# THE EMERGENCE OF ROTATING LEADERSHIP AND COLLECTIVE RESPONSIBILITY IN GRADES 1 AND 4



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## ABSTRACT

Building cultural capacity for innovation is an educational imperative. Knowledge Building pedagogy aims to engage students in sustained creative work with ideas from the earliest years of schooling, with all students taking responsibility for creating and advancing community knowledge. In this investigation, the online discourse of grade 1 and 4 students was examined to explore the possibility of identifying rotating leadership, a distinctive feature of cyberteams that create knowledge in out-of-school contexts. Network analyses were conducted to examine leadership patterns at the group level, followed by content analyses to understand leadership behaviours at the individual level. Overall, student networks were relatively decentralized, with many students leading the group at different points in time by connecting new or unique ideas to the class discussion. This research represents the first attempt to integrate Collaborative Innovation Network theory and Knowledge Building. Findings are discussed within the context of education for the Knowledge Age.

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# CHAPTER 1

# Introduction

The purpose of this chapter is to establish the context, rationale, and purpose of the current study. First, I introduce the growing need for cultural capacity to innovate. Next, I describe innovative, knowledge-creating contexts and define the central concepts of the current study, rotating leadership and collective cognitive responsibility. The chapter concludes with a statement of the objectives for the current study.

## 1.1 Study Context and Rationale

In a world of increasing change and complexity, ingenuity of all kinds is needed to generate new concepts, designs, and solutions to address complex social, political, economic, and environmental issues (Homer-Dixon, 2000, 2006; David & Foray, 2003). Given that the health and wealth of nations, as well as the sustainability of the planet, depends on the creation of new knowledge to address increasingly complex problems, building cultural capacity to innovate represents a global imperative (e.g., OECD, 2010, 2015; Ananiadou & Claro, 2009; Keating & Hertzman, 1999). Citizens are finding new ways to actively engage in knowledge creation and bringing about change themselves through virtual networks and communities (e.g., Gloor, 2006; Tapscott & Williams, 2008), but engaging students in knowledge-creating enterprises represents a challenge of a different order. As an educational imperative, schools will need to fundamentally transform their culture in order to prepare students with competencies to innovate and empower them to create knowledge for public good (e.g., Bereiter, 2002; Scardamalia, 2000; Binkley et. al., 2012; Tan & Tan, 2014; Scardamalia & Bereiter, 2014a; Sawyer, 2006; Philip, 2011).

Knowledge Building pedagogy aims to democratize innovation by fostering a culture of creative, sustained work with ideas from the earliest school years, with students taking charge of high-level socio-cognitive functions to advance

community knowledge (Scardamalia & Bereiter, 2003). Parallel to work in knowledge-creating organizations (Nonaka & Takeuchi, 1995) and Collaborative Innovation Networks (Gloor, 2006), building community knowledge in the classroom is social and improvisational. There is no script, members often surprise one another, and interactions lead to the emergence of creative insights or solutions (Sawyer, 2003a, 2015). The community may even invoke "creative chaos" (Nonaka & Takeuchi, 1995), along with other intentional actions to advance goals, reflecting systematic efforts to solve problems. Each member of the community knows what needs to be done and self-organizes accordingly (Gloor, 2006). This phenomenon is known as collective cognitive responsibility (Scardamalia, 2002, p. 68-69):

> "[Whereas] collective responsibility… refers to the condition in which responsibility for the success of a group effort is distributed across all the members rather than being concentrated in the leader. Collective *cognitive* responsibility involves an added… cognitive dimension… [Members] also take collective responsibility for understanding what is happening, for staying cognitively on top of events as they unfold… [T]hey will also take responsibility for knowing what needs to be known and for insuring that others know what needs to be known."

In knowledge-creating organizations, there is a pervasive culture of learning. Multilearning (learning across individual, group, and corporate levels) and multifunctional learning (learning by experience in various domains outside of one's expertise) enable employees to take collective responsibility for knowing the latest advances within and between organizations (Takeuchi & Nonaka, 1986). In Collaborative Innovation Networks, members collaborate openly and transparently, so that knowledge is made accessible to everyone (Gloor, 2006). During the creative "swarming" process, several leaders emerge as the group self-organizes to advance their goals (Gloor, 2006). The emergent phenomenon of "rotating leadership" implies that the success of the project is achieved by various leaders – all of whom take collective responsibility for contributing to and advancing the community goals, such as generating new knowledge, solutions, products, and other artifacts.

## 1.2 Study Objectives and Overview

This thesis seeks to contribute to the existing body of literature on knowledge creation in education, with an emphasis on emergent community dynamics. While previous work (e.g., Paavola et. al., 2004; Philip, 2007) has compared Knowledge Building theory with knowledge creation theory, no study has compared Knowledge Building theory with Collaborative Innovation Network theory. Collaborative Innovation Network theory (COIN; Gloor, 2006) represents a relatively new model for understanding community dynamics of knowledge creation, especially in virtual contexts with self-managed cyberteams and online communities. The current study is exploratory in nature, with the central aim of opening a space for dialogue between COIN theory and Knowledge Building theory. By integrating COIN theory with Knowledge Building theory, a new method of analyzing collective cognitive responsibility over time is developed. Rotating leadership is explored in three classroom contexts with young children in grade 1 and 4 (aged 6 to 10 years) engaged in the collective endeavor of creating knowledge of value to the community, while receiving appropriate pedagogical and technological supports. This thesis also aims to inform classroom design-based research, particularly in the areas of pedagogical and technological innovations. Recommendations are offered for future development of automated feedback and assessment tools compatible with virtual Knowledge Building environments, such as Knowledge Forum (Scardamalia & Bereiter, 2014b), that can help boost student capacities for knowledge creation. This thesis is organized into five chapters:

- In Chapter 2, I draw from knowledge creation theory, Collaborative Innovation Network theory, and Knowledge Building theory in order to elaborate on the emergent community dynamics that support the self-organization of members to attain shared goals. I then review studies in Knowledge Building theory as applied to educational contexts and discuss issues surrounding teaching and assessment practices.

• In Chapter 3, I elaborate on the study design, which adapts the COIN concept of rotating leadership into three Knowledge Building classes in order to examine the phenomenon of collective cognitive responsibility for knowledge advancement. More specifically, I explain the measures for social and temporal network analyses, along with the procedures for content analysis to investigate examples of student leadership.

• In Chapter 4, I report findings at the group and individual level for the three Knowledge Building cases: rotating leadership at the group level, followed by descriptions of 5 student leaders for each case. A total of 15 examples of student leadership are presented.

• In Chapter 5, I compare findings across the three Knowledge Building cases and then interpret them in relation to existing knowledge creation literature. I then discuss limitations of this study and situate the implications of the study findings within ongoing conversations about redesigning schools for the Knowledge Age.

# CHAPTER 2

## Literature Review

The purpose of this chapter is to review recent work related to knowledge creation in organizational literature and educational literature. The literature review is divided into two sections. First, I provide a brief overview of knowledge creation, Collaborative Innovation Networks, and Knowledge Building theory. From each perspective, I describe processes for creating new knowledge and community dynamics that support the emergence of novelty. Then, I highlight and summarize parallels between the three theories. In the second section, I elaborate educational challenges of implementing the Knowledge Building philosophy into teaching and assessment practices. The chapter concludes with a statement of the research questions for the current study.



## 2.1 Three Models of Knowledge Creation

### 2.1.1 Knowledge Creation Theory

One of the most influential models of organizational innovation is Nonaka and Takeuchi's knowledge creation theory (Nonaka & Takeuchi, 1995; see Nonaka, von Krogh, & Voelpel, 2006 for review). In knowledge-creating organizations they have identified "sense of mission" (Takeuchi & Nonaka, 1986) and culture of pervasive, incremental innovation ''in which the organization creates and defines problems and then actively develops new knowledge to solve them'' (Nonaka, 1994).

#### 2.1.1.1 The Knowledge Spiral

According to Nonaka and Takeuchi (1995), knowledge creation encompasses a dialectal between tacit and explicit knowledge and individual and group functioning. In their dynamic model, knowledge is converted through four

different phases: socialization (from tacit knowledge to tacit knowledge), externalization (from tacit knowledge to explicit knowledge), combination (from explicit knowledge to explicit knowledge), and internalization (from explicit knowledge to tacit knowledge).

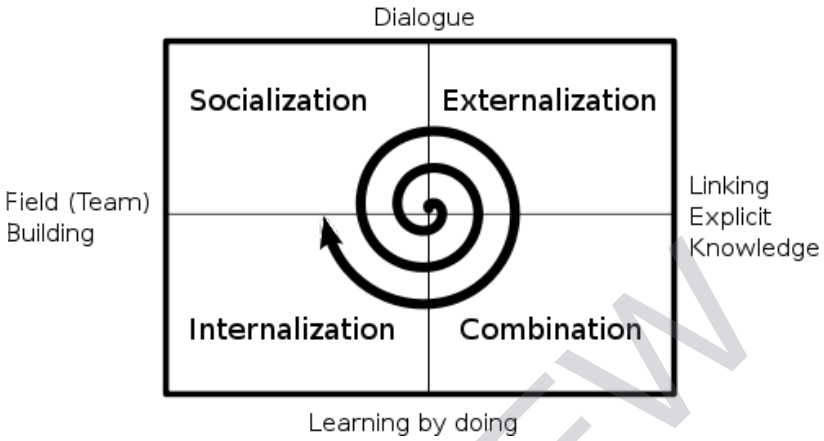


Figure 1. The knowledge spiral (Nonaka & Takeuchi, 1995)

During socialization, a common, implicit understanding is created in the group through the sharing of emotions and feelings to develop trust and the sharing of mental models to develop a shared goal. During externalization, concepts are generated, reflected upon, and improved. During combination, concepts are evaluated based on the organization's goals and values before they materialize as a prototype. During internalization, concepts are integrated into the mental models of the group members. The continuous shifting between these four modes of knowledge conversion results in the transformation of existing knowledge into new knowledge; cross-fertilization within the organization and between organizations triggers new cycles of knowledge creation (Nonaka and Takeuchi, 1995). The knowledge spiral (see Figure 1) is used to depict the interactive, cyclical process of knowledge creation.

#### 2.1.1.2 The 5 Conditions for Knowledge Creation

The knowledge spiral is facilitated by five conditions within the organization (Nonaka & Takeuchi, 1995):

*Intention*. The organization's goals and aspirations drive the knowledge spiral. They serve as the standard for evaluating the truthfulness and value of knowledge.

*Autonomy*. Individuals act autonomously and self-organize, thereby facilitating unexpected interactions that give rise to new ideas.

*Fluctuation; creative chaos*. Individuals adopt an open attitude toward organizational crises and environment changes in order to improve their habitual routines and practices. Reflection-in-action turns destructive chaos into creative chaos.

*Redundancy*. Intentional sharing of information across different levels of the organization speeds up the knowledge spiral. Redundancy of information can be facilitated through "strategic rotation" of individuals between different departments within the organization.

*Requisite variety*. Diversity within the organization is essential to its adaptation to complex contingencies of the environment.

Nonaka and Takeuchi's research on multinational companies reveals that the ideal knowledge-creating organization has a flat and flexible structure wherein different departments are interconnected (Nonaka & Takeuchi, 1995). However, in reality, the structure of the knowledge-creating organization must be dynamic as it alternates through phases of structure and flexibility within the knowledge spiral (Nonaka & Takeuchi, 1995). For example, the adaptability and participative nature of activities at the group level supports socialization and externalization, while the specialization and formalized routine of activities at the organizational level supports combination and internalization.

### 2.1.2 Collaborative Innovation Networks

Collaborative Innovation Networks (COINs; Gloor, 2006; Gloor & Cooper, 2007) represent one of the most powerful drivers of innovation of our time as they set "cool" trends to make the world a better place. Simply defined, a COIN is ''a