still not reached the market at the time of this research project. Similarly, in the highly regulated and interdependent setting of pharmaceutical in-licensing, team members themselves often do not have full control of the speed of the process.

To test the effect of vicarious team learning behavior on team performance (H2), I put together a set of established scales that have been successfully deployed to measure efficiency, quality, and overall performance in similar contexts in the past (Henderson & Lee, 1992; Guinan, Cooprider, & Faraj, 1998; Edmondson, 1999; Faraj & Sproull, 2000). For example, given the task and compared to other teams that they were familiar with, raters were asked to assess the extent to which a team had done superb work, and how they rated a team's efficiency, quality, and goal achievement. In addition, following the methodology of Brown & Eisenhardt (1997), I developed a scale based on how informants defined success. This scale asked raters to assess the quality and efficiency of a team's work broken down into financial and scientific aspects. A common factor analysis of the final nine-item scale yielded one single factor with an eigenvalue larger than one — the cut-off criterion of Kaiser's eigenvalue rule (Nunnally, 1967). A scree test strongly supported the one-factor solution. This result makes it impossible to test effects on efficiency and quality separately, and therefore H2 is tested with one global measure of team performance.

Finally, since some projects ended in an acquisition and others did not, a t-test was used to assess any response bias among raters attributed to this aspect of the outcome. No significant differences were found.

Vicarious team learning behavior. The central explanatory variable of the study is vicarious team learning behavior. To capture this construct, I developed a six-item scale —

mainly based on my qualitative research at PHARMACO. It includes items such as "This team observed the work of others outside the team to help us extract lessons that we could apply to our own task" and "We invited people from outside the team to discuss how to avoid repeating past mistakes." The complete scale is shown in Table 5 along with the other explanatory variable scales.

Other explanatory variables. The first additional explanatory variable related to team learning, *experiential team learning behavior*, is assessed using a five-item scale developed by Edmondson (1999) as an approximate measure (example: "People in this team often spoke up to test assumptions about issues under discussion"). The original scale is simply labeled "team learning behavior." Consistent with the conceptual discussion earlier, the adjusted and more specific label accentuates that the scale measures one kind of learning behavior, rather than a global construct.[4]

To capture the final variable related to learning discussed here, *contextual learning behavior*, I use an established four-item scale labeled "scouting," first developed by Ancona & Caldwell (1992) as an approximate measure (example: "This team spent time and effort collecting technical information/ideas from individuals outside of the team"). Again, the re-labeling serves the purpose of highlighting the set of activities captured by the scale as an important facet of team learning.

Control variables. I control for several variables that previous research on work teams in comparable environments have found may influence team performance (Ancona & Caldwell, 1992; Edmondson, 1999; MacCormack, Verganti, & Iansiti, 2001; Cummings, 2004). *Team size* is a count of members in the in-licensing team. *Team duration* is a count of the number of months from start to finish of the project. *Resources* is measured by asking team members to assess the availability of financial, personnel, and equipment

[4] The scale was shrunk from the original seven-item scale by removal of the two scale-items which yielded the weakest statistical properties in Edmondson's study. I also consulted Edmondson to ensure theoretical consistency.

resources (Cummings, 2004). Finally, I measure team *experience* by averaging the time individual team members have been working with in-licensing teams.[5]

A few other variables merit consideration. Overlap in the membership of teams may be beneficial if members can transfer task experiences gained from one team to another that way (Kane, Argote, & Levine, 2002). To the extent this rotation among teams occurs, it should influence team learning behavior. For example, if members with comprehensive and detailed task experiences from one team move on to another team in which those experiences are exactly applicable, then vicarious learning behavior may not be needed. Although conceptually, team member overlap is primarily an antecedent to learning behavior, there might be a direct effect between team member overlap and performance. In this data set there is very little variance in this variable, however, since there is virtually no overlap in membership across teams. Therefore, it is not part of the analysis.

Another potential control variable is the nature of the relationship with the external party from which the molecule is sourced (Sobrero & Roberts, 2001). If there is a long established relationship or if the relationship is particularly good, or bad, then team learning behavior may be influenced. There might be a direct relationship with performance as well, however, and if so this should be controlled for. For this purpose, I measured the number of times the partners had been involved in an in-licensing project together. I also used a two-item scale to measure the quality of the relationship ("Our relationship could not have been better" and reversely scaled "Our relationship was very difficult"). Neither of these measures had a significant relationship with any of the learning constructs or performance, and therefore, they are not included in the analysis.

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[5] I also assessed team member experience with regard to the technology, the function, their current position, the firm, and the industry. None of these aspects of experience had any significant correlation with any of the independent or dependent variables of the model. For parsimony, they are therefore excluded from this analysis.

Analytical Strategy

The analysis involves three key steps. First, I assess the adequacy of the measures with psychometric analysis. Second, use further analysis to I assess the uniqueness of vicarious learning behavior compared to experiential learning behavior and contextual learning behavior. A number of different techniques exist and each has its thoughtful proponents. I use principal component factoring with varimax rotation because this is the technique used in important antecedents to this research (Ancona & Caldwell, 1992; Edmondson, 1999; Cummings, 2004). Third, I analyze the relationship between vicarious team learning behavior and performance using random effects linear regression models. Hence, firm effects are controlled for. There are three reasons why a random effects specification is preferable to a fixed effects model to control for firm effects in this case. From the practical viewpoint, a random effects model is preferable in a small data set since it consumes fewer degrees of freedom (one instead of six in the present analysis). Substantively, it makes sense to assume that the firms in the data set are drawn from a random sample since the analysis addresses differences in the teams and not the firms from which they originate. Finally, a Hausman test was run for each model, which confirmed that the random effects specification is consistent with the data. As a further check I computed fixed effects models. This resulted in lower significance levels, but the parameter estimates remained stable, which supports the assumption of randomness.

RESULTS

Preliminary Analysis

I conducted preliminary analyses to assess psychometric properties of the instruments. First, Cronbach's alpha was computed for all reflective scales to assess internal consistency reliability. Second, correlations were calculated for the main variables in the study. The results of both analyses are shown in Table 3. All alpha coefficients for the reflective scales are above .7, which lends support to the adequacy of the measures for substantive analysis (Nunnally, 1967). One early observation is that vicarious learning behavior, experiential learning behavior, and contextual learning behavior are all

significantly correlated with performance as well as with one another. Another observation is that neither team size nor duration is significantly correlated with performance or any of the team learning variables.

Table 3. Descriptive Statistics

Variables	Mean	S.D.	1	2	3	4	5	6	7	8
1 Vicarious Learning Behavior	4.21	1.30	**.79**							
2 Experiential Learning Behavior	4.91	0.91	.49	**.74**						
3 Contextual Learning Behavior	5.12	1.14	.48	.45	**.79**					
4 Experience	3.50	1.03	.22	(-.14)	(.17)	--				
5 Resources	4.20	0.98	(.10)	(.17)	.2	.26	**.71**			
6 Team Size	17.5	6.90	(-.02)	(-.11)	(.16)	(-.05)	(.08)	--		
7 Team Duration	10.5	6.00	(-.07)	(.04)	(.14)	(.02)	-.25	(.01)	--	
8 Performance	4.34	1.28	.46	.36	.37	.38	(.16)	(-.02)	(-.15)	**.94**

Cronbach's alpha coefficients for reflective scales are presented on the diagonal. Correlations in parentheses not significant at $p > .05$, all other correlations are significant at $p < .05$.

Third, not only must a team level variable be conceptually meaningful at the team level, but data collected from individual respondents to assess a team level attribute must also converge (Kenny & La Voie, 1985). To assess inter-rater reliability, intraclass correlation coeffients using one-way analysis of variance, also known as ICC (1) (Shrout & Fleiss, 1979), were calculated for the team level variables based on reflective scales. As shown in Table 4, all intraclass correlation coefficients are greater than zero and significant, which indicates sufficient inter-rater reliability.[6]

[6] Compared to past research on organizational teams, the coefficients in Table 4 are generally larger than in some studies (Edmondson, 1999) and smaller than in others (Gibson & Vermeulen, 2003). The empirical settings of these studies are highly comparable.

Table 4. Intraclass Correlation Coefficients

Team Members (N = 122)	ICC
Vicarious Learning Behavior	.71***
Experiential Learning Behavior	.60***
Contextual Learning Behavior	.64***
Resources	.61***
External Raters (N = 90)	
Performance	.85***

** p< .05 ; *** p < .01

The Distinctiveness of Vicarious Team Learning

The first purpose of this field study is to demonstrate that vicarious team learning exists as a set of activities different from what is already established in the literature (H1). To this end, the individual level responses to the 15 items related to team learning were factor analyzed to establish the discriminant validity of the scales. The analysis resulted in three factors with eigenvalues larger than one, and a scree test supported the three-factor solution. Table 5 presents the results after a varimax rotation of the factor structure correlations using a cut-off criterion of >.40.

The factor analysis replicated the item groupings of the scales precisely, which strongly confirms the initial hypothesis about how the items should relate to one another (DeVellis, 1991). Most importantly for the purposes of this study, all the items of the vicarious team learning behavior scale load cleanly onto one factor. Notably, although the part of the scale that explicitly captures vicarious learning through observation has the lowest factor structure correlation, it does load distinctly onto the same factor as the component that addresses vicarious learning through discussion. This supports the notion of both observation and discussion as parts of a team's repertoire of vicarious learning behavior.

In combination with the significant intraclass correlation coefficients shown in Table 4, these results support hypothesis H1 that the vicarious learning behavior is a team level construct distinct from both experiential learning behavior and contextual learning behavior.

Table 5. Rotated Factors

Factor Loadings for Team Learning Dimensions (N = 122)			
Item	1	2	3
Vicarious Learning Behavior			
Going out to gather information regarding who to contact for advice about how to complete the task	.58		
Observing the work of others outside the team to extract lessons to be applied to the task	.52		
Inviting people from outside the team to discuss how to avoid repeating past mistakes	.72		
Talking to people outside the team about past failures to determine ways of improving the work process	.77		
Reflecting on what has worked in the past together with people outside the team with experience from similar tasks	.75		
Gathering data on how to do the task generated by past teams	.64		
Experiential Learning Behavior			
Taking time to figure out ways to improve the work process		.77	
Reflecting on the team's work progress		.58	
Speaking up to test assumptions about issues under discussion		.82	
Identifying new information leading to changes		.45	
Handle differences of opinion privately or off-line		.56	
Contextual Learning Behavior			
Finding out what competing firms or teams are doing on similar projects			.73
Scanning the environment inside or outside the organization for marketing ideas/expertise			.81
Collecting technical information/ideas from individuals outside the team			.65
Scanning the environment inside or outside the organization for technical ideas/expertise			.76

Vicarious Team Learning Behavior and Performance

The second objective of the field study is to examine the performance effects of vicarious team learning (H2). To test the relationship between different kinds of team learning behavior and performance, I ran regression models using team-level composites of the external raters' ratings of team performance as the dependent variable and measures obtained from team members as regressors. Table 6 shows the key results and, for parsimony, the only significant control variables: experience and resources.

Adding vicarious team learning behavior to the baseline model reveals that vicarious team learning behavior is a significant predictor of team performance and that it adds substantially to variance explained (model 2). When the same minimal test with one learning variable was repeated using experiential learning (model 3) and contextual learning (model 4), it yielded similar results. When all variables of the model are added together, contextual learning drops to statistical insignificance while the other learning

variables remain significant (model 5). Taken together, models 1 to 5 support hypothesis H2 that vicarious team learning behavior is positively associated with performance.

Table 6. Random Effects Models

Regression Models of Team Performance (N = 43)								
	1	2	3	4	5	6	7	8
Experience	.48***	.33**	.40***	.43***	.33**	.33**	.34**	.40***
Resources	.33**	.28**	.28**	.27*	.26*	.27*	.27*	.27*
Vicarious Learning Behavior		.42***			.29**	.30**	.35**	
Experiential Learning Behavior			.54***		.28*	.30*		.41**
Contextual Learning Behavior				.37***	.03		.13	.17
R^2 (within)	.22	.30	.26	.24	.34	.33	.31	.28

* p < .1 ; ** p< .05 ; *** p < .01

Exploring a Fine-Grained Model of Team Learning

In reality, the linear regression models presented here are too simple to capture the many faces of team learning in all their complexity. For example, the fact that contextual learning behavior drops to statistical insignificance when added to the model together with vicarious learning behavior should not be interpreted as if the variable loses its significance in practice. More likely, there is an interplay going on between the two sets of activities — contextual learning activities are likely to yield opportunities for vicarious learning and vice versa. The high correlation between the two constructs in Table 3 appears to suggest as much. The small N of the study makes it difficult to draw any firm conclusions, but adding experiential learning (model 6) and contextual learning (model 7) separately gives at least some additional support to the notion of a close relationship between the two constructs — contextual learning drops out when considered jointly with vicarious learning, while experiential learning does not. In this case, the importance of vicarious learning appears to trump the importance of contextual learning in explaining team performance, but it is easy to imagine circumstances in which the opposite would be true,

such as a context in which knowing how to complete a task is less of a concern than knowing what competitors are up to.

Similarly, the relationship between experiential and contextual learning is probably complex as well. When adding the two together, contextual learning drops out (model 8). In fact, interview data suggests that experiential learning behavior may be important in guiding contextual learning behavior. A member of the Pike team discussed earlier, echoing many others on the same team, observed that "[i]n the team meetings we had, we learned a lot about where we could go. There was so much we needed to know... that was out there."

Finally, although both vicarious learning and experiential learning are significant predictors of performance in all the models above, the relationship between these two constructs is complex too. For example, the effect size of vicarious learning is the same or slightly greater than that of experiential learning when the two are considered jointly (model 5 and 6), but the effect size of experiential learning on its own (model 3) is greater than that of vicarious learning on its own (model 4). Selectively dropping variables from the models makes substantive interpretation perilous, but the exercise does suggest the presence of a nuanced relationship.

Overall, the pattern found in Table 6 point toward a fine-grained model of learning, as discussed earlier, that is difficult to capture with precision in quantitative cross-sectional measures. In fact, it might be difficult for team members themselves to assess exactly how they engage in different behaviors in order to learn. In all likelihood, the story told by the quantitative analysis presented here is more clear-cut than the reality faced by organizational teams attempting to learn in an often-chaotic and changing task environment.

Even so, the objective here is neither to demonstrate the differential effects of various kinds of team learning behavior on performance, nor to show how these behaviors may co-evolve over time. The purpose of this study is rather more modest, namely to establish vicarious learning behavior as a distinct team level construct and to demonstrate its positive association with performance. The evidence presented here supports both hypotheses.

DISCUSSION

This research describes vicarious team learning as a set of activities that involve a range of distinct aspects. Furthermore, it demonstrates the usefulness of vicarious team learning behavior as a concept for understanding learning and performance in organizational teams. The differentiation between experiential learning and vicarious learning, so well established in theories on learning at individual and organizational levels of analysis, is important since it reveals distinct patterns of team behavior that have not been systematically addressed until now. Specifically, the data show that vicarious team learning is something beyond the internal interactions and trial and error activities that have been the focus of the team learning literature. Examining vicarious learning behavior helps making another facet of learning in organizational teams salient as well. Boundary spanning research has shown contextual learning behavior to be an important construct, and the data presented here suggest that vicarious learning at the team level involves behaviors that are related to but also different from this kind of externally oriented learning behavior. This study thus suggests that by taking vicarious learning seriously at the team level, we can contribute to two important literatures and build a valuable bridge between the two — hence, answering Edmondson's (2002) call for more research in the intersection between learning and boundary processes in teams.

There are a few other areas of research that have investigated concepts related to vicarious team learning, which merit discussion. Brown and Duguid (1991) introduced the notion of "communities of practice" in which stories and insights are shared across organizational unit boundaries. As pointed out by Edmondson (2002) though, these communities involved loosely tied networks rather than teams. Furthermore, communities of practice are typically organized around disciplines rather than tasks. Both practitioners and academics have also paid considerable attention to "best practice" and the related concept of "benchmarking." In the practitioner realm, best practices and benchmarking have typically been non-prescriptive in that the used frameworks indicate what should be done, but leaves it up to the organization to provide the implementation. Scholars, while paying attention to implementation, have focused on the "stickiness" of best practices and have tended to investigate best practices at the organizational level (Szulanski, 1996).

Vicarious team learning can be viewed as a useful complement adding insights to the activities driving benchmarking implementation and best practice transfer.

A broad but important concept that has a long history of research is "knowledge transfer." The stream of research that I find most relevant to this discussion is the careful set of empirical studies by Argote and colleagues referred to earlier (Darr et al., 1995; Argote & Ingram, 2000). Although they do not measure the different kinds of knowledge involved in knowledge transfer, they do point to the learning from the experiences of others as a particularly important part of knowledge transfer. Research on vicarious team learning may be usefully seen as building on this work by explicating the activities involved in this kind of knowledge transfer.

While they may share some properties, hence, vicarious team learning is either qualitatively different or is subsumed by these concepts. But they are by no means mutually exclusive. In fact, introducing the notion of vicarious team learning to the discourse may help shed light on important theoretical and practical aspects of communities of practice, best practice, benchmarking, and knowledge transfer.

The research presented here represents a first step in establishing vicarious team learning behavior as a construct that can help us better understand learning and performance differences in teams, but more work is needed before its implications can be fully understood. Importantly, vicarious team learning has conceptual and empirical relationships with other learning constructs that are not fully explored here. Quantitative as well as qualitative data suggest that all three sets of learning behavior investigated here should be seen as complements rather than substitutes. The nature of this complementarity is an important area of further research. My hope is that this research will have provided a conceptual stepping stone toward a fuller and more fine-grained model of team learning.

A limitation of this study is its retrospective design. The steps taken to mitigate and test for recall problems and halo notwithstanding, future research should seek to replicate the findings of this study in a setting not vulnerable to retrospective bias.

Another limitation of this study is that it does not systematically address the sources of variance in vicarious learning behavior among teams. Interviews with team leaders indicate that different levels of vicarious learning behavior seen in the studied teams were partly due to motivational factors, but that ability was the most important

factor — a finding consistent with Szulanski's (1996) research on the difficulties of transfer of best practices. In fact, team member interviews indicate that in this context, teams invariably would have liked to learn vicariously if possible, but that they often lacked the ability. Said a frustrated member from one of the teams of my study at PHARMACO: "It would have made an enormous difference if we could go outside for expertise... We would if we could."

The ability to learn vicariously appears to involve the ability to recognize the right experiences to learn from, the ability to translate the experiences of others into a language spanning boundaries, and the ability to convert language into application of others' experiences in the relevant context. Interestingly, the data does not contain any evidence of teams learning the wrong lessons. If that were a prevalent effect, after all, vicarious learning would not be a significant predictor of performance. It appears that, in the context studied here at least, if a team is not reasonably sure that expending the effort to engage in vicarious learning behavior will be productive, its members will not even try. In a time-pressured environment with complex task interdependencies the opportunity cost may simply be too high. Reflecting this sentiment, a team member at PHARMACO commented that "there is no way you'd go out there looking without knowing how it fits into the broader scheme of things." Another observation that supports this point is that teams tended to learn from teams that had already completed their tasks, rather than from ongoing teams. This way a "proof of concept" was available and causal ambiguity could be minimized.

Two root causes for lacking vicarious learning ability stand out from the interviews. First, in order for a team to learn vicariously, teams and individuals with relevant task specific experiences have to exist in its task environment. Second, in order to leverage these experiences, the team needs a context with supportive structures and procedures. Components of this support environment may be quite elaborate — such as an advanced information infrastructure with databases set up for the specific purpose of passing on task experiences — but they may also be as simple as a manager encouraging experienced teams or team members to spend time sharing experiences with less experienced teams. While their focus was on communication flows more generally, Allen & Cohen's (1969) seminal findings on how formal and informal organizational structures

influence interpersonal communication patterns appear quite consistent with this notion. In the end, these observations about antecedents are highly speculative. Further research is needed both to identify possible sources of variance in vicarious learning behavior among teams and to investigate them empirically.

Limiting the study to a particular kind of team in one industry means that generalizations to other kinds of teams in other kinds of settings should be made only cautiously. A central venue of further research is to explore the boundary conditions of vicarious team learning. This would include questions about where and when vicarious learning is a productive learning strategy for organizational teams. Importantly, if no pioneering teams exist in a team's task environment, vicarious team learning behavior is not possible. On the other hand, if the task environment is characterized by perfectly codified and readily available task knowledge, vicarious learning may well be a good learning strategy, but it would be an unlikely source of performance differences among teams. More broadly, this study points the way toward contingency thinking in team learning research, in which the most effective learning strategy — or mix of strategies — depends on the task environment in which the team operates.

An implication from this study is that managers should be explicit about the importance of vicarious team learning. To orchestrate productive vicarious learning among organizational teams, managers could encourage and reward vicarious team learning behavior, and also work to configure an organizational context supporting such behavior. More broadly, managers could foster a culture that promotes seeking out and sharing important task specific experiences among teams in the organization. Many teams are facing an environment of intense time-pressure in which critical task knowledge is simultaneously getting increasingly complex and externally dispersed (Ancona & Caldwell, 2002). Vicarious team learning is a promising strategy to deal with the challenges of such an environment.

CONCLUSION

Two conclusions stand out. First, while related to other strategies of team learning, vicarious team learning involves its own unique behavioral aspects. The team learning literature has recently added to our understanding of how teams learn, but the focus has largely been on experiential learning and internal team interactions, not on learning directly from external sources. Boundary spanning research has added to our understanding of activities involved in the exchange between teams and their environments, but when concerned about learning, it has been about teams learning what goes on in the external context, not about teams learning how to perform tasks. Thus, by examining vicarious team learning, the research presented here draws upon and contributes to both of these bodies of literature, and it also builds a conceptual bridge between the two. Second, vicarious team learning behavior is positively associated with team performance and, hence, this study shed light on a hitherto under-explored dimension of what makes a team effective. In the end, the relationship between vicarious learning and other behaviors related to learning is complex and difficult to untangle. My hope is that by building on existing research, and by adding a new level of conceptual clarity about different strategies of team learning, this chapter provides a starting point on a journey toward a more fine-grained model of how teams learn.

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