Organization Science
Vol. 21, No. 1, January–February 2010, pp. 81–96
ISSN 1047-7039 | EISSN 1526-5455 | 10 | 2101 | 0081
DOI 10.1287/orsc.1080.0413

External Learning Activities and Team Performance: A Multimethod Field Study

Henrik Bresman
INSEAD, 77305 Fontainebleau Cedex, France, henrik.bresman@insead.edu

This paper reports on a study of external team learning activities and their performance effects. It proposes and tests a model that consists of two sets of external learning activities: those that allow a team to learn from external experienced others about its task (vicarious learning activities) and those that allow a team to learn from external sources about its context (contextual learning activities). Qualitative data from six teams in one pharmaceutical firm are used to develop measures. Survey data from 62 additional teams in six other pharmaceutical firms are used, first to test the measurement model using structural equation modeling and second to test the relationships between external learning activities and team performance using random-effects regression models. Results show that vicarious learning activities are more strongly associated with performance when teams engage in more internal learning activities. Furthermore, vicarious learning activities in the absence of sufficient amounts of internal learning activities can hurt performance. The positive performance associated with contextual learning activities, by contrast, is unaffected by the level of internal learning activities. The paper contributes by distinguishing between two kinds of external learning activities and showing that they put different demands on teams to be effective. This is important because it helps us better understand how teams engage effectively in learning activities across their boundaries.

Key words: team learning; vicarious learning; team performance; multimethod research
History: Published online in *Articles in Advance* January 22, 2009.

Introduction

As innovation becomes ever more essential to growth in the face of competition, firms rely increasingly on teams to realize their innovation goals, giving such teams a new strategic significance (e.g., Ancona et al. 2002, Wheelwright and Clark 1992). Importantly, this puts the burden on teams to learn—intensively, effectively, and rapidly. A growing literature has expanded our understanding of team learning activities—the activities through which a team obtains and processes knowledge that allow it to improve its performance (e.g., Edmondson 1999).[1] Recent work has pointed out that, in addition to engaging in internal learning activities, teams in organizations also must engage in external learning activities (Argote et al. 2001, Edmondson et al. 2003, Wong 2004). Confronted with time pressure, lack of knowledge, changing circumstances, and resource scarcity, teams are increasingly turning to boundary spanning in search of external sources to learn from rather than relying solely on their own experiences and knowledge (Edmondson et al. 2003).

Ancona and her colleagues (Ancona and Caldwell 1992, Gladstein 1984) first documented the performance effects of external activities in teams. More recently, Wong (2004) focused specifically on boundary-spanning activities associated with learning, measured the extent to which teams engaged in external learning activities, and found a significant link between this and performance.

The different ways in which teams engage in learning across their boundaries are less well understood. In response scholars have suggested that to understand the effect of external learning activities on performance it is important to investigate the existence of different kinds of external learning activities, because they may have different effects on team performance (Edmondson 2002). The purpose of this paper is to investigate types of external learning activities in teams, to discuss how they differ and why it matters, to develop measures for them, and to empirically test a model of how external team learning activities affect performance.

The results from the study—a multimethod field study of innovation teams in the pharmaceutical industry—provide a more fine-grained explanation of how teams engage in external learning activities and how this is linked to performance. First, two types of external learning activities are identified: *vicarious learning activities*, which allow a team to learn from others with prior or concurrent similar experiences about key aspects of its task; and *contextual learning activities*, which allow a team to learn from external sources about key aspects of its context. Second, factor analysis confirmed vicarious and contextual learning activities as distinct subsets of external learning activities. Third, as predicted, vicarious learning activities were more valuable for performance when teams engaged in more internal learning activities (such as experimentation, reflection, and questioning assumptions). Further analysis of this interaction effect indicated that engaging in vicarious learning activities may hurt team performance in the absence of internal learning activities. Fourth, as predicted, contextual learning activities were positively associated with performance. No interaction effect was found between contextual and internal learning activities.

The results suggest that different external learning activities pose different challenges. Specifically, vicarious learning activities require internal learning activities to ensure effective outcomes. When learning from experienced others, getting the knowledge is only half the battle; the other half is applying it. This requires a significant amount of adjusting, experimenting, and reflecting. In other words, team members may be able to learn effectively from the experience of others only if they also learn from their own experience. If a team does not engage in such internal experiential learning activities, then engaging in vicarious learning activities may be a waste of time, or it may lead teams to apply the lessons learned by experienced others in ways that are flawed. By contrast, it appears that no significant amount of internal learning activities is required to absorb the benefits from contextual learning activities. If team members fail to pay attention to these differences (i.e., these two different types of external learning) they risk not reaping the full benefits from engaging in learning activities across their boundaries.

The paper starts with a brief review of research on external team learning activities. It proceeds to the first phase of the study involving qualitative research of a small set of teams. The preliminary findings are then integrated with extant research to develop hypotheses. The second phase of the study, using survey research, tests the hypotheses. The paper then presents the results and concludes with a discussion of implications for theory and future research.

Research on External Team Learning Activities

Until recently research on team learning has focused largely on *internal* team learning activities. These include asking questions, seeking feedback, sharing information, experimenting, talking about errors, and other activities that allow a team to learn based on the experiences of its members (Edmondson 1999). Several studies have demonstrated that internal learning activities at the team level have positive performance effects (e.g., Bunderson and Sutcliffe 2003, Gibson and Vermeulen 2003, Wong 2004) and pointed to a number of mechanisms by which performance may be enhanced. Specifically, through internal learning activities, teams are able to detect and correct errors, improve members' collective understanding of a situation, or discover unexpected consequences of previous actions, improving both the quality and efficiency of their work. A team that engages in internal learning activities may, for example, take time to reflect on its progress and test its assumptions by drawing on team members' experiences. If they discover that they do not have the requisite knowledge, then the team may have to engage in various trial-and-error processes. This may lead to new information and, in turn, changes in the way the team does its work. As such, internal learning activities may provide the team with opportunities to learn about all aspects of its work.

Recent team learning research has noted that teams also learn from *external* sources (e.g., Argote et al. 2001, Tucker et al. 2007). Zellmer-Bruhn (2003) measured teams' external knowledge acquisition process and showed a positive link to performance. Similarly, Haas and Hansen (2005) found a positive association, though it was moderated by the task situation. Wong (2004) demonstrated empirically that internal learning activities ("local learning") and external learning activities ("distal learning") differ in significant ways.

With little explicit cross-fertilization with the learning literature, a substantial body of research on boundary spanning informs the study of external team learning. Starting with the seminal work of Allen (1977), researchers have studied the amount of information exchanged between teams and their environment and the importance of boundary roles (Tushman 1977). More recently, Hansen (1999) examined how the complexity of knowledge involved influences boundary activities. Furthermore, Ancona and Caldwell's (1992) work on what team members actually do when spanning boundaries found that activities related to learning about the general context was positively associated with performance.

The general conclusion emerging from the literature is that external learning activities are important for team performance in organizational settings. Engaging in external learning activities may provide the team with opportunities to learn about its work over and above those provided by internal learning activities.

Another observation in team learning research is that teams engage in different external learning activities for different purposes (Edmondson 2002). For example, Argote and Ingram (2000) stress the importance of utilizing often-embedded knowledge of other organizational units with related experience to avoid having to start learning from scratch. Ancona and Caldwell (1992), on the other hand, focus on obtaining general information from others—who may have no task-related experience at all—to stay abreast with changes in the environment. Yet empirical research that attempts to develop this insight and to systematically differentiate among different kinds of external learning activities is lacking.

To increase our understanding of how external learning activities operate at the team level, I argue in this paper that external learning activities are variegated. To fully develop the hypotheses of this study, I concur with the view that advancing extant theory on team learning requires both qualitative and quantitative data to refine and add to the construct of external team learning and to test relationships among new and existing constructs in this domain (Edmondson and McManus 2007). The purpose of the first phase of the present study, described in the next section, was thus to collect qualitative data suitable for developing an understanding of external team learning and its implications.

Phase 1: Qualitative Research and Theory Development

Empirical Setting

The research uses data from a field study of drug development teams in a set of pharmaceutical firms. The teams studied are so-called in-licensing teams charged with researching all aspects of a molecule discovered by an external source, typically a small biotechnology firm, with the objective of acquiring and developing the 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 (Ancona et al. 2002).

In-licensing teams are charged with producing innovation—"the embodiment . . . of knowledge in original, valued new products, processes, or services" (Katz 2003, p. 3).[2] Innovation teams face a task situation characterized by considerable uncertainty. The team has no ready-made script to follow when completing its task, and, consequently, as pointed out by Edmondson and her colleagues, "due to the nature of their task, innovation teams will engage in more learning behaviors than routine production teams" (Edmondson et al. 2007, p. 299). Moreover, innovation teams typically operate in situations in which "changes in demand, competition, and technology are . . . rapid and discontinuous" (Eisenhardt 1989, p. 544). Such uncertainty means that even experienced innovation teams will need extensive external knowledge to perform effectively (Haas and Hansen 2005).

Data Collection and Analysis

The first phase of the study was conducted in a large pharmaceutical firm, referred to here as Pharmaco. The objective was to investigate external team learning activities. The firm provided me with an office at their headquarters, an internal phone line, and a research assistant. Six teams were studied in depth; the number was a function of available resources. To facilitate comparison, the sampling frame included two criteria: that the sampled projects should be in therapeutic programs that are comparable in terms of the kinds of processes and technologies involved, and that the sampled projects involve molecules at a similar stage of development. The primary data source was 92 semistructured interviews with individual respondents, 54 of which were taped (confidentiality concerns prevented me from taping all interviews). I interviewed most core members of each team (75%–100%). The top manager, ultimately responsible for any given project, was also interviewed. In addition, I had access to secondary sources such as newsletters, project reports, e-mail correspondence, strategy documents, and process manuals. A team member interview guide was used that contained open-ended questions related to the team process and a few probing questions about how the team engaged in learning (how the team obtained and processed the knowledge and information it needed, who was involved). I conducted two to three follow-up conversations for each case and had interviewees review case descriptions and add some details. As a further check, two researchers with no prior exposure to the research were asked to read the original interviews to form independent views. 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. I also created tables and graphs to facilitate cross-case comparisons (cf. Brown and Eisenhardt 1997).

I went through multiple iterations between the literature and what I had found in the field, and the constructs of the proposed model started to crystallize. The distinction between internal and external learning was supported. Furthermore, it became clear that the external learning activities emerging from the data converged on two types: vicarious learning activities and contextual learning activities. As part of this process, the research assistant and I read the notes from the case studies and coded the instances of vicarious and contextual learning activities. Differences in coding were few and were reconciled after discussion. Both constructs have relevant antecedents in the literature (e.g., Ancona and Caldwell 1992, Argote and Ingram 2000), as discussed in the hypotheses development section, but they have not been empirically examined jointly, and measures were found to be lacking.

I then went back to Pharmaco to verify that the theoretical constructs of vicarious and contextual learning activities could be operationalized and to develop scales to measure the constructs (see details below). I conducted numerous follow-up interviews and attended management meetings, project team meetings, presentations by management consultants, conferences, and workshops. In meetings and workshops I took notes and listened for examples of learning activities; in interviews I probed and verified to get additional details and reactions to possible measures.

In all, this phase of the study was a two-year undertaking that yielded an in-depth understanding of the phenomenon, a wealth of qualitative data, the basis for the

Table 1 External Learning Activities Classified Into Contextual and Vicarious Learning Activities

Contextual learning activities	Vicarious learning activities
We needed to get a general sense of…who our competitors had been in touch with, who they had bought from, how much they had paid, where they were in the process…making sure that we didn't start to develop a drug that someone else was already well on their way to develop…. We relied on a handful of different external consultants to help us.	Parallel to our internal team process we tried to find out what other teams had done working on similar drugs. We interviewed people who had been members of those teams…asked what did they think had gone well, what did they think had not gone well, what they could have done better. Then, together with them, we tried to figure out the difference between their experiences and our situation, to assess what was relevant and what wasn't…. For example, they had spent a lot of time on issues of early clinical development. This was not so relevant for us. We also had many more potential [uses for] our drug. But a lot of what they said was directly applicable, and a lot of what they had learned…was applicable to some extent.
Do your own thing, but it is important to be conscious about the environment…. We sniffed around quite a bit, and clearly, we ended up discarding [some drugs] and looking more closely at others as a direct result of what we found while sniffing around. What competitors were up to…market conditions, trends.	We developed a "skeleton" of how we thought we might do it, then we started to walk around with this skeleton and knock on people's doors, people who had done it before, to have them "squeeze" it, to hear what they thought. This was a way we could bring their experience to bear, use what they had learned when working on similar [tasks].
It was a bit of a leap and we did not know this market well. We identified an external guy who mapped the market for us…. What kind of market is it? What do customers demand? We needed to know the target population to know whether it was worth it to figure out how to evaluate and develop the drug.	We had these experienced people who had been involved in a project a few years ago with a drug of the same class, and we started an advisory group. They felt a certain loyalty since they had gone through similar things…. They demonstrated a lot of the things we needed to do in the lab so we could observe them work…. They shared the mistakes they felt they had made and told us what they would have done differently and how they thought we could work on our project more effectively.
Deregulation made it possible to enter [the market]. But the same deregulation made it possible for our competitors to enter too. New players would come in and be part of the game, we just did not know who yet…. We built an intelligence database with general information about our potential competitors…public information, but there is a lot of gossip going on at conferences and we used that too.	There's no doubt we were "standing on giants' shoulders." They did the heavy lifting. We picked up all lessons they'd learned and ran.
Part of what you have to do as a team is to keep a finger on the pulse of what is going on outside and what the technical developments are. Things are moving really fast nowadays. So conferences, thinkers, people outside with good judgment about where technology is going are really important to us.	

hypotheses of this study, and the measurement needed to test them. Quotes from my study with examples that illustrate vicarious and contextual learning activities are shown in Table 1. I turn now to a discussion of the theory that emerged from my qualitative work.

Theory Development and Hypotheses

The first type of external learning activities in the proposed model is vicarious learning activities. As noted above, these are the activities that allow a team to learn from others with similar experiences about key aspects of its task or process. They include identifying others with similar experiences and through observation and discussion finding from them what needs to be done, how to do it, and what to avoid. It has long been recognized that individuals learn not only from direct experience, but also from the experiences of others.[3] At the team level, activities by which tasks are learned from the similar experiences of others have received less attention. But important insights into such vicarious learning activities may be found in work by Argote and colleagues (Argote and Ingram 2000, Darr et al. 1995, Epple et al. 1991), who have investigated knowledge transfer between groups within organizations, or, as they define it, "the process through which one unit…is affected by the experience of another" (Argote and Ingram 2000, p. 151).

These studies do not spell out the range of specific learning activities that facilitates favorable learning outcomes, however, and the authors conclude that "a greater understanding of the micro processes underlying the transfer of knowledge is needed" (Darr et al. 1995, p. 1761). More recent research has begun to focus on some aspects of such activities. Without measuring the activities or their effects on performance, Ancona and Bresman (2005) conducted a preliminary qualitative study of product development teams at aerospace and pharmaceutical firms that suggested that vicarious learning activities at the team level may involve finding experienced others and inviting them to discuss past mistakes; reflecting with experienced others on what has worked in the past; extracting lessons about the task at hand by observing the work of others; and talking to others about ways to improve the work process.

Vicarious learning activities are important because teams that rely solely on internal experiential learning processes risk performing both less efficiently and less effectively. The work of Argote and Ingram (2000) suggests that vicarious learning activities can have significant performance effects. Research has further found that teams can learn from the experience of other similar teams, such that later adopters of a new process can progress faster than earlier adopters (Edmondson et al.

2003). In all, studies indicate that vicarious learning activities can advance performance of teams by enabling them to draw on the similar experiences of others, allowing improvements in both quality and efficiency.

Consider a team from the first phase of this study that I will refer to as the Alpha team. The team faced a difficult challenge in that they clearly lacked the necessary experience to complete the task on their own. No one on the team had worked on the specific class of drugs they were now charged with working on, and no people with such experience were available to be assigned as team members. Therefore, the members set out to identify experienced members of other teams who could help. Soon they found another team within the same firm, referred to here as the Beta team, which was about to conclude a project involving a similar kind of drug. Alpha invited members of the Beta team in to discuss their experiences. In this meeting the experienced team helped develop a list of "do's and don't's" to use when evaluating a candidate drug. It included suggestions about what to do, what not to do, and important questions to ask. On the basis of this list, Alpha soon determined that the first lead the team had identified did not meet its needs. But soon, list in hand, they identified another drug that did fit their criteria.

Members from the Beta team continued to play an important role in the development process. At times, experienced Beta members sat in on Alpha's team meetings. In these meetings, Alpha reflected on the team's process, but the reflection was guided by experienced others from the Beta team at key junctures. In one such meeting, for example, it was concluded that toxicology was an area of concern and that an elaborate series of tests needed to be designed and carried out. The Alpha team was unfamiliar with both the procedures and the instrumentation required, but the Beta team had recent experiences from conducting a similar set of tests. Hence, members from Alpha observed Beta members as they demonstrated how the task was done. During the tests and afterward, Alpha members asked detailed questions about what they observed. One member of Alpha commented, "The knowledge you need to run toxicology experiments is rich. It is difficult even for a very experienced team to give clear instructions about how to do it. When you shadow a team, important issues will come up and then you discuss them together." Though very helpful when possible, observing experienced others was not always practical. In such cases the team found other ways (e.g., telephone calls, meetings) to consult experienced others about how to design and run important experiments and how to interpret the results.

In sum, vicarious learning activities can help team members to find experienced others to learn from; to avoid repeating mistakes and reinventing practices, and skip unnecessary steps; to identify important practices and procedures; and to learn how to implement them.

Hypothesis 1 (H1). *Vicarious learning activities are positively associated with team performance.*

The second type of external learning activities is contextual learning activities. These are the activities that allow a team to learn key aspects of its context from sources outside the team. They include scanning the environment for information about what competitors are doing, data about customers, and ideas about technical trends. The notion of contextual learning activities has its roots in research on boundary spanning in teams (e.g., Allen 1977, Hansen 1999). Particularly important insights may be found in Ancona and Caldwell's (1992) work on team scouting activities, or the activities "that involve general scanning for ideas and information about the competition, the market, or the technology" (1992, p. 641).

Specific contextual learning activities, as suggested by Ancona and Caldwell (1992), include finding out what competing firms and teams are doing, scanning both inside and outside the organization for information and expertise about customers, and collecting information and ideas from the environment about the latest technical trends. It may involve obtaining competitive intelligence from a consultant or customer data from the marketing department. It may involve picking up technology trends by attending trade fairs or talking to industry gurus.

Like vicarious learning activities, contextual learning activities are important because they allow teams to be more effective than they would have been had they depended on internal learning activities alone. A team needs to know about and adjust to the context in which its task is completed. Some of this learning may take place through internal learning activities. For example, members may share observations in the team from other contexts they have experienced (Lewis et al. 2005). In a dynamic environment, however, team performance will likely depend on members reaching beyond its boundary to get up-to-date information about their context. Ancona and Caldwell's (1992) work indicates that contextual learning activities can have significant performance effects by ensuring that a team is aligned with a changing context.

Consider the experience of the Alpha team. An important part of determining whether a candidate drug has potential is to know what the competitive landscape looks like. If teams in other firms are working on similar drugs it may diminish the potential to make money from the drug. Much of this information is public in the pharmaceutical industry, but it can take time to gather. Alpha therefore asked a team from a small advisory firm specializing in competitive information to assist. Similarly, Alpha needed data about the market so that sales could be forecast. To this end the team e-mailed a marketing manager at the firm who provided information about size and demographic characteristics of the potential market.

In yet another example of contextual learning activity in action, an Alpha member attended a conference on drug development technologies. The objective was to keep track of any new technologies the team should be aware of. For example, new high-throughput screening technologies had recently arrived on the scene, promising to make quantum leaps in the speed with which the potential of molecules to treat a disease could be evaluated. Alpha thought it was important to know about these technologies in case competitors started to adopt them.

In sum, contextual learning activities can help team members to ensure that they are staying abreast with the competition, that they are working on a product that customers value, and that they are not about to be leapfrogged by new technologies. In all, I propose that these activities allow members to improve team performance by staying attuned to their context to an extent that would not be possible based on internal learning activities and vicarious learning activities alone.

Hypothesis 2 (H2). *Contextual learning activities are positively associated with team performance.*

Hence, though the two kinds of external learning activities are similar in that they both involve spanning the team boundary to learn from external sources, they differ on at least three key dimensions. First, the two external learning activities differ in their purpose. Vicarious learning activities are about avoiding reinventing the wheel and repeating mistakes, and generally starting at a higher level of competence by standing on the shoulders of others who have trodden similar paths before. Contextual learning activities are aimed at keeping track of a changing external environment by probing external sources about the status of the landscape in which the team operates. A quote from the leader of the Alpha team puts the difference in sharp relief.

> As a team, we need to learn from others for two reasons. First, we need to learn about the world outside. We need to learn about what the market looks like, what customers are doing, what the trends are, what the competitors are up to. So we need to talk to customers, to industry experts, to researchers, to journalists. You name it. In other words, we need to figure out what's going on out there. Second, we need to learn about how to run the process. How to do the research, how to do the tests, how to develop, how to manufacture. And this is new to us. So we need to find other teams, teams with experience, that can help us understand better how to get the job done. There's a lot of pressure to get it right the first time, and fast. We can't afford to re-invent the wheel.

Second, the nature of the external sources from which a team learns differ. Vicarious learning activities allow teams to improve based on the experience of others. Thus, these activities involve others who have experiences associated with tasks that are similar enough to yield applicable lessons learned. By contrast, contextual learning activities need not rely on others with experience of similar tasks. For example, the advisory firm that provided Alpha with competitive information had little specific expertise in pharmaceuticals, and the marketing manager who provided the team with data about its market knew nothing about how to evaluate and develop drugs—the team's core mission.

Finally, the content of the knowledge associated with vicarious and contextual learning differs in important ways. The experience-based knowledge associated with vicarious learning activities is rich and complex whereas the knowledge associated with contextual learning activities is not. This difference has important implications for how teams engage effectively in different kinds of external learning activities. Specifically, as demonstrated by Hansen (1999), complex knowledge is much harder to transfer from one situation to another than noncomplex knowledge.

The distinction between declarative and procedural knowledge is useful as a way to explicate the importance of knowledge complexity in vicarious and contextual learning activities, respectively (Cohen and Bacdayan 1994, Moorman and Miner 1998).[4] Declarative knowledge is about facts. It is explicit, is accessed consciously, and is often easy to articulate and store. As a result, declarative knowledge is typically more general and easy to apply across different tasks. Procedural knowledge is knowledge about how things are done. In contrast to declarative knowledge it is often tacit, is accessed unconsciously, and is often hard to articulate and store. As a result, procedural knowledge is typically difficult to apply across different tasks. Contextual learning activities are associated exclusively with declarative knowledge. Vicarious learning activities do involve declarative knowledge, but, importantly, they also involve a significant component of procedural knowledge. This makes the knowledge content associated with vicarious learning activities far more complex and more difficult to apply effectively.

As a result, vicarious learning activities may have to involve active engagement not only from the team that is trying to learn, but also from those whom it is learning. Rich experiences characterized by a mix of procedural and declarative knowledge are not easily transferred as directives on a set of slides; rather, it is achieved through an iterative process of intense interpersonal interaction involving discussion, observation, and problem solving. The great complexity of learning from the similar experiences of others, the multifaceted nature of the knowledge that is to be transferred, and the density of the interactions across team boundaries that is required point to a central tension associated with vicarious learning activities: although reinventing the wheel is inefficient, a team can truly learn a task involving procedural knowledge only by doing it. Hence, there is an intricate relationship between vicarious learning activities and internal learning activities.

This relationship has implications for how external learning activities affect performance. In particular, because vicarious learning activities involve the transfer of rich experiences manifested in both declarative and procedural knowledge content across team boundaries, team members may have to engage in internal experiential learning activities to apply vicarious experiences effectively.

The example of how the Alpha team observed the Beta team as they demonstrated how to run a series of toxicology tests provides a useful illustration. The two teams discussed how the test was run, the challenges that emerged, and so on. Although critical, this exercise was not enough by itself for the inexperienced Alpha team to go back to its own laboratory and run the tests with the same efficiency. Because of the lack of internal experience the team had to conduct some trial and error of its own before the tests could be done adequately. Along the way, the Alpha team went back to the Beta team several times for additional input on procedures and help with interpreting results. A few times Beta members came over to watch the Alpha team run their experiments and provide guidance. But the fact remained that some of the Alpha team's learning had to be done internally and experientially. A similar logic applies to a team learning how to assemble a product (Argote and Ingram 2000).

The dense interactions and the iterations between internal and external learning activities associated with vicarious learning activities are not needed in the case of contextual learning activities because the knowledge involved is declarative and relatively easy to transfer (Hansen 1999). The Alpha team leader's description of the team's interaction with the marketing manager noted above as "finding market data to plug into a spreadsheet" provides an illustrative example.

Hence, I propose that combining vicarious and internal learning activities allows members to improve team performance by adapting vicarious experiences to their own task and collective skill level in ways not possible based on vicarious learning activities alone.

Hypothesis 3 (H3). *Vicarious learning activities are more strongly associated with team performance when a team engages in more internal learning activities.*

Phase 2: Survey Research

Empirical Setting and Data Collection

The data for the second phase of the study, which allowed construct measurement and hypothesis testing, come from the drug licensing departments of six large pharmaceutical firms. This is the same type of setting (in-licensing teams) as that of the first phase, but Pharmaco was not included in the sample. All firms in the sample retain in-house drug discovery as well as preclinical and clinical development capabilities. Access was largely negotiated through the members of the healthcare division of the Licensing Executive Society, an international professional association. Using the sampling frame described next, 4-22 project teams within each firm were randomly sampled for study. The number of teams sampled per organization equals the maximum number agreed to by the participant firms. The final sample size was 62 teams. Among the sampled projects, 39 ended in an agreement to acquire the molecule and 23 did not. This distribution was not part of the sampling frame.

In the sample, 43 teams had concluded their work at the time of data collection (no longer than one year prior to the study, and typically no more than six months prior). The partially retrospective collection of team data was a design selected for practical reasons encountered in the field (for a similar design, see Haas and Hansen 2005). The steps taken to mitigate and test for retrospective bias are discussed in Appendix 1. The focal molecules were all drugs at the early stage of development (preclinical 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. This rather technical assessment was done in consultation with two industry experts from the Licensing Executive Society.

I distributed a questionnaire to the team leader and at least two other randomly sampled team members. All team leaders were technical contributors to the team. Team membership ranged from four to eight people, averaging 5.3 members, and the questionnaire responses represented 25%–75% of the team membership. These data refer to members who had been involved throughout the duration of the project, often referred to as "core team members." Drug development teams also involve short-term members, often referred to as "support team members," who perform lab tests, etc. It is worth noting that the learning behavior is likely to differ significantly between core and support team members. The task of the former group is novel, difficult, and nonroutine, whereas that of the latter group is often quite routine. Because it is the performance of core members that determines the outcome of a project, the focus here is on them. Consistent with previous research on organizational teams, the number of three respondents is judged to be both sufficient and cost-effective (e.g., Libby and Blashfield 1978). The response rate among team members who received a questionnaire was 80% for a total of 149 responses.

Three external performance raters for each team were randomly sampled from the permanent high-level board that pharmaceutical firms keep to review their teams' progress—sometimes referred to as the Licensing Assessment Board. The typical board member is a senior executive with a long career in research or business development. Board members become intimately familiar with the in-licensing teams' work through regular updates and presentations. The raters were asked to assess team performance after the conclusion of the project. The response rate was 68% for a total of 128 responses.

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").

Team Performance. To measure team performance, the dependent variable of this study, I assembled a scale of items that have been successfully deployed in the past (Henderson and Lee 1992, Guinan et al. 1998, Edmondson 1999, Faraj and 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 and Eisenhardt (1997), I developed items based on how informants defined success. These items, based on criteria from the firms' own team process assessment procedures, asked raters to assess the quality and efficiency of a team's work. The scale was reviewed by three academic experts and two industry experts. As a pretest, three raters were then asked to rate six teams (not part of the final sample) based on the scale. The final multi-item scale is presented in Appendix 2. A common factor analysis of the final scale yielded one single factor with an eigenvalue larger than one (Nunnally and Bernstein 1994). This result makes it impossible to test effects on efficiency and quality separately. Internal reliability was very high ($\alpha = 0.94$), as was agreement among judges based on the interrater agreement score ($r_{wg(j)} = 0.93$). Finally, because 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.

Learning Activities. As far as possible, I used existing scales to measure the learning activities of the model. The first variable related to team learning, *internal* learning activities, is assessed using a four-item scale developed by Edmondson (1999) as an approximate measure ($\alpha = 0.71$). The scale was shrunk from the original seven-item scale by removal of the two scale items yielding the weakest properties in Edmondson's study and one that proved statistically inadequate in this study.

No established scale exists that measures *vicarious* learning activities. Therefore, I developed one following the careful processes outlined in widely cited texts on scale development (DeVellis 1991, Hinkin 1998) and the practical implementation in key antecedents to this study (Ancona and Caldwell 1992, Edmondson 1999). Briefly, based on Phase 1 data I first identified categories of behavior associated with vicarious learning activities and formulated scale items associated with these categories. Then, I asked an expert panel of four academics and two practitioners to reviewed the categories and the scale items. Finally, as a pretest the preliminary scale was administered to 11 respondents across three teams and then adjusted based on the results. The final five item categories along with illustrative quotes from Phase 1 data are shown in Table 2 ($\alpha = 0.86$). Note that knowledge transfer via rotation of core team members (Kane et al. 2005) is not a practical option in the setting studied here, and it is not represented in the scale.

To capture the final variable related to team learning discussed here, *contextual* learning activities, I use an established four-item scale first developed by Ancona and Caldwell (1992) as an approximate measure ($\alpha = 0.75$). All three team learning activities scales are presented in Table 4.

Control Variables. I control for several variables that comparable studies have found may influence team performance (Ancona and Caldwell 1992, Edmondson 1999, MacCormack et al. 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 resources (Cummings 2004) ($\alpha = 0.78$). Finally, I measure team *member experience* by the amount of time the team member respondents have been working with in-licensing teams.[5] Correlations among the main variables of the study are shown in Table 3.

Aggregation

A team level variable must be conceptually meaningful at the team level, but data collected from individual respondents to assess a team level attribute must also converge (Kenny and La Voie 1985). I tested both interrater agreement and interrater reliability to ensure such convergence (Bliese 2000). First, I calculated an average interrater agreement score ($r_{wg(j)}$) for internal (0.89), vicarious (0.87), and contextual (0.86) learning activities, as well as for resources (0.88). All scores were thus higher than 0.70, an often-cited cutoff point (George and James 1993). Then I computed the intraclass correlation coefficient, ICC(1), for the variables. All coefficients were greater than zero and significant ($p < 0.001$), which indicates sufficient interrater reliability. In sum, the individual-level data of the study are suitable for team-level aggregation.

Table 2 Categories of Vicarious Learning Activities

Category	Example
Going out to gather information regarding who to contact for advice about how to complete the task.	"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 that] we could go to them and ask for their advice about how to do our estimation." "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… We wanted to contact them to ask questions about how to do [the task], but didn't know where to find them. We asked around… and we went out and found them."
Observing the work of others outside the team to extract lessons to be applied to the task.	"To have the chance to actually watch those who are doing similar [work in the lab] is gold. Some things are very difficult to describe in words… . You learn lessons you wouldn't have otherwise and you can really use them when you start working on your own [task]. You can start at a whole other level." "We were given the instrumentation used by a previous team, and guys from that team… took time to show us how to use the equipment… . This is something of an art."
Inviting people from outside the team to discuss how to avoid repeating past mistakes.	"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, and about how to avoid doing things they told us they shouldn't have done." "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 and the mistakes that they had made. Because you don't want to repeat those mistakes."
Talking to people outside the team about past failures to determine ways of improving the work process.	"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… . We talked about where they had failed and how we could make our process work more effectively." "It was best when people from [an experienced] team came over so that we were together in the lab fiddling with the system. If they had just sent over their specs, chances are nothing would have happened. But now we could talk directly about their failures and how we could improve on what they had done."
Reflecting on what has worked in the past together with people outside the team with experience from similar tasks.	"This [lack of experience] 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… . You talk about what they did right and about how this can help you, or maybe can't help you, with the challenges your team is facing." "And then [when members from an experienced team are with you in the lab], they say 'this is what worked for us,' and we say 'can't do that because of this,' 'OK then' they say, 'but then we can change this thing over here, then it will work for you too.'"

Notes. The categories of vicarious learning activities listed here are not independent constructs, but overlapping activities. These activities are reflected in the questionnaire items used to measure the vicarious learning activities construct in this study (see Table 4).

Table 3 Means, Standard Deviations, and Pearson Correlations for Study Variables

Variables	Mean	S.D.	1	2	3	4	5	6	7
1. Vicarious learning activities	5.35	1.14							
2. Contextual learning activities	4.30	1.40	0.43						
3. Internal learning activities	5.01	1.07	0.38	0.44					
4. Team member experience	3.63	1.11	0.18	0.27	(0.07)				
5. Resources	4.32	1.21	0.15	(0.10)	(0.08)	0.30			
6. Team size	5.34	1.09	(0.11)	(−0.13)	(−0.06)	(0.04)	(0.07)		
7. Team duration	10.91	6.39	(0.02)	(−0.02)	(−0.02)	(0.13)	(−0.10)	(−0.10)	
8. Performance	4.54	1.33	0.31	0.39	0.35	39	(0.15)	(−0.01)	(−0.04)

Note. Correlations in parentheses are not significant at $p > 0.05$; all other correlations are significant at $p < 0.05$.

Table 4 Team Learning Activities Scales and Confirmatory Factor Analysis Summary Statistics

Team learning activities scales
Internal learning activities (IL)
Taking time to figure out ways to improve the work process
Reflecting on the team's work progress
Speaking up to test assumptions about issues under discussion
Identifying new information leading to changes
Vicarious learning activities (VL)
Going out to gather information regarding who to contact for advice about how to complete the task
Observing the work of others outside the team to extract lessons to be applied to the task
Inviting people from outside the team to discuss how to avoid repeating past mistakes
Talking to people outside the team about past failures to determine ways of improving the work process
Reflecting on what has worked in the past together with people outside the team with experience from similar tasks
Contextual learning activities (CL)
Finding out what competing firms or teams are doing on similar projects
Scanning the environment inside or outside the organization for marketing ideas/expertise
Collecting technical information/ideas from individuals outside the team
Scanning the environment inside or outside the organization for technical ideas/expertise

Confirmatory factor analysis summary statistics ($N = 149$)

	Specification	χ^2	Df	p-value	χ^2 diff test	AIC	CFI	IFI	GFI	RMSEA	Factor corr. ($^{***}p < 0.01$)
Model 1	IL, VL, CL	106	62	<0.01		164	0.95	0.95	0.90	0.069	IL ↔ VL = 0.39*** VL ↔ CL = 0.35*** IL ↔ CL = 0.56***
Model 2	(IL + VL), CL	227	64	<0.01	<0.01	280	0.81	0.82	0.79	0.131	(IL + VL) ↔ CL = 0.33
Model 3	IL, (VL + CL)	256	64	<0.01	<0.01	310	0.78	0.78	0.77	0.142	IL ↔ (VL + CL) = 0.38***
Model 4	(IL + CL), VL	164	64	<0.01	<0.01	218	0.89	0.89	0.85	0.103	(IL + CL) ↔ VL = 0.44***
Model 5	(IL + VL + CL)	350	65	<0.01	<0.01	402	0.67	0.68	0.69	0.172	

Notes: Df, degrees of freedom; AIC, Akaike's information criterion; CFI, comparative fit index; IFI, incremental fit index; GFI, goodness of fit index; RMSEA, root mean square error.

Measurement Model

To establish discriminant validity and assess the measurement model I used confirmatory factor analysis (CFA) including the 13 items of the three team learning activities scales. The CFA was specified with three factors representing the three types of team learning activities. Results show adequate fit to the data ($\chi^2 = 106$, $df = 62$, AIC $= 164$, CFI $= 0.95$, IFI $= 0.95$, GFI $=$ 0.90, and RMSEA $= 0.069$). To test the distinctiveness of the three learning activities, the model was further compared to three possible two-factor models and a one-factor model. The three-factor model fit better than all the alternative specifications according to all fit indexes used. In addition, a chi-square difference test found the three-factor model to be significantly better than the second-best-fitting model ($\Delta\chi^2 = 121$, $df = 2$, $p < 0.01$). Table 4 presents fit indexes, significance levels, and correlations associated with the three-factor model (Model 1) as well as all the rival specifications.[6] In sum, the results support the proposed measurement model with internal, vicarious, and contextual learning activities as three related yet distinct learning activities.

Results

To test the hypotheses I use a series of 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 because 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 because 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, supporting the randomness assumption.

To test the relationship between different team learning activities 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 5 shows the key results and, for parsimony, the only significant control variables: team member experience and resources. Interaction effects are tested using mean-centered variables. I added the interaction effect between internal and contextual learning activities as a control in the final model. This effect is not significant.

Table 5 Random-Effects Regression Models of Team Performance, Robust Standard Errors ($N = 62$)

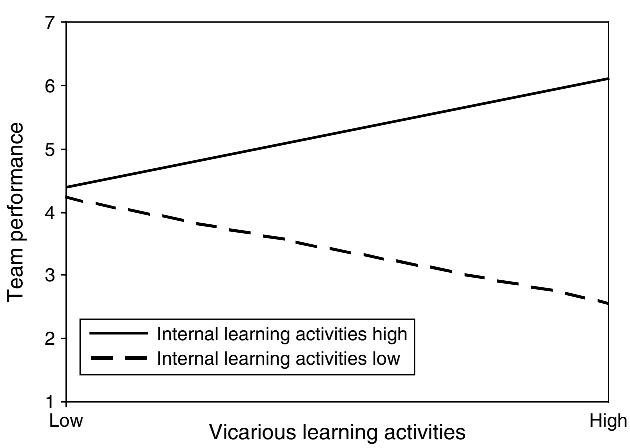
	1	2	3	4	5	6	7
Team member experience	0.50***	0.46***	0.45***	0.31**	0.33***	0.31***	0.31***
Resources	0.26***	0.26***	0.23**	0.24***	0.24***	0.29***	0.31***
Internal learning activities		0.52***			0.29**	0.33***	0.49**
Vicarious learning activities			0.36***		0.13	0.26	0.27
Contextual learning activities				0.45***	0.33*	0.28**	0.23*
Internal × vicarious learning activities						0.26***	0.22**
Internal × contextual learning activities							0.18
R^2 (within)	0.23	0.35	0.30	0.40	0.44	0.47	0.48

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Model 7 represents the specification of the theory proposed in this paper.

Hypothesis 1 states that vicarious learning activities are positively associated with team performance. The coefficient for vicarious learning activities is positive but statistically insignificant. Thus, Hypothesis 1 is rejected. Hypothesis 2 states that contextual learning activities are positively associated with team performance. The coefficient for contextual learning activities is positive and statistically significant at $p < 0.1$, supporting Hypothesis 2. Finally, Hypothesis 3 states that vicarious learning activities are more strongly associated with team performance when a team engages in more internal learning activities. The coefficient for the interaction effect between internal and vicarious learning activities is positive and statistically significant at $p < 0.05$. Hence, Hypothesis 3 is supported. To test for a nonmonotonic relationship between external learning activities and performance I created two new variables equal to the squares of vicarious and contextual learning activities, respectively. The added variables are insignificant whereas the parameter estimates for the other variables of the model remain stable (though contextual learning activities dropped to statistical insignificance). The result supports the notion of a linear relationship between external learning activities and performance.

Figure 1 Effects of Vicarious Learning Activities on Performance



An interaction plot, shown in Figure 1, provides further insight. To illustrate the direction and magnitude of effects, I dichotomized the internal and vicarious learning activities measures as high (two standard deviations above mean values) and low (two standard deviations below mean values). Mean-centered values were used. It shows that vicarious learning activities are related to better performance when teams engage in more internal learning activities. Moreover, it suggests that vicarious learning activities hurt performance if teams engage in low levels of internal learning activities.

Discussion

Internal learning processes are often not enough for a team to succeed. The goal of this paper is to develop a model of external team learning activities and performance and empirically test it in a sample of organizational teams. I present a model of external learning activities comprised of two distinct external learning activities and show their relationship to performance. Vicarious learning activities (such as observing other teams working on similar tasks and inviting experienced others to discuss how to improve) allow teams to learn about key aspects of their task, such as how to test a new drug, based on the similar experience of others. Applying these secondhand experiences can help teams better understand what the task is and how to get it done, leading to improved performance.

In contrast, contextual learning activities (such as going out to find out about customer trends and what competing firms are doing) allow teams to map their task environment and how it is changing. Applying this knowledge can help teams adapt to new circumstances and seize new opportunities, thus improving performance.

The model also proposes a performance effect from the interaction between vicarious learning activity and internal learning activity. Lessons based on the similar experiences of others are often characterized by procedural knowledge that is tacit and may not translate perfectly from one task to the next. Therefore, internal learning activities (such as experimentation, reflection, and questioning assumptions) that allow for adapting such knowledge can facilitate the performance effects of vicarious learning activity.

In an empirical study of pharmaceutical in-licensing teams, I developed measures and tested the hypothesized performance effects of the model. The findings supported the proposed positive relationship between contextual learning activities and team performance. Vicarious learning activities were found to be more valuable when teams engaged in more internal learning activities. Additional analysis suggested that vicarious learning activities may hurt performance if teams do not combine them with a sufficient level of internal learning activities. In all, this research shows the value of a more fine-grained model of external learning activities in helping us better understand how learning activities across team boundaries affect performance.

Implications for Theory

This research has several implications for research. First, the findings suggest that external team learning activities and their effects on team performance are more complex and multifaceted than previously recognized. In particular, it extends Wong's (2004) work on the performance effects of internal and external learning activities by introducing a model comprising different kinds of external learning activities. My findings suggest that teams may engage in two distinct external learning activities, each with its different pathways to performance. As such, this study provides more precise knowledge of how external learning activities influence performance (Argote et al. 2001, Edmondson 1999).

Second, the significant interaction between internal and vicarious learning activities opens the door to new insights into the relationship among external and internal learning activities (Haas and Hansen 2005, Wong 2004). Specifically, the findings point to the difficult challenges a team may encounter while attempting to learn from the experience of others. Not only must the team members identify another team with experience that is similar enough for them to model their process after, they also must continue to interact with the experienced team, through discussion and observation, to identify the specific aspects of the other team's experience that translate to their own situation and their own vernacular. They may then also have to expend significant effort engaging in internal learning activities, such as iterations of trial and error and collective reflection, to apply the vicarious experiences effectively to their own unique circumstances. If they do not, then engaging in vicarious learning activities may not only fail to benefit the team, it may actually hurt its performance. The reasons for this are not systematically examined in this study, but they may include that insufficient internal learning activities can cause teams to apply the wrong lessons from the experiences of others.

Third, in light of past work the linear relationship between external learning activities and performance found in this study bears further mention. Bunderson and Sutcliffe (2003) found that the relationship between team learning activities and performance can be curvilinear. Similarly, Haas and Hansen (2005) argued that beyond a certain point engaging in more external learning activities may be a waste of time. Based on the findings of this study, it appears that, although it is clear that teams could spend too much time learning, and not enough time doing, for organizational teams facing change—such as those studied here—the risk of wasting time may be small compared to the gain.

This research has implications for the broader literature as well. First, it has long been recognized that individuals learn not only from direct experience, but also from the experience of others (e.g., Bandura and Walters 1963, Davis and Luthans 1980, Elder 1971). As Bandura (1977) has pointed out, we would not teach adolescents how to drive or doctors how to perform surgery solely based on their own experiences of trial and error. At the organizational level, the significance of vicarious learning has also been widely recognized (e.g., Levitt and March 1988). At the team level, however, vicarious learning has not been systematically addressed. This paper adds previously lacking meso-level theory to extant macro- and micro-level theory about learning processes based on the experiences of others. As such, this research lays the foundation for better theorizing about learning and innovation at and across levels of analysis—a major concern for organizational scholars as recently argued by Gupta et al. (2007).

Second, best-practice transfer among organizational units has recently come to the forefront as an important basis of competitive advantage (e.g., Szulanski 1996, Argote and Ingram 2000). Situated primarily in the strategic management literature, this research has increased our understanding of barriers to transfer and performance effects but has not focused on the behavioral underpinnings of best-practice transfer. By examining vicarious team learning activities, this study adds insight to the set of behaviors that drives effective best-practice transfer.

Third, the ability of a firm to recognize the value of new, external information, assimilate it, and apply it, which Cohen and Levinthal have labeled "absorptive capacity" (1990), has long been a focal concept in the innovation literature. A cornerstone of Cohen and Levinthal's original theory that is typically left unaddressed, however, is that a firm's absorptive capacity "also depends on transfers of knowledge across and within subunits" (1990, p. 131). In fact, the ability to build absorptive capacity at the subunit or team level is a critical task for managers in innovation-driven environments. This research adds to our understanding of how absorptive capacity at the team level is enacted.

Finally, another strand of research in the innovation literature, the stream focused on new product development, has long emphasized the central role of project teams (e.g., MacCormack et al. 2001, Wheelwright and Clark 1992). Thus, both technological innovation and team learning researchers generally support the premise that the most important innovation work is done at the team level. At the same time, the bridge between them has not been well established. By focusing on learning in innovation teams, this study provides important material for such bridge building.

Limitations and Implications for Future Research

Though the multimethod research design and field setting provide rich insights into the multifaceted milieu faced by many organizational teams, several factors limit the study's findings. Although statistical tests were conducted, these were based on a small sample. Another limitation of this study is its retrospective component. Furthermore, using established scales designed to be simple, and yet to capture complex behaviors, means that some aspects of the underlying theory may not be captured. For example, although experimentation is an important part of the theoretical construct of internal learning activities in Edmondson's influential work (1999, p. 351), this facet is toned down in the measure. It is of value to build on existing work as far as possible, and therefore I chose to use established scales whenever such existed rather than to construct additional scales of my own. Going forward, however, there is room for expanding how we measure constructs of learning activities.

This study points to several important venues of future research. First, partitioning external team learning into separate activities allows us to examine their antecedents, moderators, mediators, and outcomes separately. Therefore, this model provides a springboard to additional and more complex theorizing about external and internal team learning activities and performance. In fact, it may be useful to explore relationships among even more fine-grained learning constructs than those presented here. For example, vicarious learning activities in this study involve both observation and discussion. In the setting studied here I did not see evidence of observation occurring without discussion. The complexity of the task appeared to make it imperative to couple observation with probing discussion. That said, exploring the relationship between observation and interpersonal communication further could increase our understanding of vicarious team learning activities in important ways. One way to gain a deeper knowledge would be a qualitative study of how the process of vicarious learning takes place over time.

Second, the positive performance effects in this study beg the question of why not all teams engage in the external learning activities specified by the model. Studying antecedents is beyond the scope of this research, but it is clearly a necessary condition for vicarious learning that teams with similar experiences exist. This is not likely to be sufficient, however. For example, Katz and Allen (1982) found that the not-invented-here (N-I-H) syndrome—when members lack the motivation to consult outsiders for advice because they believe themselves to possess all relevant experience—often puts up barriers between teams and important external learning opportunities. Mechanisms by which teams can overcome N-I-H, identify sources for external learning, and utilize the lessons they provide are likely to be critical. Further research on the antecedents to different kinds of external team learning activities is an exciting venue for further research.

Third, in their work on habitual routines, Gersick and Hackman (1990) showed that teams sometimes run the risk off harmful learning. The qualitative data do not contain much evidence of teams learning the wrong lessons or "superstitious learning" (e.g., Levitt and March 1988). The downward slope of the interaction effect plotted in Figure 1 at low levels of internal learning activities does suggest, however, that engaging in vicarious learning activities without internal learning activities might cause teams to apply the wrong lessons. More insight into the risks of learning the wrong lessons and superstitious learning at the team level associated with external learning activities would be important.

Finally, I hope that this study will help contribute to the beginnings of a discourse about how the task situation enters as a moderator in team learning models. Although the model proposed in this study is not tested across settings, it is tested in one very important setting—the one faced by innovation teams. By articulating key characteristics of this task situation, based on rich qualitative data, this study enables a valuable discussion about how its results may apply to other situations (Edmondson et al. 2007, Zellmer-Bruhn and Gibson 2006). The teams of this study operate in a dynamic setting characterized by rapidly changing demand, competition, and technology. Uncertainty about important parameters is great, and dominant procedures and routines associated with designing and producing the product have yet to emerge. Specifically, the drugs studied here are typically of a new class that has not yet reached the market and that has been discovered using methods that are not yet well established. As a consequence, the team members of this sample had little direct experience to draw on related to the drugs that they were tasked with developing. In this task situation, one may expect vicarious learning activities—such as identifying, observing, and talking to teams with related experience—to be exceptionally valuable if done right, because the team itself is likely to lack important task experience. Furthermore, effective contextual learning activities, such as talking to physicians and keeping track of competitors to ensure that the drug has a viable market, are likely to be of fundamental importance as well.

By contrast, teams operating in a more mature and well defined task situation face very different circumstances. Team members themselves are likely to have considerable task experience, and the market context is relatively stable. Consequently, although plenty of other teams with similar experience may exist, significant vicarious learning activities may not be needed, and expending a lot of effort on contextual learning activities may be a waste of time. In fact, it is in such relatively mature situations that most prior field studies of external team learning activities have been conducted (Bunderson and Sutcliffe 2003, Haas and Hansen 2005, Wong 2004, Zellmer-Bruhn 2003), which is reflected in their findings. For example, the characteristics of a mature task situation are consistent with Haas and Hansen's (2005) finding that the performance of highly experienced consulting teams suffered from engaging in extensive external learning activities. When the level of experience has reached satiation in the team, it is a waste of time to seek out more. The mature setting further helps explain why Wong (2004) found a negative interaction effect between internal and external learning activities on team efficiency. As hypothesized by Wong, members engaging in external learning activities are likely to bring new information to the internal learning process. This can slow things down when members are already quite knowledgeable about how to run the process. In a more dynamic task situation, by contrast, vicarious learning activities can speed up the process by bringing in knowledge that helps a team avoid reinventing the wheel. In sum, explicating how the findings of this study might apply across settings reveals the critical importance of a theoretical discourse concerning the role of the task situation as a moderator in models of team learning. This paper provides data to that important discussion moving forward.

Acknowledgments

This paper has benefited from the insights of many people. The author would like to especially acknowledge Deborah Ancona, Amy Edmondson, Jonathon Cummings, and members of the slump_management research group for extensive advice on this study and several drafts of this paper. Tom D'Aunno provided feedback that greatly benefited the final version. The author would also like to thank Editor-in-Chief Linda Argote and three anonymous reviewers for their guidance and suggestions. This research has been supported by the Lean Aerospace Initiative and the Program on the Pharmaceutical Industry at the Massachusetts Institute of Technology. An earlier version of this paper received the 2006 William H. Newman Award for Best Paper Based on a Dissertation from the Academy of Management. Finally, the author is grateful to the managers and teams who made the field study possible.

Appendix 1. Retrospective Bias

Several steps were taken to mitigate and test for retrospective bias. First, data were collected prior to market launch, before an organization-wide consensus about project outcome had the chance to take hold. Second, the team questionnaire was designed to minimize risks of halo effects. The introduction stated that the purpose of the questionnaire was to better understand team process. Respondents were not asked to assess the outcome of the project. Furthermore, respondents were asked to assess frequencies and kinds of behaviors rather than their perceived quality. Research on teams suggests that retrospective judgments related to the quality of behavior (e.g., quality of communication) may be affected by halo, whereas retrospective judgments related to the amount of behavior (e.g., quantity of communication) are not significantly affected by halo—even if knowledge of outcome is shared among team members (Staw 1975, Haas and Hansen 2005). Finally, following Haas and Hansen (2005), I used a series of t-tests to check for differences among the worst-performing half of the sample between the teams that had concluded their project and those that were still in progress to check for any negative attribution bias. I found no significant differences in assessments of internal, vicarious, and contextual learning activities. This supports the view that the retrospective component of the research design does not carry significant risks of accepting hypotheses that should be rejected.

Appendix 2. Team Performance Multi-Item Measure

On a scale from "strongly disagree" to "strongly agree"

1. Regarding the scientific and technical aspects of the in-licensing team's work: The quality of the team's work was high
2. [same introduction]: The team was time-efficient
3. Regarding the financial and commercial aspects of the project team's work: The quality of the team's work was high
4. [same introduction]: The team was time-efficient
5. This team did superb work

On a scale from "poorly" to "outstandingly"

6. Compared to other in-licensing teams you are familiar with, how well did this team do with regard to: The efficiency of team operations
7. [same introduction]: The quality of work
8. [same introduction]: Ability to meet project goals

Endnotes

[1]The definition focuses on activities as opposed to outcomes—a theoretically important distinction because it is quite common in the organizational learning literature to view learning as an outcome (see Edmondson et al. 2007 for a review). It is also empirically consequential because it allows processes and outcomes of learning to be investigated separately.

[2]Because in-licensing teams work on molecules discovered by another source, some may argue that their task does not constitute innovation. I concur with the view of Gupta and his colleagues that "as long as the idea is new to the people involved, it must be treated as innovation" (Gupta et al. 2007, p. 886). Furthermore, though the molecule may already be identified, a long and undefined path remains for the team before the drug reaches the market.

[3]Typically defined as learning "by watching others … and talking to them about their experiences" (Pitcher et al. 1978, p. 25), vicarious learning at the individual level has long been

recognized for its great importance. The term "vicarious learning" has been used in research in psychology (e.g., Bandura and Walters 1963), sociology (e.g., Elder 1971), and organizational behavior (e.g., Davis and Luthans 1980) in reference to individuals learning tasks from the similar experiences of others. Researchers have differed on the behavioral foundation of vicarious learning (organizational learning research using the term vicarious learning has been agnostic about the activities by which it occurs (e.g., Levitt and March 1988)). This research has at times equated vicarious learning with observational learning (e.g., Davis and Luthans 1980), and at times it has included both observation and discussion (e.g., Elder 1971). Bandura, whose name is perhaps most closely associated with vicarious learning, equated the construct with observational learning in his early work (e.g., Bandura and Walters 1963). In later work, he expanded the definition to include both observation and symbols, which can be expressed "through verbal or pictorial means" (Bandura 1989, p. 15). This notion is consistent with more recent research in experimental psychology on vicarious learning "from dialogue and discourse" (Cox et al. 1999). Bandura's later work provides the definitional foothold for the team-level vicarious learning construct used in the present paper.

[4]In the innovation and strategic management literatures the distinction between know-what and know-how is commonly used rather than that between declarative and procedural knowledge. As pointed out by Garud (1997), the two typologies essentially map onto each other.

[5]The measure was constructed with a five-item scale ($1 = <6$ months; $2 = 6$ months–1 year; $3 = 1$–5 years; $4 = 6$–10 years; $5 = >10$ years). I also assessed member experience of 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 variables of the model. For parsimony, they are therefore excluded from this analysis. Another potential control variable is the experience of the relationship with the external party from which the molecule is sourced. 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 the learning constructs or performance (there was little variance in the sample) and are not included in the analysis.

[6]I also ran models using team-level data. Though the smaller N weakened the statistical power, the results were parallel.

References

Allen, T. J. 1977. *Managing the Flow of Technology*: *Technology Transfer and the Dissemination of Technological Information Within the R&D Organization*. MIT Press, Cambridge, MA.

Ancona, D. G., H. Bresman. 2005. Begging, borrowing and building on ideas from the outside to create pulsed innovation inside teams. L. Thompson, H.-S. Choi, eds. *Creativity and Innovation in Organizational Teams*. Lawrence Erlbaum, Mahwah, NJ, 183–198.

Ancona, D. G., D. F. Caldwell. 1992. Bridging the boundary: External activity and performance in organizational teams. *Admin. Sci. Quart.* **37** 634–665.

Ancona, D. G., H. Bresman, K. Kaeufer. 2002. The comparative advantage of X-teams. *Sloan Management Rev.* **43** 33–39.

Argote, L., P. Ingram. 2000. Knowledge transfer: A basis for competitive advantage in firms. *Organ. Behav. Human Decision Processes* **82** 150–169.

Argote, L., D. H. Gruenfeld, C. Naquin. 2001. Group learning in organizations. M. E. Turner, ed. *Groups at Work*: *Theory and Research*. Erlbaum, Mahwah, NJ, 369–411.

Bandura, A. 1977. *Social Learning Theory*. Prentice-Hall, Englewood Cliffs, NJ.

Bandura, A. 1989. Social cognitive theory. R. Vasta, ed. *Annals of Child Development*. JAI Press, Greenwich, CT, 1–60.

Bandura, A., R. H. Walters. 1963. *Social Learning and Personality Development*. Holt, Rinehart and Winston, New York.

Bliese, P. D. 2000. Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. K. J. Klein, S. W. J. Kozlowski, eds. *Multilevel Theory, Research, and Methods in Organizations*. Jossey-Bass, San Francisco, 349–381.

Brown, S. L., K. M. Eisenhardt. 1997. The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Admin. Sci. Quart.* **42** 1–34.

Bunderson, J. S., K. M. Sutcliffe. 2003. Management team learning orientation and business unit performance. *J. Appl. Psych.* **88** 552–560.

Cohen, M. D., P. Bacdayan. 1994. Organizational routines are stored as procedural memory: Evidence from a laboratory study. *Organ. Sci.* **5** 554–568.

Cohen, W. M., D. A. Levinthal. 1990. Absorptive capacity: A new perspective on learning and innovation. *Admin. Sci. Quart.* **35** 128–152.

Cox, R., J. McKendree, R. Tobin, J. Lee, T. Mayes. 1999. Vicarious learning from dialogue and discourse: A controlled comparison. *Instructional Sci.* **27** 431–458.

Cummings, J. N. 2004. Work groups, structural diversity, and knowledge sharing in a global organization. *Management Sci.* **50** 352–364.

Darr, E. D., L. Argote, D. Epple. 1995. The acquisition, transfer, and depreciation of knowledge in service organizations: Productivity in franchises. *Management Sci.* **41** 1750–1762.

Davis, T. R. V., F. Luthans. 1980. A social learning approach to organizational behavior. *Acad. Management Rev.* **5** 281–290.

DeVellis, R. F. 1991. *Scale Development*. Sage, Newbury Park, CA.

Edmondson, A. C. 1999. Psychological safety and learning behavior in work teams. *Admin. Sci. Quart.* **44** 350–383.

Edmondson, A. C. 2002. The local and variegated nature of learning in organizations: A group-level perspective. *Organ. Sci.* **13** 128–146.

Edmondson, A. C., S. E. McManus. 2007. Methodological fit in management field research. *Acad. Management Rev.* **32** 1155–1179.

Edmondson, A. C., J. R. Dillon, K. S. Roloff. 2007. Three perspectives on team learning: Outcome improvement, task mastery, and group process. J. P. Walsh, A. P. Brief, eds. *Acad. Management Annals*. Routledge, New York, 269–314.

Edmondson, A. C., A. B. Winslow, R. M. Bohmer, G. P. Pisano. 2003. Learning how and learning what: Effects of tacit and codified knowledge on performance improvement following technology adoption. *Decision Sci.* **34** 197–223.

Eisenhardt, K. M. 1989. Making fast strategic decisions in high-velocity environments. *Acad. Management J.* **32** 543–576.

Elder, G. H. 1971. Racial learning and conflict. *Sociometry* **34** 151–173.

Epple, D., L. Argote, R. Devadas. 1991. Organizational learning curves: A method for investigating intra-plant transfer of knowledge acquired through learning by doing. *Organ. Sci.* **2** 558–570.

Faraj, S., L. S. Sproull. 2000. Coordinating expertise in software development teams. *Management Sci.* **46** 1554–1568.

Garud, R. 1997. On the distinction between know-how, know-why and know-what in technological systems. A. S. Huff, J. P. Walsh, eds. *Advances in Strategic Management*. JAI Press, Greenwich, CT, 81–101.

George, J., L. James. 1993. Personality, affect, and behavior in groups revisited: Comment on aggregation, levels of analysis, and a recent application of within and between analysis. *J. Appl. Psych.* **78** 789–804.

Gersick, C. J. G., J. R. Hackman. 1990. Habitual routines in task-performing groups. *Organ. Behav. Human Decision Processes* **47** 65–97.

Gibson, C., F. Vermeulen. 2003. A healthy divide: Subgroups as a stimulus for team learning behavior. *Admin. Sci. Quart.* **48** 202–239.

Gladstein, D. L. 1984. Groups in context: A model of task group effectiveness. *Admin. Sci. Quart.* **29** 499–517.

Guinan, P. J., J. G. Cooprider, S. Faraj. 1998. Enabling software development team performance during requirements definition: A behavioral versus technical approach. *Inform. Systems Res.* **9** 101–125.

Gupta, A. K., P. E. Tesluk, M. S. Taylor. 2007. Innovation at and across multiple levels of analysis. *Organ. Sci.* **18** 885–897.

Haas, M. R., M. T. Hansen. 2005. When using knowledge can hurt performance: The value of organizational capabilities in a management consulting company. *Strategic Management J.* **26** 1–24.

Hansen, M. T. 1999. The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Admin. Sci. Quart.* **44** 82–111.

Henderson, J. C., S. Lee. 1992. Managing I/S design teams: A control theories perspective. *Management Sci.* **38** 757–777.

Hinkin, T. R. 1998. A brief tutorial on the development of measures for use in survey questionnaires. *Organ. Res. Methods* **1** 104–121.

Kane, A., L. Argote, J. M. Levine. 2005. Knowledge transfer between groups via personnel rotation: Effects of social identity and knowledge quality. *Organ. Behav. Human Decision Processes* **96** 56–71.

Katz, R. 2003. *Managing Creativity and Innovation*. Harvard Business School Press, Boston.

Katz, R., T. J. Allen. 1982. Investigating the Not Invented Here (NIH) syndrome: A look at the performance, tenure, and communication of 50 R&D project groups. *R & D Management* **12** 7–19.

Kenny, D. A., L. La Voie. 1985. Separating individual and group effects. *J. Personality Soc. Psych.* **48** 339–348.

Levitt, B., J. G. March. 1988. Organizational learning. *Ann. Rev. Sociol.* **14** 319–340.

Lewis, K., D. Lange, L. Gillis. 2005. Transactive memory systems, learning, and learning transfer. *Organ. Sci.* **16** 581–598.

Libby, R., R. K. Blashfield. 1978. Performance of a composite as a function of the number of judges. *Organ. Behav. Human Performance* **21** 121–129.

MacCormack, A., R. Verganti, M. Iansiti. 2001. Developing products on "Internet time": The anatomy of a flexible development process. *Management Sci.* **47** 133–150.

Moorman, C., A. S. Miner. 1998. Organizational improvisation and organizational memory. *Acad. Management Rev.* **23** 698–723.

Nunnally, J. C., I. H. Bernstein. 1994. *Psychometric Theory*. McGraw-Hill, New York.

Pitcher, B. L., R. L. Hamblin, J. L. L. Miller. 1978. The diffusion of collective violence. *Amer. Sociol. Rev.* **43** 23–35.

Staw, B. M. 1975. Attribution of the "causes" of performance: A general alternative interpretation of cross-sectional research on organizations. *Organ. Behav. Human Performance* **13** 414–432.

Szulanski, G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management J.* **17** 27–43.

Tucker, A. L., I. M. Nembhard, A. C. Edmondson. 2007. Implementing new practices: An empirical study of organizational learning in hospital intensive care units. *Management Sci.* **53** 894–907.

Tushman, M. L. 1977. Special boundary roles in the innovation process. *Admin. Sci. Quart.* **22** 587–605.

Wheelwright, S. C., K. B. Clark. 1992. *Revolutionizing Product Development*. Free Press, New York.

Wong, S.-S. 2004. Distal and local group learning: Performance tradeoffs and tensions. *Organ. Sci.* **15** 645–656.

Zellmer-Bruhn, M. 2003. Interruptive events and team knowledge acquisition. *Management Sci.* **49** 514–528.

Zellmer-Bruhn, M., C. Gibson. 2006. Multinational organization context: Implications for team learning and performance. *Acad. Management J.* **49** 501–518.