A REVIEW OF TEAM LEARNING

by

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Abstract

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Supervising Professor: George S. Benson

The purpose of this thesis is to review literature on team learning published from 1985 to 2013. The papers were selected from academic journals from business, as well as psychology, education and management. I examine the various terms and definitions used for team learning, as well as measurement methods. I discuss models of team learning as a process of learning and its placement within the three levels of learning: individual, team, and organizational. I also suggest future directions and areas of focus for future research into team learning and its merits in the workplace.
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Chapter 1

Introduction

As one of the major work engines of organizations, teams must be effective in both skill and ability to adapt to new knowledge and concepts. Hackman and Edmonson define teams as “work groups that exist within the context of a larger organization and share responsibility for a team product or service” (Hackman, 1987; Edmonson, 2007, p.269). The importance of teams arises in the fact that “an organization’s ability to learn – that is, to improve its outcomes through better knowledge and insight – is dependent on the ability of its teams to learn” (Fiol & Lyles, 1985; Senge, 1990; Edmonson 2007, p.2). Teams need to learn effectively to adapt to changes in the market and their organizations. Learning leads to more efficient and effective work for the organization. In this way, team learning is crucial to good communication within the organization and to generate knowledge and resulting innovation (Weick and Roberts, 1993).

Team learning has been explored in a vast range of fields of study, including communication, psychology, knowledge management, and education. Researchers have published significant work on team learning and its effects in various settings (Weick and Roberts, 1993; Ellis et al., 2003). In this thesis, I review the research on team learning published from 1985 to 2013. The review focuses on three topics: 1. the various conceptions and definitions of team learning, 2. the antecedents and consequences of team learning, and 3. quantitative and qualitative measures used to investigate team learning.

This thesis is motivated by several observations regarding the literature on team learning. First, though many scholars have studied team learning, studies have either defined team learning in inconsistent terms across their research. Therefore, it has been difficult to compare findings across studies. I review the various definitions proposed for team learning and categorize their similarities and differences for comparison. Second, similar to the variation in definitions and measure of team learning, there has also been a great variety of variables and vocabulary used for defining antecedents and consequences of team learning across studies. Third, the methodologies and measures used to study team learning are as diverse and
numerous as the number of studies performed on team learning. Thus, this thesis attempts to identify and summarize similar research methods and measures to suggest a future direction for measurement strategies for team learning research. This thesis will then conclude with a discussion of important issues that need to be addressed and recommendations for future research.
Chapter 2

Literature Review

2.1 Methodology

The thesis reviews the current literature on team learning, and lays out the common measures and variables used in analyzing team learning data. I outline and present an integrative model for team learning, including the antecedents and consequences proposed by the reviewed articles. I categorize and define vocabulary to compare and contrast common definitions and concepts of team learning.

For the articles reviewed in this thesis, I searched for research papers in peer-reviewed publication databases with the key words “team learning” or “group learning” in the title, abstract, or list of keywords of the paper. The search returned 1303 academic journal articles for the years 1985 to 2013. The databases searched were EBSCOhost, Business Source Complete (1,154 papers), EconLit (82), and PsychLit (67). Out of these 1303 articles, I examined all 75 articles that defined team learning as a mediating process, excluding those that defined it as an independent or dependent variable, as well as review articles on team learning.

The thesis includes “group learning” as a keyword, because the terms “team” and “group” are often used interchangeably. The notion of ‘group’ consists of interdependent individuals who perform tasks as a member of a group. Members in a group are seen as a ‘social entity’ (Alderfer, 1997; Hackman, 1987). The notion of ‘team’ has largely replaced this term, defined as groups that develop commitment towards their organization and improve the effects of synergy among individuals (Katzenbach & Smith, 1993). However, many researchers use the terms ‘teams’ and ‘groups’ interchangeably in literature - such as in the case of Guzzo and Dickson who use concepts like, ‘empowered teams, self-managing teams, and semi-autonomous work groups’ (1996, p.309).
Figure 2.1 Team Learning Papers Published between 1985 and 2013

Figure 2.1 shows the total number of papers on team learning published between 1985 and 2013. The numbers of articles per year before the year 1990 are in the low single digits and the thesis does not include the years before 1985 since the publication of research on team learning was rarely found before 1985. The number of publication papers has significantly increased in the past ten years. Also, the rate at which researchers have team learning as a team process has accelerated, suggesting an increased focus on team-based work, its merits, and how it works.
### Table 2.1 Articles Reviewed by Year

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<th>Year</th>
<th>Journal Article Title</th>
<th>Author(s)</th>
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<td>Motivational processes affecting learning (Report)</td>
<td>C. S. Dweck</td>
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<td>Organizational learning: the contributing processes and the literatures</td>
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<td>Knowledge of the firm, combinative capabilities and the replication of technology</td>
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<td>1995</td>
<td>Knowledge, Knowledge work and organizations: An overview and interpretation</td>
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<td>Team-level predictors of innovation at work: a comprehensive meta-analysis spanning three decades of research</td>
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<td>2011</td>
<td>Multiple team membership: A theoretical model of its effects on productivity and learning for individuals and teams</td>
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<td>2011</td>
<td>Linking capacities of high quality relationships to team learning and performance in service organizations</td>
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<td>2012</td>
<td>Facilitating team learning through transformational leadership</td>
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<td>2012</td>
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<td>A multilevel model of team goal orientation, information exchange, and creativity</td>
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<td>2012</td>
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<td>2014</td>
<td>Team learning in IT implementation projects: Antecedents and consequences</td>
<td>A.E. Akgun, G.S. Lynn, H. Keskin, D. Dogan</td>
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</table>
Among the 75 articles, 7 papers are conceptual papers and review articles about team learning (Kasl, Marsick and Dechant, 1997; Ilgen et al., 2005; Kozlowski and Ilgen, 2006; Kaye and Burnett, 2006; Wilson et al, 2007; Edmonson et al., 2007; Edmonson and Roloff, 2008). 7 papers extend the concept of learning to individual levels, or organizational levels and attempt to examine how team learning links to individual learning, organizational learning, or both (Kim, 1993; Blackler, 1995; Guzzo ad Dickson, 1996; Crossan, Lane and White, 1999; Argote, Gruenfeld and Naquin, 2001; Edmonson, 2002; Magni, Paolino, Cappetta, and Proserpio, 2013). The rest of the 61 papers empirically examine how team-level predictors (e.g. team composition, team context) relate to team learning and how they affect outcomes (e.g. team performance, team mental model, and organizational learning).

2.2 Definition of Team Learning

Learning can be defined as the acquisition of knowledge through experience, study, or teaching. More specifically, it is when learners

“naturally make connections between pieces of knowledge. When those connections form knowledge structures that are accurately and meaningfully organized, students are better able to retrieve and apply their knowledge effectively and efficiently” (‘Learning Principles’, Eberly Center).

Thus, learning can be thought of as the development of efficient knowledge storage and retrieval processes, as well as the wisdom for how to apply them in constructive ways. Team learning refers to this learning, but in terms of a group of learners, or team members. In this thesis, I focus on the definitions of team learning as a process by which a team learns knowledge, shares knowledge amongst its members, and applies the gained knowledge to work more effectively and easily within the organization.

Kim states that, “because teams and organizations are composed of individuals, individual learning is the most basic unit of learning” (1993). Individual learning is defined as “a relatively permanent change in knowledge or skill produced by experience” (Weiss, 1990, p. 172). While this may seem similar to the general definition of learning given above, Weiss is referring to personal experiences occurring at the individual level.
Individual learning theory has an assumption that ideas and knowledge occur, not to organizations, but individuals (Nonaka & Takeuch, 1995). This is unlike team learning theory, where the assumption is that ideas and knowledge occur among team members, but not them individually. Team-level learning attempts to integrate and incorporate each of the members’ dispersed knowledge and ideas. That is, teams utilize team members’ individual abilities to acquire knowledge and skills. Many researchers posited that team members create new knowledge through team learning: members share and receive their collective knowledge, as well as consolidating new knowledge with their own prior knowledge (Argyis and Shon, 1987, 1996; Daft and Weick, 1984; Huber, 1991, Argote et al., 2001). This contradicts the notion that team members themselves are responsible for their own knowledge and their relation to the organization.

Throughout the current literature on team learning, there seem to be two general ways for defining team learning: team learning as a behavioral process such as proposed by Edmonson and colleagues (1999), and team learning as a socio-cognitive process proposed by Argote, Gruenfel, and Naquin (2001). Researchers who have studied both learning processes agree that team learning takes place within interactions or interpersonal relationships within a team. However, behavioral processes mainly focus on the collective actions of members seeking feedback and sharing information to change learning behavior; while socio-cognitive processes focus on how collective team learning emerges from individual learning such as one’s ideas, insights, and information (Kostolous et al., 2011). The literature divides relatively neatly along these lines, with various ideas – such as the final step of knowledge codification – shared between them. In addition to the perspective team learning as a process, I defined as different types of team learning: local learning and distal learning, and exploratory learning and exploitative learning.
2.2.1 Team Learning: Behavioral Process

The behavioral processes of team learning deal with actions that team members take, either collectively or individually, to learn and to gather new knowledge for the benefit of the organization and to simply get work done. The team, essentially, “takes action, obtains feedback, and makes changes to adopt or improve” (Edmonson, 2002, p.129). Watkins and Makrsick defined team learning as “reflection of the spirit of collaboration and collaborative skills that undergird the effective use of teams (1996, p.6). Similarly, Gibson and Vermeulen contended that team learning consists of the complementary actions of experimentation, and mutual communication and combining of learned knowledge (2003).

However, Gibson and Vermeulen also argued that though the learning actions complement each other, they are not interchangeable. For example, if team members lack experimental knowledge related to a certain task, it is difficult or nearly impossible to implement reflective communication or knowledge codification for that task (Gersick and Hackman, 1990). This is because they have not gained the necessary insights or experiences to exchange, share, and discuss any knowledge. Conversely, other researchers argued, “insights gained from experimentation can only be enhanced when team members share and discuss insights” (Stasser, 1999; Lovelace, Shapiro, and Weingart, 2000).

Thus, the authors agree that the learning activities enable teams to dynamically adapt and improve their performance in the workplace. Taken together, the concepts of team learning as a behavioral process suggest that team learning behavior consists of activities that team members carry out utilizing previously obtained data and information to create new knowledge or skills. Communication and shared experiences through activities are vital for the exchange of knowledge and development of team knowledge.

However, team learning is not limited to behavioral processes and activities between team members. Individual socio-cognitive processes are also crucial to the concept of team learning.
2.2.2 Team Learning: Socio-Cognitive Processes

The socio-cognitive processes of team learning involve 'a process of acquiring, sharing, and combining of knowledge' by team members (Argote, Gruenfel, and Naquin, 2001). Whereas behavioral processes were concerned with the relatively external processes outcomes of team learning such as diagnosing the errors and mistakes, and obtaining knowledge from the experience, this area of team learning deals with the issues of internal knowledge structures. That is, while the behavioral processes facilitate the exchange and distribution of knowledge, socio-cognitive processes strengthen and build up the knowledge of individual members within the team context.

Crossan et al. (1999) created a process model for socio-cognitive processes, but in relation to organizational learning. There were four steps in their model: intuition, interpretation, integration, and institutionalization. Kostolous, then, defined team learning as an analogous process that includes four steps: intuition, interpretation, integration and codification (Kostolous, Soanos, and Prastacos, 2011).

Intuition refers to the “preconscious recognition of pattern[s] and/or possibilities inherent in a personal stream of experience” (Weick, 1995b, p.25). Thus, intuition borrows heavily from an individual’s personal and work history. Kostolous goes on to say that “this process can affect the intuitive individual’s action, but it only affects others when they attempt to interact with that individual” (2012).

Interpretation refers to “the explanation, through words and action, of insights or idea to one’s self and to others” (Crossan et al., 1999, p. 525). This process involves interactions in which members share and the refine their intuitions.

Integration is “the process of developing shared understanding among individuals and of taking coordinated action through mutual adjustment” (Crossan et al., 1999, p. 525). After generating a common interpretation and a shared understanding within a team, team members keep up conversation to develop coordinated individual members’ knowledge. Thus, Integration
focuses on changes in cognitive elements (common interpretation and shared understanding) and actions (coordinated behaviors and team activities) (Kostolous, Soanos, and Prastacos, 2011). Those changes are developed through various modes of practice, such as storytelling. Weick and Roberts (1993) put special emphasis on stories, saying that they “reflect the complexity of actual practice rather than the abstractions of the classroom” (Seely-Brown and Duguid, 1991). Stories told by team members are more practical and cohesive than raw, individual pieces of knowledge that have been gathered in previous steps.

Codification is referred to as “enabl[ing] a team to put knowledge and ideas into practice and reflect and build on what has been learned” (Gibson and Vernulen, 2003, p. 206). Codification here is similar to the codification mentioned above in the behavioral process, where individual insights and knowledge is consolidated and reformed into shared knowledge. Cognitive elements and actions learned through the previous stages will be translated into practical, physical outcomes. Thus, the final step in team learning should result in an ability to apply the newly acquired knowledge, while also laying down foundations for another iteration of this four step learning cycle.

Without all of these steps, learning cannot take place in an effective manner. Intuition and interpretation are needed to take in and analyze new knowledge. Integration and codification are needed to process and retain the knowledge for use and application. Team members who lack the ability or capacity for any of these steps may hinder the performance of the team.

2.2.3 Different types of team learning

Team learning has been defined in several inter-related ways. (c.f Senge, 1990; Wong, 2004; Kostopoulos and Bozionelos, 2011; Reval, 2011). As noted above, it is widely defined that team learning is knowledge acquisition, sharing, and combination activities of group members (Argote et.al., 2001). Extending this concept of team learning, researchers who study team learning present the different types of team learning, because they investigate different ways to facilitate team outcomes (i.e. team performance or team effectiveness) (Edmonson, 2002; Wong,
2004). In other words, it is important to explore whether different types of team learning is trade-offs from stressing one type of team learning over other types of team learning at the same time. In doing so, it is aimed to develop team outcomes (Wong, 2004). Based on these perspectives, I will introduce two sets of team learning: Local learning and distal learning, and exploratory and exploitative learning. Related studies results that different types of learning have different impacts on team performance.

First, several modes of team learning were introduced by Wong (2004). Wong separated team learning into two distinct categories, local learning and distal learning (2004). Local learning refers to team members learning within the group, while distal learning refers to team members learning through external sources. Participants of both local learning and distal learning rely on the condition of external and interpersonal sources of knowledge exchange (e.g., Allen 1970; Ancona and Caldwell 1992a). These two types of team learning is critical because they have impacts on learning process in different ways; local learning and distal learning mutually contradict each other. In other words, team conditions that maintain balance two types of team learning should be encouraged.

In addition, Kostopoulos and Bozionelos analyzed two types of team learning activities, exploratory learning and exploitive learning. Exploratory learning refers to “those learning activities that develop new capabilities” (p. 386). On the other hand, exploitative learning refers to “those activities that refine existing knowledge and skills” (Kostopoulos & Bozionelos, 2011, p. 386). They argued that exploration and exploitation learning are distinct but mutually interrelated learning activities at team level. In contrast with the relationship between distal learning and local learning, exploratory and exploitative learning should be balanced, in order to achieve an improvement in performance. In other words, exploratory and exploitative activities should be used synergistically to enhance team learning and create a more effective work environment.
2.3 Team Learning and Related Concepts

In the following sections, I will discuss how team learning itself can also be thought of as the intermediary level between individual learning and organizational learning. Senge (1990) argued that teams are “the fundamental unit” in an organization. Edmonson states, “an increasing amount of work in organizations is carried out by teams” and that much of the organizational learning occurs in the team context (2002, p. 129). However, she also stresses the importance of individual cognition and learning as the way “through which organizational learning necessarily occurs” (2002, p. 129). I examine the three levels in detail and discuss them in relation to team learning.

2.3.1 Individual Learning and Team Learning

The consolidation of dispersed individual knowledge and memory has been studied in terms of memory systems and mental models. These concepts have been introduced in relation to teams in the forms of Transactive Memory Systems (TMS) and Team Mental Model (TMM). In the light of teams developed TMS, Team’s objective is to learn “who knows what” about its complex tasks and how a team systemically coordinates different individual team members’ memories through TMS. In a way, teams are aimed to maximize the effects of team learning through TMS.

2.3.2 Transactive Memory System and Team Learning

TMS is actively engaged in the team learning process between the interpretation and integration steps of the socio-cognitive process. According to the theory of Wegner (1987), TMS is helpful in cooperation, and the storage and retrieval of information between individuals. In other words, as a shared memory system, TMS, coordinates scattered knowledge and expertise, and refines them. Specifically, TMS allows members to retrieve non-overlapping information or knowledge through communication with other members.

Similar to team learning, TMS can be developed by focusing on internal relationships among members in a team. Team learning is facilitated by TMS, because TMS is helpful in
transferring knowledge through distributing expertise and ideas among members. As noted above, TMS is referred to as a learning system that influences team’s learning and learning transfer. TMS is a relatively new concept to explain the patterns of learning of individuals in a close relationship. In Wegner’s initial study on TMS (1987), he suggested that intimate couples solve their problems by integrating separated knowledge. He found that they solve their problems by relying on one another’s memory due to their close relationship.

Recently, TMS was applied to teams to observe the relationship between shared team members’ memory system and team learning (e.g. Liang et al., 1995; Moreland and Myaskovsky, 2000; Lewis et al., 2005). TMS refers to “a combination of an individual’s knowledge and a shared awareness of who knows what” (Austin, 2003; Wegner, 1987). In particular, Lewis et al. (2005) identified TMS as a learning system that has an influence on learning and the transfer of learned knowledge to generate sustained team performance (2005). In this way, Lewis et al. (2005) contends that team learning occurs as an outcome of having developed a TMS. TMS can be seen as being helpful in learning transfer, which is a critical feature of team learning. It takes place when members acquire knowledge in a certain situation, in turn affecting learning or performance in other situations (Singley and Anderson, 1989; Cormier and Hagman, 1987).

Lewis et al. (2005) empirically investigated the process of how TMS influences team learning, emphasizing the features of TMS that relies on members’ memory system and shared understanding knowledge relevant tasks among members. Lewis et al. presented the following three cycles to explain the theory of how TMS affects team learning (2005).

First, as members learn about the knowledge and specialties of other members, they can apply them to previously learned knowledge. Also, they can develop a set of processes for encoding, storing, and retrieving what team members know and also each member’s expertise. Second, members may learn while actually performing the required tasks. These initial “first tasks” allow the members to learn by experiencing actual work first-hand. Learning by doing helps members understand their team and tasks, as well as build patterns for communicating and
retrieving information. This cycle aims to develop TMS by establishing transferable knowledge structures and stable relationships among members. Third, performing another set of tasks produces additional learning by producing increasingly abstract knowledge about the principles underlying both tasks. The effects of third stage are evidenced by an abstract, strategic understanding of the task domain, which in turn facilitates learning transfer and performance on subsequent tasks in that domain. Thus, while in the second cycle – the initial first tasks – the members learn practical knowledge for working within the group, the third cycle reinforces more subtle information about the team dynamic and the purpose of the tasks in relation to each other and the overall goal of the group.

2.3.3 Team Mental Model and Team Learning

TMM can be thought of as outcome of team learning because mental models could act as one of the resources of team learning. In other words, TMM contributes to correcting members learning behavior such as feedback and team reflection (Blickensderfer et al., 1997). Thus, teams that develop TMM show outstanding learning behavior, which brings teams effective work results.

Like TMS, TMM is a collective mental representation that emerged from individuals’ mental models. TMM can be easily be confused with the concept of ‘knowledge sharing’. Knowledge sharing is an essential function of team learning. However, it is important to distinguish the differences among knowledge sharing, TMS, and TMM. The difference between ‘knowledge sharing’, TMS, and TMM is that TMM represents mental representations that are held in common among team members. In other words, TMM can be referred to as the degree of shared common knowledge or beliefs among team members about the team environment (Klimoski & Mohammed, 1994). TMS, on the other hand, focuses on the awareness of ‘who knows what’ and then on distributing individual members’ different expertise and specialties. Knowledge sharing is the activity of sharing and exchanging information.

TMM is another line of understanding of shared mental representations of knowledge in regards to a team’s relevant environment (Klimoski and Mohammed, 1994). TMM relies on
shared common knowledge of team members and its clear representation between those members. In the following section, I will explain the relationship between team mental model and team learning.

TMM is a collective model that emerges from individual members’ mental models. A mental model is defined as the mechanisms that allow humans “to generate descriptions of system purpose and form, explanations of system function and observed system stated, and predictions of future system states” (Rouse and Morris, 1986, p. 360). In addition, mental models are “important cornerstones for building knowledge and defining some of the cognitive processes that support change and learning” (Allee, 1997, p. 11). Mental models include the biases, beliefs, experiences, and values of individuals (Ford & Sterman, 1998). Based on this notion, mental models organized knowledge structure – declarative, procedural, and strategic - that makes it possible for individuals to interact with their environment (Mathieu, Heffner, Goodwin, and Cannon-Boewer, 2000). In a way, mental model has been linked with learning (e.g. Kim, 1993; Mohammed and Dumville, 2001).

Expanding the notion of mental model at individual level, Cannon-Bowers and Salas (1990) introduced the concept of TMMs to explain how teams function in a cooperative fashion in a rapidly changing business environment. TMM is defined as “shared, organized understanding of knowledge regarding key components of a team’s environment that is shared amongst team members” (Mohammed, Klimoski, & Rentsch, 2000).

TMMs are constantly adjusted and recreated, in ever-changing environments, through learning. Just as likely, TMM can be developed as a result of action – sharing and distributing among members, as well as learning. Also, TMM results from the activity of sharing and exchanging information and knowledge under the stable relationships among members. Just as more interaction promotes team learning, team learning fosters the development of TMM.
2.3.4 Organizational Learning and Team Learning

Organizational learning literature includes both individual-level learning and organization-level learning. Organizational learning has one basic assumption: an organization gains insight and innovative ideas through interactions that occur amongst individuals or individuals working within a team, not the organization as a whole (Nonaka and Takeuchi, 1995). Organizational learning is defined as “a process of learning of sharing and adopting the knowledge to reach maximum organizational effectiveness” (Moingeon and Edmonson, 1996). Consistent with this, Crossan et al. (1999) referred to organizational learning as the dynamic process of learning that occurs over time and across levels, as well as creating new knowledge in an organization (p.532).

Thus, organizational learning can be thought of as the outcome of team learning. This is because organizations cannot gain insight unless teams communicate and there is interaction among team members. However, knowledge learned by individuals cannot be integrated into organizational knowledge without team learning. Chen et al. posited that ‘collective learning within a team is a precursor to organizational learning’ (2002). Through the processes of team learning, such as sharing and discussing, members in an organization create new knowledge to maximize organizational effectiveness (Argyris and Schon, 1978; Daft and Weick, 1984; Huber, 1991).

Compared to individual learning – which focuses on individual learning process of gaining, sharing, and utilizing knowledge – organizational learning is viewed as the dynamic learning process of creating knowledge and achieving maximum effectiveness at the organization level. Moreover, some research contends that organizations can learn only through team members learning. In other words, teams collectively learn knowledge through interaction and exchanging their ideas (Nicolini and Meznar, 1995).
<table>
<thead>
<tr>
<th>Process Type</th>
<th>Author (year)</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral</td>
<td>Watkins &amp; Makrisck (1996)</td>
<td>Reflection of the spirit of collaboration and collaborative skills that undergird the effective use of teams (p.6)</td>
</tr>
<tr>
<td></td>
<td>Edmonson (1999)</td>
<td>An ongoing process of reflection and action, characterized by asking questions, seeking feedback, experiencing, reflecting on results, and discussing errors or unexpected outcomes of actions (p.129)</td>
</tr>
<tr>
<td></td>
<td>Sole &amp; Edmonson (2002)</td>
<td>The acquisition and application of knowledge that enables a team to address team task and issues for which solutions were not previously obvious (p.18)</td>
</tr>
<tr>
<td></td>
<td>Edmonson (2002)</td>
<td>A process in which a team takes action, obtains and reflects on feedback, and makes changes to adapt or improve (p.129)</td>
</tr>
<tr>
<td></td>
<td>Gibson &amp; Vermeulen (2003)</td>
<td>The exploration of knowledge through experimentation, the combination of insights through reflective communication, and the explication and specification of what has been learned through codification (p. 203-204)</td>
</tr>
<tr>
<td></td>
<td>Elis, Hollenbeck, Ilgen, Porter &amp; West (2003)</td>
<td>A relatively permanent change in the team's collective level of knowledge and skill produced by the shared experience of team members (p.822)</td>
</tr>
<tr>
<td>Socio-Cognitive</td>
<td>Argote, Gruenfel &amp; Naquin (2001)</td>
<td>The activity through which individuals acquire, share, and combine knowledge through experience with one another (p.370)</td>
</tr>
<tr>
<td></td>
<td>London, Polzer &amp; Omorge (2005)</td>
<td>The extent to which members seek opportunities to develop new skills and knowledge, welcome challenging assignments, are willing to take risks on new ideas, and work on tasks that require considerable skill and knowledge (p.114)</td>
</tr>
<tr>
<td></td>
<td>Kostolous, Soanos, &amp; Prastacos (2011)</td>
<td>A socio-cognitive process that includes four steps: intuition, interpretation, integration and codification</td>
</tr>
</tbody>
</table>
2.4 Measurements of Team Learning

This thesis identifies two sets of measures of team learning: 1) team learning behavior and 2) the socio-cognitive processes of team learning.

2.4.1 Measurement Set 1: Team Learning Behavior

Between the two sets of measurements, Edmonson (1999) conceptualizes team learning as “seeking and discussing errors within a team” (p.8), focusing on learning as a process rather than an outcome. Edmonson’s measure for team learning behavior is the most widely adopted, both in laboratory and field experiments. Her research has been cited 518 times since 1999, according to sources searched through EBSCOHost (Gerben and Bunderson, 2005; Edmonson, 2002; Brueller and Carmell, 2011). Out of the 75 papers in this thesis, Edmonson’s measurement is used 5 times (Chan, 2002; Edmonson, 2002; Vegt and Bunderson, 2005; Brueller and Carmeli, 2011; Savelbergh et al., 2012).

She developed survey items by conducting quantitative and qualitative research on 51 work teams in a manufacturing company. To develop the survey items, Edmonson first coordinated interviews and observations for different types of teams including New Product Development (NPD) teams, project teams and functional (marketing, manufacturing, service, and operation) teams. The remainder of the teams did not overlap with any of these and were not explained for the purposes of the studies. Then, she designed surveys and interviews to gain quantitative data for all teams. Based on these team level data, she selected and examined seven teams that showed higher or lower levels of learning behavior. Gerben and Bunderson (2005) used Edmonson’s measures to assess how learning and performance is associated.

Edmonson’s work (1999) has been broadly adopted for measurement because her measures are intensive and thorough for both laboratory and field. However, there are still more diverse metrics useful for quantifying team learning. For example, some researchers have established the concept of a “self-developed measurement” (c.f. Ellis, et al., 2003; Vashdi et al., 2013). Self-developed measurement was initially designed for the laboratory environments such
as classroom (Ellis, et. al., 2003). Another method is to develop a scenario for the observation of team learning and examining its effects. Afterwards, multidimensional research study of team learning can be developed. Recently, Dana et al. established a formula for measuring team learning (2013). I recommend a convergence of measurement systems for team learning.
### Table 2.2 Survey Questions for Team Learning Behavior (Edmonson, 1999)

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Team Learning Behavior</strong></td>
<td></td>
</tr>
<tr>
<td>Survey Questions</td>
<td></td>
</tr>
<tr>
<td>We regularly take time to figure out ways to improve our team's work process</td>
<td></td>
</tr>
<tr>
<td>This team tends to handle differences of opinions privately or off-line, rather than addressing them directly as a group</td>
<td></td>
</tr>
<tr>
<td>Team members go out and get all the information they possibly can from others such as customers, or other parts of the organization</td>
<td></td>
</tr>
<tr>
<td>This team frequently seeks new information that leads us to make important changes</td>
<td></td>
</tr>
<tr>
<td>In this team, someone always makes sure that we stop to reflect on the team’s work process</td>
<td></td>
</tr>
<tr>
<td>People in this team often speak to test assumptions about issues under discussion</td>
<td></td>
</tr>
<tr>
<td>We invite people from outside the team to present information or have discussions with us</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2.3 Survey Questions for Socio-Cognitive Processes (Kostopoulous, 2011)

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intuition</strong></td>
<td></td>
</tr>
<tr>
<td>$(\alpha = 0.91)$</td>
<td>I could combine and synthesize diverse data, information and ideas in this team</td>
</tr>
<tr>
<td></td>
<td>In this team, I offered new ideas and solutions to complicated problems (I was inventive)</td>
</tr>
<tr>
<td></td>
<td>I could effectively improvise in this team</td>
</tr>
<tr>
<td><strong>Interpretation</strong></td>
<td>In our team, we managed to agree upon the actions and activities that we should perform.</td>
</tr>
<tr>
<td>$(\alpha = 0.88)$</td>
<td>In our team we shared information, ideas and results while performing project tasks.</td>
</tr>
<tr>
<td></td>
<td>During the project, our team developed and experimented with a number of different implementation scenarios, project deliverables, prototypes or production designs.</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>We managed to agree upon the actions and activities that we should perform</td>
</tr>
<tr>
<td>$(\alpha = 0.90)$</td>
<td>In our team, we shared information, ideas and results while performing project tasks.</td>
</tr>
<tr>
<td></td>
<td>During the project, our team developed and experimented with a number of different implementation scenarios, project deliverables, prototypes or production designs.</td>
</tr>
<tr>
<td><strong>Codification</strong></td>
<td>Our team carefully documented how we did our work.</td>
</tr>
<tr>
<td>$(\alpha = 0.86)$</td>
<td>In our team, we had a formal system to capture good ideas</td>
</tr>
</tbody>
</table>
2.4.2 Measurement Set 2: Socio-Cognitive Processes

Another important measurement is related to team learning as a socio-cognitive process. Kostopolus et. al. (2011) developed the measures and validation for analysis of team-level and individual-level learning. As noted above, the socio-cognitive process consists of intuition, interpretation, integration and codification. The authors focus on the development of measuring team learning as a multi-level phenomenon, which is different from measurement set 1 from Edmonson. In other words, Edmonson’s measures analyze at the team level, whereas measurement set 2 analyzes how team learning is developed through individual learning.

Furthermore, Edmonson measured team learning behaviors on various types of teams, such as high-level (factory support, NPD, fusion, and stain) and low-level (help desk, chair production, and publication) learning behavior. On the other hand, Kostopolus et al. collected data set from differing national and industrial contexts, which would help to analyze different patterns of knowledge structure and functions in diverse teams.

Kostopolus et al. (2011) empirically studied how the structures and functions of team learning relate to performance outcomes, studying the movement of learning from the individual level into the team level. They define structure as how collective phenomena occur, and define functions as the effects of causal relationships. Also, they examined that the measurement of learning in cross-level relationships (i.e. individual level and team level), providing evidence for the idea that individual factors including cognition and actions mainly engage the elements of team learning. Thus, Kostopolus et al. (2011) proposed that team learning should be analyzed and measured as a two-level process, rather than a single-level process.

Out of all 5 articles which cite Kostopoulos et al., none use the Kostopoulos measures in their studies. Yet, their measurement would be helpful in understanding the emergence of learning at the team level. In addition, this measurement explains about collective learning based on socio-cognitive process. Therefore, measurement set would be appropriate to measure team
learning of how teams develop and refine the individual members' knowledge to team’s knowledge.
Chapter 3
Antecedents and Consequences of Team Learning

To better understand the findings from the research on team learning I review the antecedents and consequences of team learning from recent research. Figure 3.1 shows antecedents of team learning placed on the left side and the consequences placed on the right side, based on the ‘Input-Process-Output’ (IPO) model that expresses that input effectiveness on performance (Ilgen et al., 2005). IPO model illustrates the "classic system model" in which the inputs precede the process that, in turn, results in the outputs. In the IPO model for this thesis, the input includes team composition, team context and team behavior (Ilgen et al., 2005), the process includes team learning, and output includes team performance, team mental model and organizational learning.

![Diagram of Team Learning Framework]

Figure 3.1 A Framework for Team Learning
3.1 Antecedents of Team Learning

This section classifies the antecedents of team learning into three main types: team composition, team context, and team behavior. In regards to the IPO model, team input variables are identified as team composition and team context (Hulsheger et al., 2009) that promote learning at the team level. Also, I added team behavior as input variables because they have received attention in recent years (Gruenfeld, Martorana, Fan, 2000; Hiller and Linda, 2012).

Team composition inputs include cognitive ability, personal traits, diversity, and membership. Team context includes psychology safety, cooperation/cohesion, and leadership. I found 7 articles relating to team composition, 7 papers for team context, and 2 papers for team behavior.

3.1.1 Team Composition

Team composition has been studied as a team-level predictor that affects team processes and outcomes (Moreland & Levine, 1992; Kozolowski and Bell, 2003). It is defined as “the aspect of a team created by the configuration of team member attributes” (Bell, 2007). In general, member’s attribution affects team learning by changes in individuals’ learning behavior.

Team composition includes personality factors, members’ abilities, and demographics. In general, team composition variables classify team membership characteristics, such as surface (diversity, membership change) and deep-level factors (cognitive ability) in different configurations (Bell, 2007). It is predicted that those variables are affected by various complicating factors. This thesis does not include team size, which is a factor of team composition; because it is rarely found that team size affects team learning.

3.1.1.1 Diversity

Diversity refers to the “difference between individuals on any attributes that may lead to the perception that another person is different from self” (Jackson, 1992; Williams & O’Reilly, 1998; Knippenberg et al., 2004, p. 1008). Diversity has been researched in relation to different domains: social categories and information/functional diversity (Jackson, 1992; Jehn, Northcraft, & Neale, 1999; Miliken & Martins, 1996; Tsui, Egan, & O’Reilly, 1992). Dann and Schippers
defines social categories as “the differences between members may engender the classification of others as either in-group or out-group categorization,” such as sex, age, and ethnicity (2007, p. 517). Information/functional diversity refers to the differences in attributes related to job tasks, such as functional and educational background. Though a number of research studies on diversity focused on work performance (Guzzo & Dickson, 1996; Kozlowski & Bell, 2003; Williams & O’Reilly, 1998; Dann et al., 2004), there are few that deal with on diversity within the context of team learning.

When teams have differences in demographic characteristics and information/functional diversity, each member has different views and information about tasks. Because members may offer diverse views, insights, skills, and information, they can create new creative solutions and new knowledge. These different types of diversity can have different levels of impact on team learning. For example, diversity in culture and personal background can provide unique perspectives into working toward a common goal (Gibson and Vermeulen, 2003). Informational/functional diversity promotes team learning under the conditions of high levels of team identification, which refers to commitment and emotional involvement toward a team (Vegt and Burnderson, 2005). Also, information/functional diversity may facilitate the individuals’ consideration and discussion, because information/functional diversity is more task-relevant.

However, because of differences in opinion, experience, and culture, conflicts inevitably arise. Team members may refuse to speak to one another or even work with each other due to these types of differences, destroying team cohesion. Studies have been performed on how these conflicts can be resolved in a team setting (Gibson and Vermeulen, 2003; Vegt and Burnderson, 2005). In general, it shown that communication is the crucial factor that determines whether diversity helps or hinders team learning. Without communication, team members cannot work out their differences or resolve conflicts of arising from diversity.

Gibson and Vermeulen (2003) investigated the relationship between diverse subgroups and team learning. Subgroups refer to the extent of overlap across differences of demographic
characteristics among team members. In other words, they suggested that different compositions of age, sex, ethnicity, and functions among sub-group members foster team learning. Their study implied that moderate levels of similarities of subgroups allow members to share information and insights, while differences across members enable members to consider diverse ideas and information.

Compared with the study of Gibson and Vermeulen, Vegt and Bunderson (2005) examined how teams that have different information and expertise affect team learning. They investigated multidisciplinary teams are associated with team learning. Multidisciplinary teams are composed of individuals with different information resources, knowledge, and expertise. Specifically, they analyzed the relationship between expertise diversity and team learning. The concept of expertise diversity refers to “the differences in the knowledge and skill domains in which members of a group are specialized as a result of their work experience and education” (Vegt and Bunderson, 2005, p. 533), similar to the definition of informational/functional diversity (Dann and Schippers, 2007). They showed that expertise diversity has positive impacts on team learning behavior.

3.1.1.2 Cognitive Ability

Cognitive ability is defined as “any abilities that concern some class of cognitive tasks” (Caroll, 1993, p. 10); the term “task” refers to “any activity that a member engages in order to achieve a specifiable or terminal state of affairs”. Similar to this notion, a cognitive task could be thought of as any activity that need or utilize cognitive processes: encoding, storage, and retrieval (Humphreys, 1979). Encoding is the initial stage for entering information into memory. Information is stored into memory during the storage stage and stored memory is brought back for application during the retrieval stage (Wegner, 1987). Thus, cognitive ability may refer to as one’s capacity to perform any cognitive task.

According to research by Kamfer and Ackerman, cognitive ability and individual-level learning are positively related (1989). Based on their theory, Ellis et al. (2003) investigated the
relationship between cognitive ability and team learning. They posited that teams which consist of individuals with high cognitive ability are likely to possess a higher capacity to learn. In support of this position, they found that project teams with higher levels of general cognitive ability have, in practice, higher levels of team learning (2003).

Similar to the study of Ellis et al. (2003), Olivera and Staus (2004) posited that the cognitive process is primarily related to the transfer of learning within a group. Their study found that certain cognitive factors foster group collaboration, such as group interaction and interpersonal relationships. Enhanced group collaboration facilitates collective learning; Bossche called this “the creation of mutually shared cognition” (2006). Also, cooperative learning provides a chance to transfer learning at the group-level.

Because each individual member may show different cognitive ability, team members are likely to depend on other members’ unique cognitive abilities. Consistent with this notion, Wegner et al. introduced the concept of “cognitive interdependence”, which stresses the importance of memory for a team as essential (1985). It is necessary for teams to develop cognitive interdependence because team members are not able to learn all knowledge individually to perform tasks. Rather, they tend to rely on others’ expertise by interacting with each other in an interpersonal context. Also, cognitive interdependence can be developed through the process of ‘acquiring, remembering, and generating knowledge’ among members in a team (Hollingshead, 2001; Wegner et al., 1985).

Central to the concept of cognitive interdependence, Wegner et al., introduced the notion of ‘transactive memory’ (1985), later conceptualized by Wegner to TMS (1987). As discussed before, TMS is defined as “a shared division of cognitive labor with respect to encoding, storage, retrieval and communication of information from different domains that often develops in a close relationship” (Wegner, 1987; Ren and Argote, 2011 p. 191; Hollingshead, 1998a; Ren, Carley, & Argote, 2006). Lewis et al (2005) viewed TMS as learning system. With this perspective, they showed that TMS facilitates team learning and learning transfer among members. They provided
evidence that TMS influences member's ability to apply prior knowledge and coordinate knowledge within the team.

Also, Akgun et al. empirically investigated how TMS positively affects team learning by conducting research on NPD teams (2006). Teams who develop TMS have the capacity to learn each member’s expertise and specialties. In doing so, members learn how they can effectively apply previously learned knowledge and develop deeper understandings of given tasks. Thus, teams with highly developed TMS are more likely to transfer knowledge among members which, in turn, enhances team learning.

3.1.1.3 Membership change

Organizations attempt to take advantages of membership change through joining members who have worked together before with newcomers (Gruenfeld and Fan, 1999). In other words, membership change positively affects team learning through new knowledge gained from incoming members.

Membership change occurs when members within a team leave or join the workplace (e.g. turnover, promotion, and transfers). Membership change is inevitable because the team aims to promote team learning from new members with "diverse knowledge stocks" (Kane, Argote and Levine, 2005) as well as to enhance internal processes (Feldm, 1994; Levine and Moreland, 1985; Sutton & Louis, 1987). It is difficult to gain positive outcomes if teams fail to learn from one another (Argote, 1995; Gruenfeld and Fan, 1999; Szulanski, 1994).

Membership change has impacts on team learning in various ways. Gruenfeld et al. (2000) suggested two different types of membership: itinerant members (those who leave their teams of origin temporarily to visit a foreign team) and indigenous members (original members of the team). Gruenfeld et al. (2000) contended that itinerant members would affect the knowledge of indigenous members after changing group members. Also, they empirically examined probable advantages of membership change across teams towards promoting learning.
First, itinerant members have direct impacts on team knowledge between the original members. For instance, teams are directly affected when indigenous members accept knowledge and advice of itinerant members. In addition to direct impacts on indigenous members, itinerant members indirectly affect learning in that they provide “diversity and dissent to enhance team problems solving, but do not provide the solution itself” (Nahavandi and Aranda, 1994; Gruenfeld et al, 2000, P. 47). Overall, itinerant members have impacts on indigenous members, because itinerant members are more likely to generate unique and differentiated ideas than the native team members who have worked together and built up a general rapport. Likewise, Keltner et al. (2003) provided evidence that membership change contributes to sharing innovative ideas with a team.

Another study of membership showed the effects of membership change on team cognition and its influences on team learning (Lewis et al., 2007). Itinerant members may pose a problem, due to their lack of knowledge about their new tasks and team members. However, the minor upset during the initial training phase is often offset by the advantages mentioned above. Lewis et al. showed membership changes affected teams’ ability to encode, store, and retrieve knowledge (TMS). They found that even though a team experiences membership change by an influx of newcomers, teams still developed TMS and could effectively transfer and distribute their knowledge to each other. They found out that TMS enables members to access deep and specialized knowledge and expertise even with a change of members.

3.1.2 Team context

Team context is referred to as “conditions that influence the team not only team members’ action but also teamwork and performance” (Moreland & Levine, 1992). Also team context is a “collection of relevant conditions and surrounding influences that make a situation unique and comprehensible” (Anderson, 1995; Brezillon, 2005, p.2). Depending on how organizations create context, team learning is influenced under various conditions such as
psychological safety, cohesion/cooperation, and leadership. The following section will analyze how team context influences team learning.

3.1.2.1 Psychological Safety

Initially, the concept of psychological safety originated from research in organizational change. Schein and Bennis (1956) contend that organizations need to create environments in which individuals feel secure and capable of changing. Kahn defined psychological safety as “feeling able to show and employ one’s self without fear of negative consequences to self-image, status, or career” (1990, p. 709). Later, Edmonson studied psychological safety as linked with interpersonal processes and learning behavior: “a shared belief held by members of a team that the team is safe for interpersonal risk taking” (1999, p. 350).

Team psychological safety is similar to trust, but is thought to be more complicated. Trust is thought of “as the expectation that others’ future actions will be favorable to one’s interests, such that one is willing to be vulnerable to those actions” (Mayer, Davis, and Schoorman, 1995; Robinson, 1996). Psychological safety depicts team context by interpersonal trust and mutual respect.

In a field study, Edmonson examined how psychological safety affects team learning (1999). Psychological safety positively affects team learning because it relieves excessive concern about others’ negative reactions, which influences team learning behavior (Edmonson, 1999). For example, psychological safety encourages the formation of positive climates when team members speak out with their new ideas and opinions. Team members freely express their ideas or opinions only under conditions that encourage members to feel secure and trust. Also, as psychological safety increases and interpersonal processes are engaged, members actively exchange and discuss their ideas.

Also, Brueller and Carmeli (2011) examine that High Quality Relationships (HQR) are positively related to psychological safety, and thus, promote team learning. Social interactions among members within and outside the organization form these types of relationship. The
concept of HQR is important due to the requirements of maintaining positive relationships among team members. In other words, HQR refers to the extent that team members are able to express their emotions to others, how members openly express their ideas, and how members deal with various types of conflicts in a team. In the study, psychological safety is modeled as mediating HQR and team learning. They show that psychological safety could be enhanced through positive relationships among team members. Therefore, this study provides evidence that positive relationships among team members are predictive indicators for building psychological safety.

Kostopoulos and Bozionelos provided evidence for how psychological safety associates differently with exploratory and exploitive learning by conducting the experiment on 174 innovation project teams (2011). The study shows that psychological safety positively associates with exploratory learning. That is, work environments that encourage risk-taking and different, contrasting ideas fortify learning behavior at the team level. As a result, they found that psychological safety is an effective means to promote team learning.

3.1.2.1 Cohesion and Cooperation

According to the research by Bossche et al. (2006) team members who have a strong sense of belonging and feelings of attachment to other members are highly likely to interact with other members, share, and exchange their ideas. Cohesion is defined as “the commitment of team members to their work team and their desire to maintain group membership” (Lott & Lott, 1965). Van den Bossche et al. referred to cohesion as “the nature and quality of the emotional bonds of friendship such as linking, caring, and closeness among group members” (2006, p. 499). Cohesion is considered as an important factor in the team context because it influences members’ commitment as well as internal processes, including communication among members.

Cohesion and cooperation foster team learning by reducing conflicts. Specifically, cohesion and cooperation increase commitment and bond, leading to enhance internal relationship among members. Wong, in regards to local and distal learning, argues that high-levels of cohesion reinforce distal learning whereas excessive cohesion affects local learning.
negatively (2004). This outcome contradicts the common belief that internal cohesions increase the resistance to external knowledge. He suggests that this finding should be investigated more carefully and may be a good direction for future research. In addition to cohesion, cooperation promotes interpersonal interactions among team members. Cooperation is defined as “the process of working together towards the same goal and mutual benefits” (Bossche et al., 2006). The degree of cooperation within a team is one of the important factors that influences team learning.

Today, organizations inevitably experience mistakes. However, mistakes and errors provide experience from which to learn through cooperation (Nonaka and Takeuchi, 1995; Starkey, 1998). Though learning from experience has been thought of as an essential source for gaining knowledge, learning from mistakes is often challenging and hard to manage (Edmonson, 1999). If the attitude within the team is uncooperative (e.g. blaming mistakes and errors on others), members ultimately are reluctant to exchange their opinions, or engage in constructive interactions with others.

Tjosvold, Yu and Hui studied cooperation and its effects on team learning (2004). It is important for teams to foster team learning and learn from mistakes and errors, by encouraging cooperative and interpersonal team contexts. They posited that when one member moves toward the goal, other members will also try to reach the goal, because they believe that they have common tasks and would share rewards and success. Also, cooperation enables members to maintain mutual relationships, which facilitates learning knowledge.

3.1.2.2 Leadership

Many research studies have shown that team-learning behaviors are affected by the behavior of the leader. Edmonson found that leaders play a crucial role in resolving problems and facilitating team communication that promotes team learning (1999). Also, the leader’s behavior is related to team reflexivity, or how members learn knowledge related to work. Leaders learn from
solving challenging tasks, from leading their members, and from dealing with complex issues (Hirst et. al., 2004).

In another study, Raes et al. attempted to find the relationship between different leadership styles and team learning (2013). They focused on two opposing types of leadership: transformational leadership and laissez-faire leadership. Transformational leadership is defined as “the process within which leaders and followers raise one another to higher levels of morality and motivation” (Burn, 1978, p. 20). Transformational leadership contributes to sustaining mutual relationships among leaders and followers, as well as building a positive organizational culture that encourages commitment and interdependence. Moreover, transformational leaders stimulate their followers to achieve self-actualization and self-interest for the organization (Bennis & nanus, 1985; Sergiovanni, 2006). In contrast to transformational leadership, laissez-faire leadership is described as a passive form of leadership (Bass & Avolio, 1994; Northouse, 2004). Laissez-faire leadership tends to avoid making decisions and responsibility. Also, this leadership has a lack of transaction with their followers and is missing motivation and work satisfaction in the followers. Thus, laissez-faire leadership has a less powerful impact than transformational leadership.

Raes et al. conducted a cross-sectional study on 498 healthcare workers to find how transformational leadership enhances team learning. In particular, they indicated that transformational leadership has a more positive, practical impact than laissez-faire leadership. According to research, transformational leadership positively influences learning processes at the team level (Hannah and Lester, 2009; West, 1999). This is because transformational leaders encourage team members to create innovative ideas (Vera, Crossan, 2004; Jansen et al., 2009) as well as make them feel safe and free to share ideas and insights for the sake of their organization (Zaccaro et al., 2008).

3.1.3 Team behavior

In general, team behavior includes feedback, teamwork, commitment, and management support (McDonough, 2000). Also, different types of team behaviors including feedback
associated with team learning (c.f. Gruenfeld, Martorana, Fan, 2000). In the field study, team behaviors have been shown to have an impact on team learning. For instance, Akgun et al. (2013) provided the evidence that team learning in the IT field influences team behaviors such as ‘team work’, ‘team communication’, ‘interpersonal trust’, ‘team commitment’, and ‘manager support’. They demonstrated that team learning is positively related to team behaviors.

3.1.3.1 Feedback

Literally, feedback is defined as “the modification or control of a process or system by its results or effects”. London & Sessa (2006) stated, “feedback allows the group to recognize the effects of its actions and choices and, if need be, to change those actions and choices over time to have a different effect” (p. 306). Moreover, feedback is an important factor because it provides information to increase work function (Linda and Jenson, 2012).

Edmonson (1999) argued that team members are able to acquire desired outcomes through experience and the activity of asking questions and searching for feedback within a team. Most of all, feedback enables team members to reflectively react to their own behaviors related to tasks. Feedback can correct their ineffective behaviors while working, as well as increase their productive and effective behaviors (London, 2003). This is because feedback enables team members to discuss how they performed and what kind of mistake or errors they made in the process (Garvin et al., 2008).

Hiller and Linda (2012) explored how feedback facilitates team learning. When feedback proceeds in a systematic and effective way, learning occurs among team members (Edmonson, 2008; Garvin et al., 2008). Specifically, the authors emphasize that systematic feedback enables teams to improve performance. For instance, feedback promotes strengthens member interdependence, and the creations of shared mental model among members (London and Sessa, 2006; Senge, 1990). Therefore, team learning is enhanced by team feedback that fosters interaction and correction of behavior among team members.
3.2 Consequences of Team Learning

The consequences of team learning can be classified into three types: team performance and organizational learning. Unlike the antecedents of team learning, the consequences of team learning are consistent throughout the research done on the subject. Many studies have examined that team learning positively influences various outcomes including team performance and organizational learning.

Team performance is defined as the outcomes that achieve the goals of a team. In particular, team performance includes effectiveness that is often measured as customer satisfaction, speed, and creativity (Gladstein, 1984; Guzzo and Dickson, 1996; Kozlowski and Ilgen, 2006; Ren and Argote, 2011). Another consequence, organizational learning is the process in which organizational performance is improved, as mentioned above. Beyond this concept, here, organizational learning is thought of as the consequences of team learning.

3.2.1 Team Performance

Some authors posit that team learning behavior increase team performance. Team-learning behavior allows members to adopt change and modify their mistakes. Specifically, team-learning behavior such as seeking errors and mistakes provide the information about performance. Also, team learning enables members to respond better to changing situations and contexts, causing members to seek ways to enhance team performance.

Edmonson (1999) empirically examined the effect of team learning and team performance beyond laboratory experiments. Edmonson measured how teams meet customer satisfaction. Also team learning behaviors accompanied with psychological safety positively affects team performance by not only building upon internal trust but also taking on challenging new tasks.

Similarly, Brueller and Carmeli (2011) show that team learning has a positive relationship with team performance in regards to measured HQR and psychological safety. They conducted experiments in several service organizations. Compared with Edmonson’s research (1999), the
research of Bruller and Carmeli assessed team performance including overall team performance, completing tasks on time, the quality of team performance, and achieving work goals. Likewise, they found out that service teams develop team performance by facilitating team learning.

Also, Kostopoulos and Bozionelos (2011) conducted experiments within 142 project teams to examine the relationship between exploratory/exploitative learning activities and team performance. Their study showed that psychological safety is an effective tool in motivating employees to engage in these learning activities. They do comment that, because two different types of learning are completely separate and complementary, members should perform different learning activities in both to bring out the most improvement in team performance.

3.2.2 Organizational Learning as a Consequence of Team Learning

Chan et al. (2003) studied organizational learning as a consequence of team learning, showing that the direct relationship between individual learning and organizational learning was ambiguous. Accordingly, organizations are able to learn through the processes of team experience and the sharing of knowledge among members (Bennett and O'Brien, 1994; Bierly and Hamalainen, 1995; Dodgson, 1993). This is because organizational learning is not simply achieved by aggregating each individual's learning but rather it should incorporate an integrated learning process at the team level (Edmonson, 2002).

In addition, Chan et al. (2003) empirically explored how team learning is related to organizational learning. Individuals in a team are closely connected with each other in that they share a vision for their collective objectives and a business plan, as well as developing a commitment to the team and an open mind to possibilities. These findings indicate that team learning plays a key role in developing organizational learning.
Building on previous research studies on team learning from 1985 to 2013, I was interested in understanding the factors behind team learning, including the predictors and outcomes of learning at the team-level. Team learning has been the topic of a variety of research studies in many different fields and I have endeavored to summarize the current state of team learning research and provide insights into the underlying antecedents and consequences.

This thesis has identified several significant questions known in this literature. First, there is the question of how team learning operates in a well functioning team. Specifically, some researchers tend to treat team learning to be as an outcome of a process, whereas others primarily view team learning as a learning process, in and of itself. It is important to understand how team learning operates due to its uses for developing good team work habits and routines, resulting in more effective teams and productive outcomes. This is because team learning allows teams to incorporate their capabilities through interactions within the team and streamlines the exchange of ideas and knowledge among team members.

Research studies view team learning as the process of communication or coordination wherein members engage in interactions related to their task, resources, and context. In this perspective, team learning operates by leveraging their members’ knowledge and skills under various work conditions. Also team learning can be measured by how well a team performs. Other research has shown that team learning is influenced by managerial and contextual factors such as team composition and team context, as noted above in Chapter 3. Team learning conceptualizes the ways in which teams share, exchange, and discuss members’ ideas, strengths and workload, leading to the creation of knowledge and, ultimately, better work.

Also, mentioned above, team learning includes more than one type of learning, such as local learning and distal learning, and exploratory learning and exploitative learning, allows
observing diverse team context and variables. I predict those different types of team learning are related to various task variables under the different team context.

Second, there is only marginal agreement on the core components of team learning from one study to another. The way team learning is defined varies considerably, but can be categorized into two distinct types of processes: behavioral process and socio cognitive process. A number of articles observe team learning as an ongoing behavior-driven activity of asking questions and seeking feedback, experience, and reflecting on results (Edmonson, 1999). The behavioral team learning process mainly focuses on correcting the behavior by seeking errors and mistakes. The researchers of this area posit that team learning would be helpful in creating new knowledge through the experience of errors and mistakes. Thus, the researchers emphasize the work environment where cooperative or cohesive climate and encourage team members feel psychological safety.

However, team learning can also be viewed as the socio-cognitive process of acquiring, sharing, and combining knowledge through experience (Argote, 2001). In this view, team learning produces positive outcomes, such as team performance and coordinating members’ cognitive abilities and actions (Edmonson, 1999). Also, the socio-cognitive perspective of team learning contributes not only to seeking and developing new capabilities but also improving current capabilities. This is due to socio-cognitive processes having beneficial impacts on members’ internal knowledge processes, such as analyzing new knowledge and retaining prior knowledge for application. This type of team learning also focuses on integrating different knowledge from team members. So, the socio-cognitive team learning process relies on team composition factors, such as diversity, cognitive ability, and membership change. Despite the differences between behavioral process and socio-cognitive process, I believe that it is critical for teams to coordinate behavioral activities together with socio-cognitive processes in order to develop all positive effects of team learning.
Third, though team learning is interrelated with other concepts such as individual learning, TMS, TMM and organizational learning, team learning is distinct from those concepts. Unlike individual learning, in which each individual acquires and obtain knowledge through experience, team learning occurs through interaction and coordination between individuals. In addition, team learning is developed when members actively share, exchange, and reflect on their ideas and knowledge amongst each other. Though some research suggested that individual learning might extend to organizational learning (Ibeens, 1997; Kim, 1993), the nature of the relationship between individual and organizations is still ambiguous (Niclini and Meznar, 1995).

Next, TMS plays a role in facilitating team learning through transferring one’s knowledge and expertise among individuals. In the perspective that TMS emphasizes the sharing of members’ memory, team learning is linked with TMS. Furthermore, as seen in the definition that team learning is viewed as a behavioral process and a socio cognitive process, team learning also focuses on exchanging and discussing members’ ideas and knowledge through physical and verbal interaction and interpersonal, and therefore social, relationships. On the one hand, the concept of TMM also relies on the individual’s shared mental system. However, unlike TMS, TMM stresses the sharing of common knowledge among members, which results from the activities through which teams develop team learning. An important note is that the research done on team learning and related concepts tend to rely on only theoretical studies. Therefore, I would recommend that future research should be examined for further empirical investigation.

4.1 Antecedents

This thesis presents a number of antecedents for team learning, and key findings from research into them. The studies of team composition as an antecedent of team learning are divided into two diversity research studies, cognitive ability studies (4 studies), and membership change studies (2 studies). The research on team context includes three psychological safety studies, two cohesion/cooperation studies, and two leadership studies. The research on team behavior has one feedback study. In other words, the effects of team composition and team
context variables have been relatively well investigated, whereas the effects of team behavior have been looked at in only a small number of studies. Thus, of the three types of antecedents for team learning discussed in this thesis, team composition and team context have been studied considerably more than team behavior. Future research should give more attention to studying the relationship between team learning and the effects of team behavior including feedback, commitment, teamwork, and management support (McDough, 2000). Thus, it is important to examine the relationship between team learning and team behavior variables, because team behavior variables are associated with the members’ motivation to learn collectively. In other words, team behavior variables foster one’s motivation to learn.

A number of these antecedent variables, such as cognitive ability and diversity, are more associated with a team’s or team member’s ability, and are less involved with the motivation to learn. However, team behavior variables such as commitment and management support encourage members to learn, in turn promoting team learning.

Future research is also needed for finding factors that affect opportunities for developing team learning. For example, team learning is influenced by two categories of uniqueness of team members: demographics and expertise. By examining these two types of diversity within a single research project, researchers may explore which of the uniqueness factors affects team learning more, whether they are complementary, or whether they affect team learning at all. Another example is to examine the relationship between the wide range of leadership styles, such as “authentic leadership” and “servant leadership”, and team learning. Likewise, additional research should be concentrated on a wide range of variables to find the factors that enhance team learning.

4.2 Consequences

I considered two other consequences of team learning: 1) team performance and 2) organizational learning. Compared with antecedents, research on the consequences of team learning converges relatively nicely. Research studies have conducted experiments within widely
diverse types of organizations such as service firms, hospital firms, project-teams, and cross-functional teams (Edmonson, 1999; Akgun et al., 2006; Brueller and Carmeli, 2011; Kostopoulos et al., 2001). Many research studies examined a great amount of data on team performance in measuring ways of team performance such as customer satisfaction, and team effectiveness. This is because teams with highly developed team learning possess sufficient knowledge and skills that would enhance creativity.

Furthermore, this thesis posits that organizational learning is viewed as the consequence of team learning, in light of the fact that team learning can benefit organizations. Organizations can maximize benefits not only when individual exchange their ideas but also when different individuals cooperate to learn complex tasks. Likewise, such ‘cross-functional’ learning occurs in teams (Edmonson et al., 2004). A promising future direction is the inclusion of creativity, as the outcome of team learning. The primary purpose of learning is to solve problems and to create new knowledge. I found one study that examined indirectly the relationship between team learning and creativity (Chen et al., 2002), which opens up a new research ideas in that direction.

4.3 Measurement

In this thesis, I have discussed three ways of measuring team learning. One important direction to examine in future studies is how to utilize the wide range of available research designs in order to acquire data. The majority of research in the literature has examined their hypothesis with cross-sectional research designs. However, I believe the effect of team learning is likely to occur over long periods of time.

In particular, longitudinal study would provide more validated measures to observe the patterns of team-learning behavior. For example, scholars have observed factors for team learning and find changing trends only across extended periods. This type of research would provide a chance to carefully examine the factors that cannot easily explain certain causal relationships, such as diversity (Gibson, 2003). However, cross-sectional research is currently
widely used. A large majority of the papers in this literature uses cross-sectional research because of its lesser expense (Kostopoulos et al., 2011).

Future research should observe the team learning processes as they develop. For example, the researcher may address such questions as how to change the initial conditions (Lewis, 2004) for team learning. In other words, researchers may measure the initial conditions, such as the extent of familiarity among members and the extent of distribution of knowledge in a team. Then, researchers can observe the degree of changes to these variables over time. In addition, they could examine how the teams that emerge affect team learning in the future.

In summary, earlier research done on team learning was highly based on laboratory studies. Laboratory studies have advantages of establishing causality and setting boundary conditions- researchers manipulate and control the experiments and variables. Out of 75 studies, only 3 papers have data and analysis from laboratory research (Ellis et al., 2003; Olivera and Starus, 2004; Lewis et al., 2005; ). However, it has limits due to observations of sterile conditions and application to a real industry environment. On the other hand, field studies have strengths in measuring quantitative and qualitative data about social phenomena. However, they have the weakness of being set in a limited variety of work environments, as well as the likelihood of generating unpredictable control variables. Because of this, even much of the recent research has been theory-driven. Also, researchers primarily depend on theoretical insights on the effects of team learning as a team process.

Team learning is thought to bridge the gap between individual and organizational learning and be vital to their successes. Therefore, I would recommend that future researchers would integrate two kinds of research by complementing of their advantages and disadvantages mentioned above. Both of these researches methods would be valuable for future team learning research.

To summarize, this review has overviewed the current state of team learning research and provided helpful insights into its antecedents and consequences. This review of team
learning attempted to integrate diverse perspectives and definitions of team learning. Also, I suggested a framework for team learning, summarizing the influential team level predictors and outcomes. Future research into team learning may lead to new discussions into how organizations can work and succeed more effectively with their internal teams and subgroups.
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Biographical Information

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