THE CASE FOR DESIGN-MEDIATED INNOVATION PEDAGOGY

by

Angèle Marie Beausoleil

BAA, Ryerson University, 1987
MA, The University of British Columbia, 2013

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Abstract

Innovation is a key driver for growth and is considered critical to a sustainable economy. Across the globe, governments and industries continue to invest significantly in innovation-development activities with mixed results. In early 2016, the government of Canada published its innovation agenda in response to its mediocre innovation performance. It identified the lack of innovation-ready citizens as one critical action area and the need for Canadians to develop an innovative mindset. This dissertation investigates how a design method could improve understanding of the innovation process and increase individual and organizational innovative capacity. An interdisciplinary literature review provides insights into how the innovation process happens and helps define the competencies associated with innovative capacity or individual innovativeness. Findings from a document analysis and two action-research studies are translated into a visualization of the innovation process and a competencies framework for both classrooms and organizations. A design-mediated innovation pedagogy is proposed to develop key innovativeness competencies commonly associated with innovators. This pedagogical model suggests a shift from entrepreneurship to *innovatorship* education. My research contributes knowledge in understanding the ways in which individuals and their organizations learn to think, act and work in innovative ways. It offers implications for the application and future research of design-based innovation pedagogy models inside Canadian classrooms, business studios and global organizations.

Preface

As of the date of this dissertation, no part of my research has been partly or wholly published. The action research studies were approved by UBC's Behavioural Research Ethics Board and identified by Ethics Certificate Number H14-03234.

I was the lead investigator for the document analysis and action research studies described in Chapters 3, 4 and 5. I was responsible for all areas of research design, data collection and analysis, as well as the author for the entire manuscript and all the framework visualizations.

This dissertation is original, unpublished, and independent work by the author, Angèle Marie Beausoleil.

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Definition of Terms Specific to this Dissertation

Competencies: Individual capabilities, aptitudes and skills that are integrated within innovation development and innovation management activities and systems.

- **Core competencies:** Skills or areas of expertise possessed by an organization that makes it particularly good at doing some things and which makes an important contribution to its success by giving it competitive advantage over other organizations.
- **Key competencies**: Specific qualities in an individual that an organization has decided are desirable for an employee to possess.

Entrepreneur: A person who directs a new company and takes commercial risks.

Entrepreneurship: The capacity and willingness to develop, organize and manage a business venture along with the risks and uncertainty to make a profit.

Innovation: An idea, practice or object perceived as new by an individual or organization; the introduction of new or improved methods; and, the development of new or improved products or practices.

Innovation Pedagogy: An integrated set of teaching methods, activities and learning values that informs and motivates the design and delivery of an innovation-process learning experience.

Innovation Process: A sequence of activities involving an intention to solve a problem specific to a particular context, the development of something perceived as new, and the adoption of the new element, over a period of time.

Innovativeness: Proposed as the willingness to experiment with new approaches of inquiry, the commitment to master new knowledge, and the ability to exhibit innovative behaviour over time.

Innovator: A person or company who adopts new ideas, thinks creatively and critically, and copes with uncertainty; a person or company that brings in new ideas and methods; and, a person who adopts a new practice or buys a product first.

Innovatorship: The capacity and willingness to participate in the knowledge exploration, interpretation and recombination activities of the innovation process; an essential quality of a globally competitive organization, and nation.

Intrapreneur: A person who uses entrepreneurial skills and thinking to seek out initiatives that could benefit their organization.

Intrapreneurship: The capacity and desire to practice entrepreneurship inside an organization.

Strategic Design Method: An approach that involves strategic thinking and reflective action through the use of creative and critical thinking techniques, resulting in situated innovation.

SDM: UBC's strategic design method.

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Chapter 1: Introduction

> *"In an era of fast and profound change, Canadians need to be adaptable and resilient so that they can spot the opportunities to create jobs, drive growth across all industries and improve lives. The country is at its most prosperous when everyone has a fair chance at success. Innovation is the path to inclusive growth. It fosters a thriving middle class and opens the country to new economic, social and environmental possibilities. It is essential in shaping our future.*
>
> *That's why Canada needs an inclusive plan to foster a confident nation of innovators—one that is globally competitive in promoting research, translating ideas into new products and services, accelerating business growth and propelling entrepreneurs from the start-up phase to international success. The way forward is to act on a bold new vision: to build Canada as a global centre for innovation." (Minister Bains, Canada's Minister of Innovation, Science and Economic Development, Canada, 2016).*

The government of Canada (2016) recently declared a call to action to develop a distinctive culture of innovation. They identify six inclusive action areas focused on people, technology and partnerships, and outline the role for academe to assist with making Canadians "innovation- ready". They suggest developing abilities "to spot opportunities, imagine possibilities, discover new ideas, learn and grow". They seek to encourage an innovation mindset that encompasses creativity, risk-taking and ambition to succeed in the global marketplace. They recommend that science, technology, engineering and financial literacy should be taught alongside business, math, social science and the arts (Canada, 2016).

The six action areas include: (1) Entrepreneurial and Creative Society—Being innovative becomes a core Canadian value; (2) Global Science Excellence—Canadian science capabilities and research infrastructure become among the best in the world; (3) World-Leading Clusters and Partnerships—Super clusters that are the destination of choice for ideas, talent and capital; (4) Grow Companies and Accelerate Clean Growth—Canadian companies compete to win and create jobs; (5) Compete in a Digital World—Canada is at the forefront of economy-wide digital development and adoption; and, (6) Ease of Doing Business—Canada is the location of choice for investment and growth.

After twenty years as a practicing strategist, communication designer and innovator in Canada, I have witnessed organizational leaders and peers struggle with engaging effectively in the innovation process. From operational concerns with risk, budgets and resources, to marketing challenges with identifying customer needs, many individuals (regardless of rank) seem to lack the knowledge, aptitude and skills associated with innovative thinking and acting. It is from this perspective that I pursued a doctoral journey to investigate, and then translate the complex innovation process into a form that can be better understood and practiced.

This dissertation is a timely response to the Government of Canada's first action area focused on developing an entrepreneurial and creative society by increasing our innovative capacity. My research approach integrates a seasoned practitioner's experience with the innovation development process and a scholar's experience with teaching design-based innovation education at the University of British Columbia's (UBC) Sauder School of Business.

1.1 Problem Statement

Innovation doesn't just happen. Its process is designed, either implicitly or explicitly, and is complex. How can one navigate its complexity without knowing its critical elements and functions? How does one face and ultimately "ride" the cycles or waves of innovation, accept the falls and get wet in the process? How might we develop an innovative capacity?

Innovation is critical for a sustainable economy. Across the globe, governments and industry continue to invest significantly in innovation-development infrastructure and activities, with mixed results. Unfortunately, most countries have overlooked the need to develop the skills, aptitudes and competencies associated with innovation that are necessary for individuals, organizations and their regions to prosper. Ranked 9th among 16 peer countries (TCBC, 2015), Canada's innovation performance is considered poor.

Academics, industries and government agencies suggest the performance reflects outdated public policies, such as taxation, R&D tax credits, and regulations. Some argue it is the lack of sufficient risk capital, scientists, engineers, or entrepreneurial support. Former University of Toronto scholar,

Michael Helander, told Financial Post reporters (2014) that Canada needs "more innovators to step-up, start companies and break their research out of the lab."

The Conference Board of Canada (2015) agrees, and suggests that the behaviour of firms and entrepreneurs, such as management reluctance to take risks or to build globally competitive large corporations, is to blame. The Globe and Mail (Grant, 2015) article further supports this argument, stating Canada's relatively poor innovation record is due to weak entrepreneurship or intrapreneurship levels within large organizations, suggesting workers at big firms are hesitant to take initiative. Canada has one of the highest entrepreneurship levels among Group of Seven countries, yet produces a shortage of enduring businesses beneficial to the nation's economic prosperity. Is Canada more concerned about entrepreneurs than the broader category of innovators?

In a recent government Institute for Research on Public Policy report (IRRP, 2016) the federal government provided an innovation agenda for achieving the goal of building Canada into a centre of global innovation. The report outlines critical strategies that aim to go beyond Canada's traditional focus on R&D. The key strategies include: (a) promoting rather than hindering market competition; (b) focusing regulations and policies to facilitate innovation incentives, while promoting broader public interests; and, (c) promoting partnerships between business, government and post-secondary educational institutions to enhance skills, reinforce innovative ecosystems, and support sectoral and regional clusters of activity.

Canada's recent call to action to develop innovators (Canada, 2016) follows the IRRP 2016 report identifying Canada's need to enhance innovation-related skills necessary for cross-sectoral innovative activities. It argues that, Canada has one of the highest rates of post-secondary graduation in the OECD, yet we lack actual employable skills to solve problems (IRRP, 2016). It proposes "the problem lies with the education system itself, which is not providing education for the competencies required for participation in the innovation-driven economy" (IRRP, 2016: 27). As Canada continues to invest in traditional R&D and STEM-focused initiatives (e.g. technology-focused invention) at national and regional levels, it may be overlooking the development of human-centred research competencies required for individuals and organizations to innovate.

Competencies in this context refer to individual characteristics that contribute to effective innovation performance and include knowledge, aptitudes, and skills. This imbalance is threatening our growth in the global economy.

Many studies have examined entrepreneurial and intrapreneurial traits and training methods. However, only a few have investigated a pedagogy and associated competencies required for individuals to explicitly and effectively engage in the process of innovation (Leonard-Barton, 1992; Midgley and Dowling, 1978; Tidd and Bessant, 2001; Matthews and Brueggemann, 2015). Considering innovation's core resource is *human capital*, research is needed to first observe and analyze how humans and their social systems innovate, and then to design the appropriate academic, economic, technological and political infrastructures.

The IRRP report (2016), written in response to the 2011 OECD research study (OECD, 2011), identified a critical need to improve the data and analysis of social and educational systems associated with innovation competency and management. As a member of the OECD, the Canadian government and media comment frequently on the shortage of skilled workers with innovation-related competencies. The competencies explored in this dissertation refer to individual capabilities, aptitudes and skills that integrate within innovation development and innovation management activities and systems (Leonard-Barton, 1995). Helping Canadians develop the necessary innovation-related competencies is the core motivation for this dissertation.

1.2 Research Question

As a former innovation practitioner, my initial research question sought to rigorously investigate how the innovation process happens and how innovative capacity is developed. As an active innovation process researcher and sessional lecturer for a design-based undergraduate commerce course focused on business innovation, a new research question framework emerged.

My central research question evolved to ask *can a design-led innovation pedagogy develop innovative capacity?* This question would require investigating a series of sub-questions that included: How does innovation happen?; What are the related innovation, learning and design

theories?; and, Which competencies associated with the innovation process are critical to developing innovative capacity or innovativeness? A document analysis (i.e. of the innovation process and an instructional method the simulates the innovation process) combined with action research was identified as the appropriate methodology to investigate how innovative capacity can be taught and learned.

My hypothesis is that for individuals to learn *how* to effectively participate in the innovation process, they must first understand the process itself, and then develop the competencies associated with innovative capacity or *innovativeness*. Innovativeness is one's innovative capacity and can be simply defined as the integration of characteristics associated with innovators, along with innovative aptitudes and skills.

Although the characteristics and behaviours of the innovator have been well studied in the domains of entrepreneurship and intrapreneurship, my research suggests a more inclusive and broader concept of innovators inside organizations and in civil society. I propose the concept of *innovatorship* as reflecting the qualities associated with innovativeness. I suggest it can be observed as the degree of individual innovativeness that positively impacts the initiation through to the implementation of an innovation, in organizations and society. I suggest that *innovatorship* is achieved through the ability and willingness to adopt new ideas, think creatively and critically, act with curiosity, and tolerate uncertainty through an innovation process. Unlike entrepreneurship or intrapreneurship, *innovatorship* is not concerned with new business ventures or new divisions within organizations. *Innovatorship* is concerned with the capacity and willingness to participate in the knowledge exploration, interpretation and recombination activities of the innovation process. It reflects innovator qualities and behaviour developed from key innovativeness competencies and embodied in individuals. It forms the essential quality of a nation's ability to succeed in an ever changing and increasingly competitive global marketplace.

Innovatorship is the output formed by a competence with innovativeness. For this dissertation, innovativeness competencies are examined as individual capabilities, aptitudes and skills that are integrated within innovation development and innovation management activities and systems.

1.3 Theoretical Framework and Methodology

The interdisciplinary theoretical frameworks informing this dissertation integrate innovation process, social and experiential learning, and design. They include Everett Rogers' diffusion of innovations theory (1962-2002), Chris Argyris and Donald Schön's double-loop learning theory (1978), David Kolb's experiential learning theory (1974), and Herbert Simon's (1969) theory of design.

From the interdisciplinary theoretical framework, document analysis and action research methods are employed to examine and code participant interactions with an intervention that simulates the innovation process. Document analysis provided a qualitative research method of interpreting the literature reviewed and associated documents and artifacts collected from the action research studies. Action research is considered a structured and systematic research process that helps teacher-researchers collect data on various classroom procedures (instructional methods) with an end goal of changing those procedures to make them more effective for all involved (Elliott, 1991). The instructional method is a strategic design method (SDM) that involves active and experiential learning of innovation competencies. SDM is taught at the University of British Columbia and offers a way to learn, think and practice with visual, investigative and prototyping tools associated with developing something new. By applying SDM as the innovation-intervention, observations and insights are made from how subjects responded to the introduction of a new element into their social system and the diffusion and adoption (or not) of the innovation process, as it occurs.

The data collected from the document analysis and action research studies are applied to a comparative process analysis and a comparative competency analysis involving Rogers' innovation-development process and the strategic design method. The findings provide a categorization of competencies that suggest individual innovativeness can be developed for specific phases of the innovation process and inform an innovation pedagogy proposed for future research in innovation development.

1.4 Contribution

This dissertation reflects my 20 years as an innovator-practitioner and my recent four years as innovation process researcher-instructor. It offers the government of Canada a way to better define and develop a nation of innovators. It aims to provide valuable observations and insights to complement the theoretical discussions of skills and literacy necessary for innovation. As stated by Dr. Hess in a Forbes 2014 article, "Innovative thinking, like critical thinking, does not come naturally to most people. To innovate, individuals have to take their normal thinking to a much higher level. Most of us have to be taught how to do that" (Forbes, 2014). My personal goal is to offer a greater audience an understanding and literacy of the innovation process, without having to have an advanced degree in statistical analysis, economics or sociology.

My research intent was to investigate past studies of the innovation process and observe the process in real-time to:

- identify and validate its common phases and stages;
- identify the innovative capacity (i.e. innovativeness) associated with each stage;
- translate the findings in a way to improve one's understanding and practice with innovative thinking and action; and,
- propose a pedagogical model and key competencies framework to help individuals and their organizations understand and learn how to innovate.

This dissertation aims to contribute new knowledge to the innovation discourse by proposing:

1. An interdisciplinary typology of the innovation process literature.
2. A visual exploration of the innovation process to assist with understanding complex process models.
3. An ontology of the competencies associated with individual innovativeness.
4. A design-mediated innovation process pedagogy for further research.

1.5 Dissertation Sections

The dissertation is organized into the following sections:

Chapter 1: Introduces the problem and the research questions associated with a design-led instructional method's effectiveness to develop innovative capacity or innovativeness.

Chapter 2: Provides a literature review on the most influential innovation process theory, innovator, social and experiential learning models, and theories of design.

Chapter 3: Outlines the methodology involving document analysis and action research.

Chapter 4: Outlines the research design and data collection involving document analysis and two action research studies.

Chapter 5: Explains two action research studies involving individuals (undergraduate students) and an organization (Creative BC), and describes the instructional method under study.

Chapter 6: Provides findings from the document analysis and action research studies.

Chapter 7: Concludes with a conceptual learning model to improve innovativeness.

Chapter 8: Offers a reflection on the process, my journey and future research areas.

Chapter 2: Literature Review and Theoretical Frameworks

The dissertation hypothesizes that innovation-related competencies can be taught and learned. To understand how, we must first review how the process of innovation happens and how learning (adoption) occurs. This chapter reviews the innovation literature and provides a summary of the common elements, phases and activities. It classifies the most common motivations, traits, behaviours and competencies associated with its complex process. This chapter also provides the theoretical frameworks for the action research studies outlined in Chapters 3 and 4.

The literature reviewed in this chapter includes a broad *Innovation Studies* and *Innovation Management* corpus that discusses innovation, learning and design theories. The innovation process literature comprises the most influential diffusion scholars, as adoption of their innovation theories reflects successful influence. The learning theories' literature comprises empirical studies of innovation and associated learning models. The design theory literature situates dimensions, methods and competencies associated with the innovation process.

This chapter is organized in the following sections: (2.1) An overview of the innovation process literature; (2.2) How innovation happens: the innovation process and models explained; (2.3) Why individuals and organizations innovate; (2.4) The innovation process and learning theories; (2.5) The innovation process, design theory and methods; (2.6) Rogers' innovation development process and competency classification; (2.7) Innovativeness constructs, traits and competencies; and, (2.8) Summary.

2.1 An Overview of the Innovation Process Literature

The literature on the topic of the innovation process is vast, multi-disciplinary and spans over 100 years. Economist Joseph Schumpeter (1934) describes the innovation process as involving a science-push and problem-solving methodology, focused on tangible products and processes that can be measured economically. Organization scholar Andrew Van de Ven (1999) proposes that the innovation process is a journey along an uncharted river, led by individuals with ambiguous goals, who display divergent and convergent behaviours. Design engineer scholar Rolf Faste (1994)

proposes the innovation process engages ambidextrous thinking for a more balanced and potent approach to problem solving. Psychology scholar José Fonseca (2002) argues the innovation process is a form of social relation between people, and is fundamentally a conversational process. The table below outlines the interdisciplinary innovation literature reviewed for this paper. A more detailed table is available in Appendix A.

Humanities		**Social Sciences**		**Sciences**
Arts/ Geography	**Philosophy**	**Economics**	**Sociology/Anthropology/ Psychology**	**Applied**
Hagerstrand, T. (1968). Innovation diffusion as a spatial process. Innovation diffusion as a spatial process.	Christensen, C. (2013). The innovator's dilemma: when new technologies cause great firms to fail. Harvard Business Review Press.	Schumpeter, J. A. (1934). The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle (Vol. 55). Transaction publishers.	Rogers, E. M. (1962-2010). Diffusion of innovations. Simon and Schuster	Gabor, D. (1970). Innovations: Scientific, Technological, and Social. And Gabor, D. (1946). Theory of communication. Part 1: The analysis of information. Journal of the Institution of Electrical Engineers. 93(26), 429-441.
H. G. Barnett (1953). Innovation: The Basis of Cultural Change (New York: McGraw-Hill Book Company.	Drucker, P. (2014). Innovation and entrepreneurship. Routledge.	Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: a new perspective on learning and innovation. Administrative science quarterly, 128-152.	Burns, T. E., & Stalker, G. M. (1961). The management of innovation. University of Illinois. Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.	Simon, H. A. (1996). The sciences of the artificial (Vol. 136). MIT press.
	De Tarde, G. (1903). The laws of imitation. H. Holt.	Chesbrough, H. W. (2006). Open innovation: The new imperative for creating and profiting from technology. Harvard Business Press.	Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. Organization science, 2(1), 40-57.	Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. Technology review (64) 254-228.
	Moore, G. A. (2002). Crossing the chasm. Harper Publications.	Freeman, C., & Soete, L. (1997). The economics of industrial innovation. Psychology Press.	Van de Ven, A. H. (1986). Central problems in the management of innovation. Management Science, 32(5), 590-607	
		Nelson, R. R. (Ed.). (1993). National innovation systems: a comparative analysis. Oxford university press.	Gardner, J. W. (1995). Self-renewal: The individual and the innovative society. WW Norton & Company.	
		Von Hippel, E. A. (2005). Democratizing innovation.	Comte, A. (1868). The positive philosophy of Auguste Comte.	
		Kline, S. J., & Rosenberg, N. (1986). An overview of innovation. The positive sum strategy: Harnessing technology for economic growth (14) 640.	Rothwell, R. (1994). Towards the fifth-generation innovation process. International marketing review, 11(1), 7-31.	
		Pareto, V. (1964). Cours d'économie politique. Librairie Droz. Pareto, V. (1971). Manual of political economy.		
		Usher, A.P. (1954) A History of Mechanical Inventions. Harvard University Press.		

Table 2.1 Most Cited Innovation Process Literature

For organizations, Van de Ven defines the innovation process as a facilitated approach to creativity, and successful management of the complex process of turning creative ideas into reality (Van de Ven, 1999). Chaput (2011) argues innovation is a change management process. He proposes that where the capacity for change is a requirement for innovation, the main task is to lead a group towards a given direction different from the observed one, knowing people would prefer other options; that this group decides to cooperate and move towards an end, and that tools are provided to exercise this will to cooperate (Chaput, 2011). Manzini (2003) proposes that the innovation process is actually a short-term strategic process, which results in new forms of organization and innovative forms of co-production of value. Amabile et al (1996) and Damanpour et al (1984) propose the innovation process is the development, adaptation and implementation of an idea that is useful and new to the organization at the time of adoption. Christensen (1997) associates the innovation process with disruptive technologies leading to disruptive innovations. Akrich and Fonseco et al (2002) argue innovation is potentially a new patterning of everyday experiences, a responsive and generative process resulting in sense-making and new meanings.

Most innovation researchers describe the innovation process as a staged approach. Although many scholars argue there is no one universal and smooth sequence of steps to the innovation process, all agree there are typically four stages, involving the initial vision, idea generation, innovation development, and implementation" (Amabile, 1988:151). Many researchers (Marcus, 1988; Rogers, 1983; Staw, 1990; Zaltman, Dun, and Holbec 1973) have supported a general two-stage model: (1) an initiation stage, which consists of "all activities pertaining to problem perception information gathering, attitude formation and evaluation, and resource attainment leading to the decision to adopt"; and (2) an implementation stage which consists of "all events and actions pertaining to modifications to the innovation and/or organization, initial utilization, and continued use or discontinued use (Damanpour, 1991:562). Van de Ven et al (1999) argue the innovation process is comprised of three phases: (1) an *initiation* period comprised of events that set the stage for launching the efforts of developing the innovation; (2) a *developmental* period comprised of activities and efforts undertaken to transform the innovation idea into a concrete reality; and (3) an *implementation* period which comprises of innovation adopted as a new program, product or business or terminated and abandoned. Their framework reflects the common elements empirically

derived from his studies of the innovation journey. They separate the *development* phase from the implementation phase as it engages in a messy, chaotic and series of events. These events do not align with the operational activities (i.e. commercialization and diffusion) well studied in the innovation management literature.

The innovation process models are critical to understand, because they break down the innovation process into a series of phases and staged activities, each associated with a particular set of tasks, skills or roles. Generally, the innovation process models include two common phases that each involve numerous and varying sub-stages. The first or front-end phase, described as *initiation* or a combination of *initiation* and *developmental* (Van de Ven et al, 1999) commonly involves generating ideas and the second or *implementation* phase typically involves taking action to implement them. At the human level, both phases require an individual to combine and recombine existing knowledge in new ways. Individuals participating in both phases require innovation-related competencies to be able to move between domain specific knowledge (individual's learned knowledge) and context specific knowledge (situated knowledge). This dissertation seeks to investigate individual competencies for the front-end of the innovation process.

2.2 How Innovation Happens: The Innovation Process Explained

The innovation process literature spans linear, non-linear and cyclical models. A table describing innovation process models from the past 80 years is provided in Appendix B. The majority of models share key elements of ideas, implementation and evaluation. The innovation process commonly involves change in technology, human perception and affiliated social systems. A satisfactory model must move away from a linear, stage-based process, to a dynamic, continuous conception of change over time (Van de Ven & Rogers, 1988: 638).

Notable innovation process models include: Wilkening's (1953) four-stage model; Utterback and Abernathy dynamic product to process innovation models (1975, 1978); Roberts and Fusfeld's five (1981) critical functions model; Faste's (1987) design thinking model; Kline and Rosenberg's (1986) chain–linked model; Cooper's (1990) stage-gate model; Trice and Beyer's (1991) nine-element cultural innovation model; Rothwell's (1994) fifth-generation process model; Freeman's

(1996) firm-specific linear models; Brown's (1999) six-phase design innovation model; Van de Ven et al's (1999) twelve-stage chaotic model; Tidd and Bessant's four-actions model (2001); UK Design Council's (2005) double-diamond model; Kumar's (2013) seven-modes design model; and, Rogers' (1962-2003) innovation development and diffusion of innovation models.

The first visual model of the innovation process is attributed to rural sociologist, Eugene Wilkening (1953). Wilkening describes the innovation process as a proposal of a new practice (new farming technology) that requires acceptance and approval before adoption. Wilkening's process of acceptance before adoption reflects a decision-making process, through which learning, decision and action occur over a period of time. He offers a four stage process that includes: (1) initial knowledge, (2) acceptance of practice as a good idea, (3) acceptance of the practice as trial, and, (4) adoption of the practice (Wilkening, 1953:9). Wilkening's model is significant in that it provided a theoretical and visual learning model of the innovation process. The model (Figure 2.1) offered a structured analytic and investigation process into an adoption of innovation, complete with data collecting steps. It also proposed a simple, four-phase process for future innovation studies to build upon (Godin, 2015:40).

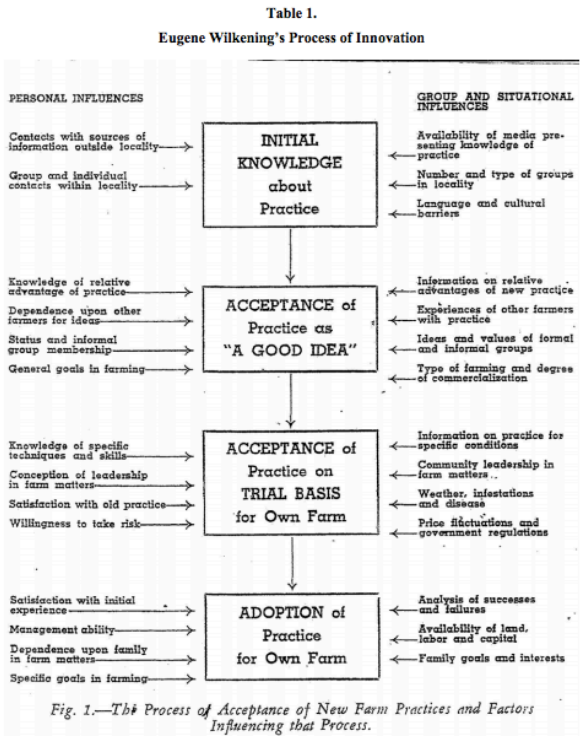


Figure 2.2 Wilkening's process of innovation model

Wilkening's visual model is introduced and discussed in the seminal work of the most attributed innovation scholar, sociologist Everett Rogers. Rogers' (1962) innovation research identified four main elements (Figure 2.2): (1) an *innovation*, as an idea, practice or object that is perceived as new by an individual or other unit of adoption; (2) *communication channels*, as the means by which messages about the innovation move from one individual to another; (3) *time*, a unit that measures the duration of innovation-decision process itself, how long it takes for the innovation to be adopted by an individual or group, and the innovation's rate of adoption; and, (4) *social system*, a set of interrelated units that are engaged in joint problem solving to accomplish a common goal (Rogers 1962, 1993, 1995).

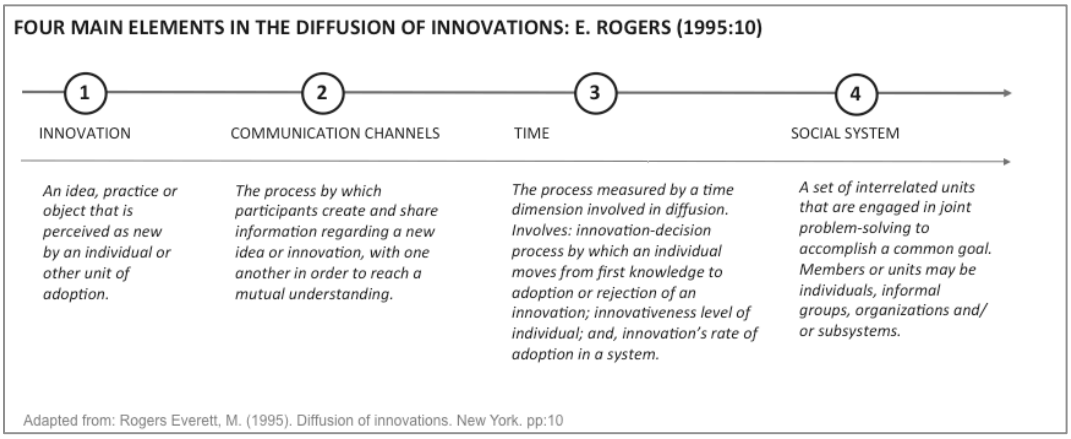


Figure 2.2 Adaptation of Rogers' Diffusion of Innovations Theory

Freeman (1974) was the first to observe whole systems of innovation where R&D played a central role in initiating and being the source of product and process innovation development. His influential work on '*The National System of Innovation'* would expand the innovation process to a systemic level, encompassing "education, training, production, engineering, design, quality control, etc." as related activities to R&D (Freeman, 1995). Duncan proposed (1976:174) the early stages of the innovation process (conception, proposal generation, and initiation) require fewer controls and more autonomy. He argued that diversity, openness, informality and the ability to bring a variety of base information to bear on a problem needs to be encouraged, or developed. He introduced the concept of "ambidextrous" organizations as those which are adept at moving between initiation stages and implementation stages (Duncan, 1976:167).

Marcus' study on nuclear reaction stations (1988) argued the innovation process is heavily dependent on the individual. His insights of the process included how it "resembles market-driven processes, which rely on individual initiative and competence to achieve objectives that cannot be accomplished by central direction (within the organization)" (Marcus, 1988:251). Rothwell's (1995) forward look on the innovation process, suggested a continued process of market needs leading change and technology matching market needs. He identified strategic elements and enabling factors for innovative organizations that can be considered for innovator-related education and training. These included: time-based strategies (faster, more efficient product and service development; quality focus on development (non-price factors); corporate flexibility and responsiveness; customer focus; primary supplier integration; horizontal technological collaboration; computer-based data processing; and commitment to total quality control. His work supports the identification of competencies required for organizations and individuals in a market first, technology second approach to innovating products, services, and practices.

Tidd and Bessant (2001) explain their innovation process as a four-actions model that resembles a funnel. The first action is *Search* (how can we find opportunities for innovation?); the second is *Select* (what are we going to do and why?); the third action is *Implement* (how are we going to make it happen?) and the fourth action is *Capture* (how are we going to get the benefits from it?).

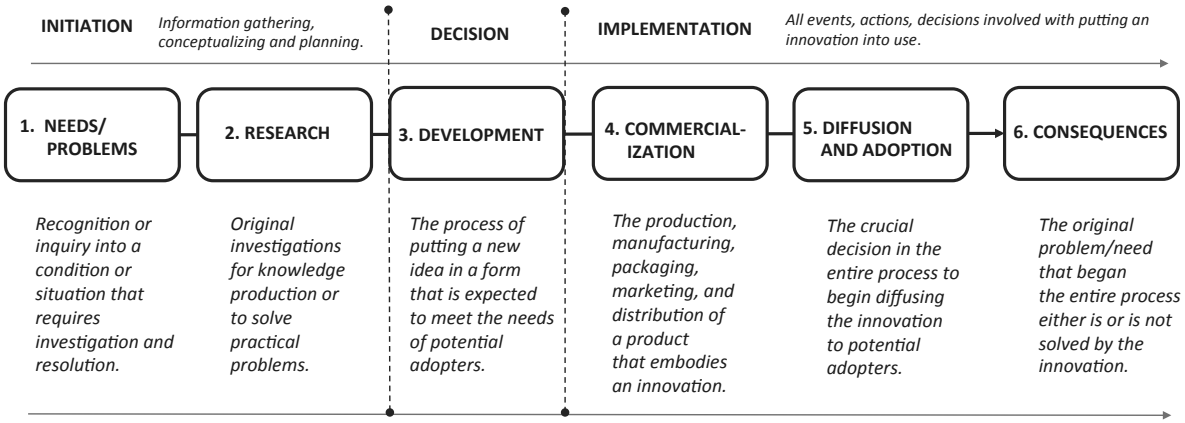
Van de Ven (1995) observed how innovative ideas were developed and implemented by people, who engaged in transactions (or relationships) with others, and who made the adaptations needed to achieve desired outcomes within changing institutional and organizational contexts" (Van de Ven 1995: 274). He described the innovation process as consisting of a growing number of events performed by many different people over an extended period of time. Van de Ven would collaborate with Rogers (1988) and together propose four requirements to study the innovation process as: a) a clear set of concepts about the object being studied; b) systematic methods for observing change in the object over time; c) methods for representing raw data to identify process patterns; and, d) a theory to make sense of the process pattern (Van de Ven and Rogers, 1988: 638). This dissertation reflects their scholarly approach to the study the innovation process.

Observing the innovation process would be locus of Rogers' work for over 40 years, earning him recognition as the most influential and cited innovation scholar of the 20th century. Rogers' theory of the innovation process is referred to as the *Diffusion of Innovations.* A sociologist and communication scholar, Rogers published over 3,000 works and has been cited over 68,000 times. Considered a seminal social science theory and first published in 1962, Rogers' *Diffusion of Innovation*s describes the complex innovation process as: "consisting of all of the decisions, activities, and their impacts that occur from recognition of a need or problem, through research, development, and commercialization of an innovation, through diffusion and adoption of the innovation by users, to its consequences" (Rogers, 1995:132). In contrast to most of the other innovation management literature contributions, Rogers' work is written from a sociological perspective, focusing on the human and systemic conditions that affect the adoption by users of products, processes or technologies new to them. Rogers also offers a detailed examination of the innovation process from both an individual and organizational perspective. As a human-centred process, (i.e. not economic or technological), Rogers' innovation-development process theory, is foundational to this study and informs a design-led instructional method for innovation education.

2.2.1 The Innovation

The first and critical element of Rogers' theory is the innovation. Rogers defines an *innovation* as an idea, practice, or object perceived as new by an individual or other unit of adoption (Rogers, 1995). Although Rogers centres his work on the diffusion and adoption of innovations, he does remark on the lack of *pre-diffusion* studies that contextualize where innovations come from, how they are initiated and what events, activities and decisions inform their later adoption and diffusion. He proposes a six-phase innovation-development process (Figure 2.3) that integrates past 'tracer' and 'diffusion' published studies. The *innovation-development process* consists of the recognition of a need or problem and the decisions and activities involving research, development and commercialization of an innovation. It also includes the diffusion and adoption of the innovation by users, and the impact and consequences of adoption. He suggests the phases of innovation-development are not always in the same order or even encompass all phases for all innovations. Rogers makes a clear request for more research to validate and evolve his well-studied model (Rogers, 1995:133). Supported by years of research, he states that his process is "driven by the

exchange of technical information in the face of a high degree of uncertainty" (1995:138). It is this innovation-development process (IDP) model that is the foundational theory for this dissertation.



Adapted from: Rogers Everett, M. (1995). Diffusion of innovations. New York. pp:133

Figure 2.3 Adaptation of Rogers' Innovation-Development Process.

Rogers proposes five main characteristics of an innovation that will affect its rate of adoption. The five attributes include relative advantage, compatibility, complexity, trialability, and observability (Figure 2.4). The innovation must be perceived as having a *relative advantage* of being better than others that preceded it; must be *compatible* to the existing values, past experiences and needs of its potential adopters; must present a *reduced complexity* to be understood and used; must be *trialed*, sampled or experimented with; and, must be *observed* or its value made visible and communicated effectively to others (Rogers, 1995: 204).

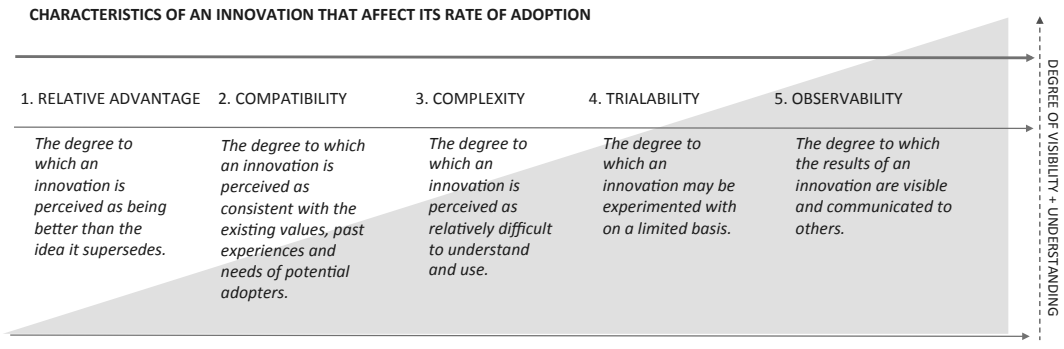


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Figure 2.4 Adaptation of Rogers' Five Factors.

2.2.2 Communication

Rogers' second element is communication. He defines the *communication channels* as the means by which a message is exchanged between two or more individuals. He argues that there are three elements to this information exchange: an innovation, the individual or unit of adoption who has knowledge about it, and, another individual or adopting unit who may not have experience or knowledge about the innovation. He simplifies the channels into two types: mass media and interpersonal channels. Mass media refers to means of transmitting the message to a large population to create awareness of the innovation. Examples of mass media channels include television, radio and print publications. Interpersonal media involves a direct exchange between two or more individuals. Examples of interpersonal channels include face-to-face meetings, telephone and video conferencing.

2.2.3 Time

Time is the third element in the *Diffusion of Innovations* model and is the most valued contribution to innovation process literature. Rogers proposes three time-based dimensions to his theory that include the (a) innovation-decision process, (b) innovativeness units of adoption, and (c) rate of adoption:

(a) The *innovation-decision process* is the mental process through which an individual (or other decision-making unit) passes, from first acknowledging an innovation to forming an attitude toward it, to a decision to adopt or reject it, to implementation of the new idea, and to confirmation of this decision. An individual seeks information at various stages in the innovation-decision process in order to decrease uncertainty about an innovation's expected consequences. Rogers presents a five-step decision making process (Figure 2.4): (1) *Knowledge*: when a person becomes aware of an innovation and has some idea of how it functions (2) *Persuasion*: when a person forms a favorable or unfavorable attitude toward the innovation (3) *Decision*: when a person engages in activities that lead to a choice to adopt or reject the innovation (4) *Implementation*: when a person puts an innovation into use; and, (5) *Confirmation*: when a person evaluates the results of an innovation-decision already made.

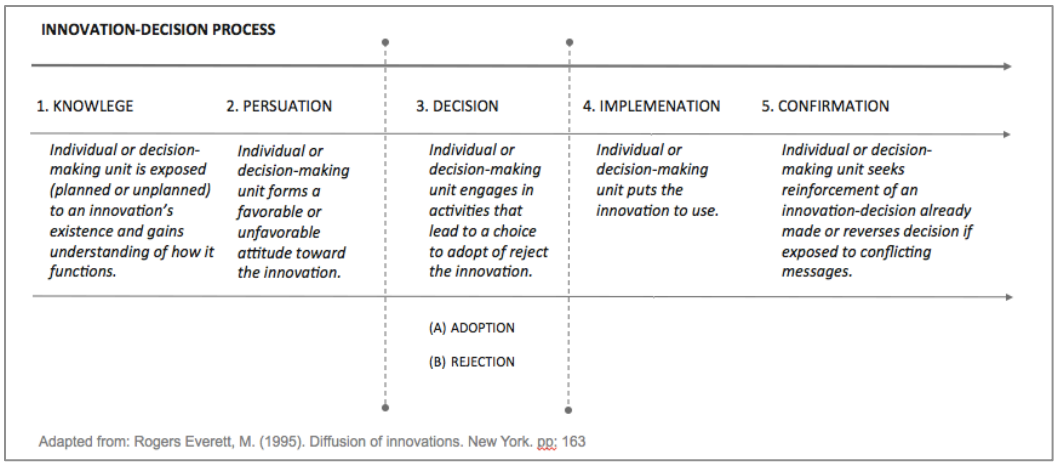


Figure 2.5 Adaptation of Rogers' Innovation-Decision Process.

(b) The *units of adoption* refer to the time involved in diffusing the innovation, based on the innovativeness of an individual or other unit of adoption. Innovativeness is the degree to which an individual or other unit of adoption adopts new ideas relative to other members of a social system. Rogers categorized five adopter types (Figure 2.5) or classifications of social system members on the basis on their innovativeness: (1) *Innovators*: who represent approximately 2.5% of a social system population; (2) *Early adopters*: who represent approximately 13.5%: (3) *Early majority*: who represent approximately 34%; 4) *Late majority*: who represent approximately 34%; and, (5) *Laggards:* who represent approximately 16% of a social system population. Rogers does offer a limitation of generalizing this curve as one can fit into different categories depending on the innovation and the prior conditions associated with it. He generalizes that early adopters are often opinion leaders and role models, and thus are instrumental in getting an innovation to the early majority, and influential in the successful diffusion of an innovation. This dissertation explores the possibility of influencing the rate of adoption with an increase in innovativeness capabilities.

Figure 2.6 Units of innovation adoption curve (Rogers, 1995).

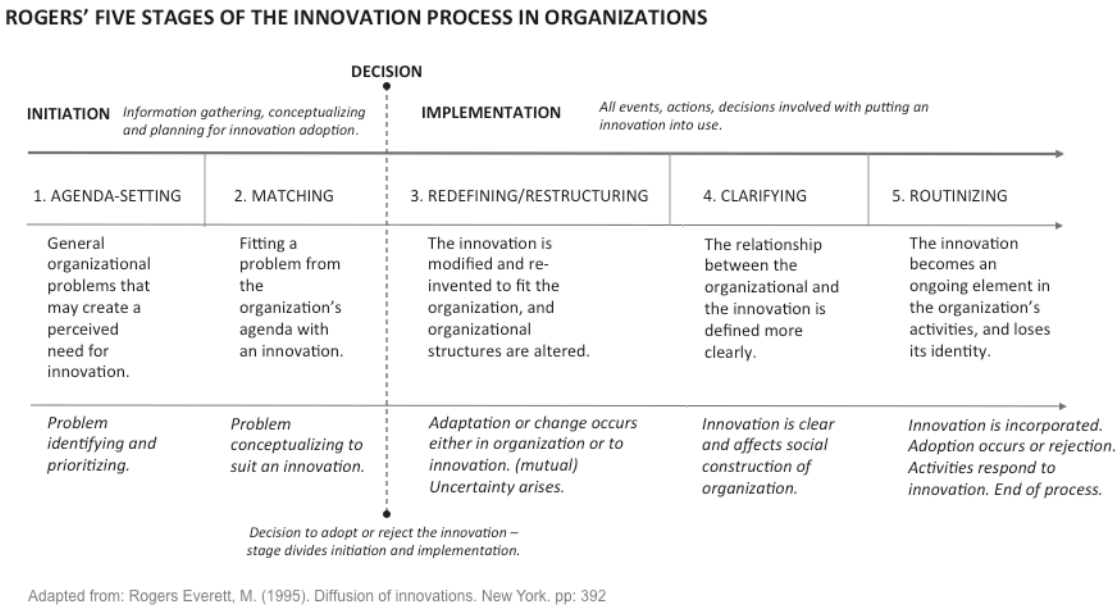
(c) The *rate of adoption* is the relative speed with which members of a social system adopt an innovation. The rate of adoption is usually measured as the number of members of the system that adopt the innovation in a given time period. It is influenced by the prior attributes of an innovation and existing conditions, contexts, and innovativeness types. Here, Rogers interprets sociologist Gabriel Tarde's ideology (1903) from his work entitled "*The Law of Imitation"*, to imply that an individual learns about an innovation by copying someone else's adoption behaviour. Rogers embeds Tarde's fundamental law of imitation as "the more similar the innovation is to the ideas that have already been accepted, the more likely the innovation will be adopted" (Rogers, 1995:40)

2.2.4 Social System

The fourth and final element is the *social system*. Rogers defines a social system "as a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (Rogers, 1995:23). The members of a social system may be individuals, informal groups, organizations, and/or subsystems. The social system constitutes a boundary within which an innovation diffuses. The system's social structure, its norms and opinion leadership all affect the diffusion of innovation. Although Rogers identifies the critical role of the social system within the diffusion of innovations process, its role as an original source of innovation and creativity is not explored. Interestingly, although Rogers integrates Tarde's ideology and imitation law into his theory, he does not discuss, nor suggest the inventive and creative capacity of the social system as an important element to initiate the innovation process. Specifically, Tarde argued that the innovation (invention) process involves society initiating new acts of imitation, triggering a cultural learning process while interrupting existing imitation streams, and advancing social change and behaviours (Nicholls et al, 2016). Tarde's sociology is concerned with *invention* as the genesis of new social

practice and social learning. Although not directly attributed to Tarde, Rogers introduces social learning theory as applicable to diffusion networks as social systems. Social learning occurs when an individual learns from another by means of 'observational modeling' and then does something similar (Rogers, 1995:330). Social learning, originally proposed by Tarde and extensively studied by psychologist Bandura (1977) is contextualized in Rogers' theory. All seek to study and explain the change of behaviour as a result of introducing a new idea or practice to individuals, society or organizations.

In summary, Rogers' innovation theory can be described as a four-element framework of diffusion that involves an innovation, communication channels, time, and a social system. The innovation process stages common across most studies involve two distinct phases: initiation and implementation. The two phases are divided by a critical decision point, which involves continuing or ending the innovation process (Figure 2.6). The decision point separates the problem-focused phase (i.e. initiation) from the solution phase (i.e. implementation).



Adapted from: Rogers Everett, M. (1995). Diffusion of innovations. New York. pp: 392

Figure 2.7 Rogers' Innovation Process Inside Organizations

2.2.5 The Innovation Development Process

Rogers' work has been extensively studied by innovation scholars and adopted by practitioners, who find his perspective useful when engaged in the actual development of an innovation, or if they are deciding whether (or how) to adapt an innovation to meet their needs or requirements (Ellsworth, 2000:40). Authors from academe and industry have integrated his theories into their published works. Rogers' diffusion theory can be traced in notable works, such as Herbert Simon's *The Sciences of the Artificial* (1996), Henry Chesbrough's *Open Innovation* (2006), Geoffrey Moore's *Crossing the Chasm* (2002), Clayton Christensen's *The Innovator's Dilemma* (2013), and Andrew Van de Ven's *The Innovation Journey* (1999).

Rogers provides compelling evidence that individuals tend to expose themselves to ideas "that are in accordance with their interests, needs and existing attitudes" (Rogers, 1995:164). He argues that individuals consciously or unconsciously avoid messages that are in conflict with their predispositions. This tendency is referred to as "selective exposure", originally introduced by Hassinger (1959), which describes how individuals seldom expose themselves to innovation messages unless they feel a need to. Both Hassinger and Rogers argue that individuals have consistent, and unfavourable, attitudes about ideas that have not been previously encountered, thus "selecting" ideas that are more familiar or not new. This dissertation explores the notion of recognizing a 'need' and exposing the concept of 'new ideas' through an experiential learning process of innovating.

From the interdisciplinary literature review, descriptive models of the innovation process suggest a consistent pattern with two key phases generally described as initiation and implementation. The table below (Table 2.1) highlights a selected list of reviewed innovation process models and presents a distinction between problem-focused and solution-focused phases, stages and activities.

Source	Initiation Phase (Problem)	Implementation Phase (Solution)
Wilkening (1953)	1. Initial knowledge about the practice	2. Acceptance of the practice as "a Good Idea" 3. Acceptance of the practice on Trial Basis 4. Adoption of the practice
Simon (1969)	1. Intelligence Gathering (environment)	2. Design (invention and development) 3. Choice (direction of course)
Rogers (1962-1999) Organizational Innovation Theory	Stage 1: Agenda-Setting Stage 2: Matching	Stage 3: Redefining/restructuring Stage 4: Clarifying Stage 5: Routinizing
Rogers (1962-1999) Innovation Development Process Theory	1. Needs/Problem Recognition 2. Research	3. Development 4. Commercialization 5. Diffusion and Adoption 6. Consequences
Argyris and Schön 1978)	Double Loop: Problem	Double Loop: Solution Double Loop: Implementation
Roberts and Fusfeld (1981)	Stage 1: Idea generation	Stage 2: Championing Stage 3: Project leading Stage 4: Gatekeeping Stage 5: Project sponsoring or coaching
Kline and Rosenberg (1986)	1. Potential Market 2. Invention/Analytic Design	3. Detailed Design and Test 4. Redesign and Produce 5. Distribute and Market
Cooper (1990)	Stage 0 - Discovery: Ideas Stage 1 - Scoping: Assessment	Stage 2 - Build Business Case: New product Stage 3 - Development: Development Stage 4 - Testing and Validation: Stage 5 - Launch: Commercialization
Kelley (1991)	1. Empathize 2. Define	3. Ideate 4. Prototype 5. Test
Buchanan (1992)	1. Problem definition (analytic step)	2. Problem solution (synthetic sequence step)
Ulrich and Eppinger (1995)	Phase 1: Concept Development	Phase 1: Concept Development Phase 2: System-Level Design Phase 3: Detail Design Phase 4: Testing and Refinement Phase 5: Production Ramp-Up
Freeman (1996)	1. Basic Research	2. Applied Research 3. Invention 4. Marketing Testing 5. Diffusion and Imitation
McGrath (1996)	Phase 0: Concept Development	Phase 1: Planning and Specification Phase 2: Development Phase 3: Test and Evaluation Phase 4: Product Release
Faste (1998)	1. Express (idea generation)	1. Express (idea generation) 2. Test (prototyping and design) 3. Cycle (solution modification and development)
Brown (1999)	1. Observation	2. 1deation 3. Rapid Prototyping 4. User Feedback 5. Iteration 6. Implementation

Source	Initiation Phase (Problem)	Implementation Phase (Solution)
Van de Ven, Polley, Garud and Venkataraman (1999)	1. Gestation 2. Shock	3. Plans 4. Proliferation 5. Setbacks 6. Criteria Shift 7. Fluid participation of organizational personnel 8. Investor/top management 9. Relationship with others 10. Infrastructure develop 11. Adoption 12. Termination
Tidd and Bessant (2001)	1. Search (for opportunities)	2. Select (key opportunity) 3. Implement (innovation) 4. Capture (manage and measure)
UK Design Council (2005)	1. Discover 2. Define	3. Develop 4. Deliver
Brown (2009)	1. Inspiration – the problem or opportunity that motivates the search for solutions;	2. Ideation – the process of generating, developing and testing ideas; and, 3. Implementation – the path that leads from the design studio, lab and factory to the market.
Quayle (2009)	Ask: finding problems and needs	Try: prototype and test ideas Do: make decisions, build ideas
Kumar (2013)	Mode 1: Sense Intent Mode 2: Know Context Mode 3: Know People	Mode 4: Frame Insights Mode 5: Explore Concepts Mode 6: Frame Solutions Mode 7: Realize Offering

Table 2.2 Typology of Innovation Process Models

Considering the empirical evidence from which Rogers constructs his *Diffusion of Innovations* theory, it is his innovation-development process (IDP) that is selected as the foundational theoretical framework for this dissertation. Rogers' IDP theory has been reflected in the majority of innovation process models since its introduction in 1962. It is central to my research on comparative process analysis and innovation-related competencies analysis.

2.3 Why Individuals and Organizations Innovate

Extensive studies on the innovation process suggest its initiation is triggered by causal events. From Rogers' seminal work, events are identified as important social problems, such as the increase in rural crime rates, the decrease in farm population through migration to cities, or disease control in urban areas (Rogers, 1993:54,65). He also describes events occurring inside laboratories where scientists perceive a forthcoming problem and engage in research to find solutions, such as the invention and trial of a new drug (Rogers, 1995:138). Havelock (1972) studied political events, such as how new public policies and federal laws on auto safety initiated an innovation process responding to the increase in traffic fatalities. Von Hippel (1976) observed

'lead users' initiating innovations in response to problems they personally perceived, such as athletes designing and developing new or improved sporting equipment. Van de Ven et al. (1999) identified innovation events as triggered by a shock or crisis. A shock is a situational event that may be internal or external, and serves to draw attention to the situation and focuses the efforts of the individuals or organizations to initiate action to resolve it. Individuals may face shocks involving personal finance, employment marketability, unforeseen weather (as a farmer), transportation access, or unexpected death, causing them to engage in invention or innovation activities. Organizational shocks may include new leadership, product failure, budget crisis, and loss of market share (market condition) and serve as currency to champion an innovative idea to commercialization, and urgency towards innovation activity and outcomes. (Van de Ven et al, 1999). Generally, most diffusion scholars propose the majority of innovations are caused by a perceived economic need for new technology to improve an existing situation. Situations may be the need to improve an operational task (e.g. manufacturing), operational practice (e.g. quality management control) or experience (e.g. faster service).

Amabile (1988) argues the intrinsic motivation for creativity may explain the initiation of an innovation process. She highlights Carl Rogers' (1954) definition of creativity as "the emergence in action of a novel, relational product, growing out of the uniqueness of the individual on the one hand and the materials, events, people, or circumstances of his/her life on the other". She proposes that individual creativity is the "central building block of organizational innovation" (1988:128).

Other intrinsic motivations, such as socio-economic motivations have also been proposed that can initiate the innovation process. Becker (1970) observed that the prestige motive, or improved social status, was important for engaging in the development and adoption of an innovation before one's peers, through his study of county health departments deciding to launch new health programs. In one study, Rogers suggests *modernity* as a motive for the initiation of the baby bottle innovation in third world countries. This desire for new and contemporary products led to adoption, even with negative consequences (disease) associated with bottle-feeding (Rogers, 1995:112).

It is generally accepted that the most common way the innovation-development process begins is the recognition of a problem or need (in response to an event), which stimulates activities designed to create an innovation that solves the problem or need (Rogers, 1993:135). Despite the variety of events and motivations to initiate the innovation process, the inherent recognition or perception of a need or problem is constant across all studies. Reasons for innovation initiation failure are similar to the attributes observed with the rate of adoption. The effectiveness of initiating the innovation process can be correlated to an awareness or perception of the need or problem, and thus the lack of 'recognition' or awareness may prevent initiation from occurring.

Innovation scholars (Rogers et al (Wellins, 1955), 1995) have traced cultural beliefs and the innovation's (new idea) compatibility with those beliefs, values and past experiences of the individual, as factors in failing to generate innovations within a social system. Studies on the conditions for failure of innovation initiation suggest there are three key challenges: the lack of motivation to change; limited understanding of the innovation process; and poor execution of the process itself (Ouchi, 1980). This dissertation hypothesizes that these conditions can be reduced and potentially eliminated by improving the modeling and communication of the innovation process. I suggest individuals and organizations are socially and economically motivated to increase their understanding of the process and develop associated competencies through repeated practice.

2.4 The Innovation Process and Learning Theories

Rogers acknowledges the innovation development process does engage in social system learning as a collective practice, but he situates it within the implementation stage or diffusion phase, and not in the earlier initiation stage of his process (Rogers, 1995:331). Tarde (1903) suggests innovation (invention) is a phenomenon comprised of learning and memory and is initiated by society. He proposes invention (innovation) as imitation and involves individual learning, collective or organizational learning, and individual and organizational memory (Djellal and Gallouj, 2014). In this section, I extend Rogers and Tarde's arguments, and connect them to

social and experiential learning models as a bridge between the front-end stage (i.e. initiation) and the diffusion stage (i.e. implementation).

Innovation inherently exhibits a learning process, which Getler and Wolfe (2002) describe as involving "the development of new common understandings of the problems that members of the organization face and consequently, a shared approach to the solutions. In this sense, learning implies a sharing of meanings among those who learn." (Getler and Wolfe, 2002). The innovation process literature, theories and discussions focus on the solution as the idea that is perceived as new in a social system. The act of initiating a process that begins with a recognized need, and results in a solution or new idea, is commonly known as the *innovation process*. The innovation process has been described as a communication process (Rogers, 1993), a journey (Van de Ven, 1999), creative destruction (Schumpeter, 1934), uncertain (Kanter, 2001), knowledge intensive, (Hargadon, 2002), controversial (Kanter, 1991 and Fast, 1979), cross-boundary (Kanter, 1983), and transformative (Christensen, 1997). Most innovation scholars agree the process of innovation involves social learning (Lundvall, 1988; Johnson, 1992).

Social learning theory proposes that individuals can learn and change their behaviour from observing others, while not necessarily having to experience the direct exchange (verbal or visual) themselves. It recognizes external factors for behavioural change and supports the notion that visible communication artifacts can act as powerful influencers to behavioural change. Rogers (1993), Van de Ven (1999) et al, describe the innovation-development, the innovation-decision and the diffusion and adoption processes as social learning theory in practice. This social modeling often occurs through interpersonal networks and through a public display of stimuli. They argue it is important to clarify that the individual does not mimic the model; instead the learner-adopter usually abstracts or generalizes the information learned from the model. It is through interpersonal information exchanges (e.g. communication channels) that behaviour begins to change (Rogers, 2003: 330-332).

One type of social modeling observed in the innovation process is based on Chris Argyris and Donald Schön's *Double-loop learning* theory (1978). *Double-loop learning* involves the way one

plans, implements and reviews one's actions (Figure 2.8). It encourages individuals and organizations to explicitly reflect on their theories and actions. Argyris and Schön argue *Single-loop learning* is the most common style of learning. It occurs through problem-solving and seeks to improve the system as it exists. *Double-loop learning* is considered a less common learning style, and involves problem exploration. It encourages questioning underlying assumptions behind goals, beliefs, values and techniques.

Social learning is situated within wider social systems or communities of practice. The members of a social system learn as a unit, as opposed to large numbers of individuals learning independently (Reed et al, 2006). This argument supports Freire's (1970) approach to learning in which people collectively become critically literate about their circumstances, achieving consensus through collective reflection and problem definition. The evidence that collective learning can perform better than individual learning is demonstrated in studies of organizational learning (Senge 1990, Argyris and Schön 1996), and the 'wisdom of crowds' (Surowiecki 2004). Their studies also suggest social learning is a two-way causal process, where individuals bring their personal attributes and beliefs to the learning environment and in turn influence the environment (Bandura, 1977). These social interactions are varied and may be between an individual and the knowledge, an individual and an organization, or peer to peer within a social system or networks of social systems.

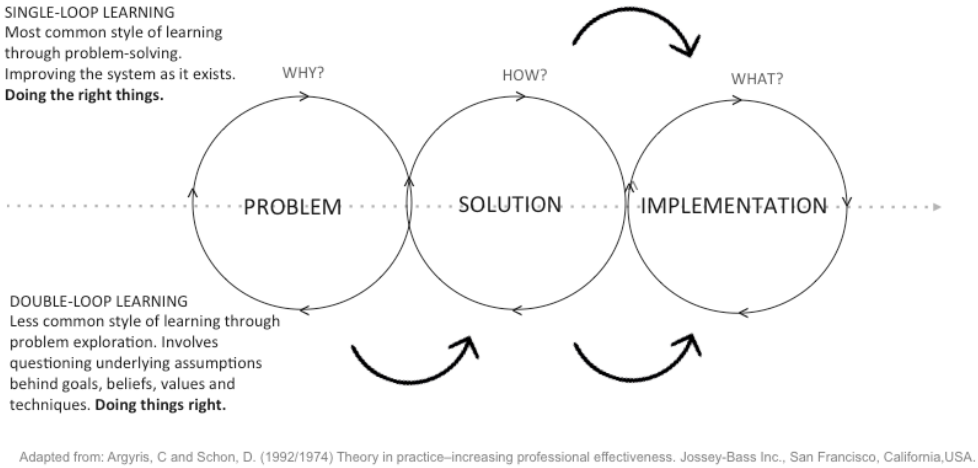


Figure 2.8 Adaptation of Argyris and Schön's Double Loop Learning Model

The innovation process also reflects Kolb's (1974) experiential learning theory, where people have concrete experiences and learn increasingly deeply as they reflect upon these experiences. Generating abstract concepts and then concrete models are expressions of learned behaviour through active experimentation. David Kolb (1974) combined various theories of learning to build what he called "experiential learning theory" in which he defined learning as "the process whereby knowledge is created through the transformation of experience," and he defined the learning process as applying the four steps -- *experiencing, reflecting, thinking*, and *acting* -- in a highly iterative fashion.

Experiential learning is often used interchangeably with active learning, problem-based learning, and transformative learning concepts and techniques. As an overarching theory it encompasses many other learning models, such as: learning by doing (Arrow 1962); learning by using (von Hippel 1976; Rosenberg 1982); learning by trying (Fleck, 1994); learning by interacting (Lundvall, 1988; von Hippel, 1988); learning by searching (Cohen and Levinthal, 1989); and learning by learning (Sabel, 1994; Cooke, 1997). All of these descriptions express Tarde's notion of innovation (invention) as repetition and imitation of one's own and others' actions in the course of the innovation process (Djellal and Gallouj, 2014).

Emerging models that are exploring new ways of learning and teaching innovation include Innovation Management scholar John Bessant's current TACIT project (Bessant, 2016). The TACIT project is a three-year EU Knowledge Alliance (2016-2018) where academics and organizations will explore, prototype and roll out a suite of tools and methods to think and act more innovatively. They discuss eight core approaches that reflect social and experiential learning elements. These include: storytelling, peripatetic learning, future-based learning, entrepreneurship laboratory, innovation theatre, innovation games, design making, and project based learning.

For this dissertation, social learning is observed as occurring between different actors (peer to peer students and occupational workers) and with an intervening instructional method (SDM). In

both studies the learners deliberated and negotiated rules, norms and power relations, individually and within work groups, and through directed events (curriculum and workshops).

2.5 The Innovation Process, Design Theory and Design Methods

Rogers and most of his contemporaries describe the innovation process as a change-making process. The dynamic nature of the organizational innovation process closely reflects another process, commonly referred to as *design* (Friedman 1993). Similar to the common two-stage innovation process, both Fuller (1969) and Buchanan (1992) describe the design process as having two steps or stages. Fuller (1969) proposes the first step is a subjective process of search and research, which is similar to the needs/problem finding and research phase of the innovation process. The second step is a generalizable process that moves from prototype to practice, which reflects the development and diffusion of innovation phase. Buchanan (1992) argues the design process has its two distinct phases: the first is an analytic step of problem definition, followed by the second step of a synthetic sequence of problem solution.

Merriam-Webster (1993:343) defines the *verb* design as "to conceive and plan out in the mind; to have as a specific purpose; to devise for a specific function or end." Design as a *noun*, is defined as "a particular purpose held in view by an individual or group; deliberate, purposive planning; a mental project or scheme in which means to an end are laid down", (Merriam-Webster, 1993:343). Design as a verb takes precedence over all other meanings as it is synonymous with intend, arrange, plan, devise, construct, and map out.

The concept of design for this dissertation is concerned with the initiation stage of the innovation process, and less with the implementation stage. Krippendorff (1989) affirms that design as a process enables the "making sense (of things)". While 'making' is related to innovation as something perceived as new and different, the 'sense' or meaning relates to understanding and knowledge. Design is considered a powerful, however neglected, strategic tool (Kotler and Rath, 1984). It is only in the last ten years that we have seen an increase in design practice across private and public sectors as a core capability to enhance innovation performance (Bertola and Teixeira, 2003; Design Council, 2008).

Herbert Simon, in his work entitled *The Sciences of the Artificial* (1969), argued that innovation is a process that involves intelligence gathering, design and choice. His innovation process combined rationality and complexity with the science of design. Simon implicitly connects design to the innovation process by defining design "as a process by which we devise courses of action aimed at changing existing situations into preferred ones" (1996:111). Simon introduced a theory of design as *design science,* which involves rational inquiry, suggesting "you only learn about the interior structure of an artifact when it fails to respond to the environment properly" (Simon, 1996:114), such as observing the consequences of an overloaded bridge. He applies this logic to the study of human trial and error as valuable in understanding how the brain works. He situates design as "concerned with how things ought to be, with devising artifacts (or practices) to attain goals" (Simon, 1996:112). His theory of design influenced the emerging disciplines of design research and design thinking as methods associated with innovation and innovativeness.

Simon's theory explores design's distinctive composition as the intersection of utility and probability, and investigating problems from both internal and external environments. Whereas the internal or 'inner environment' of the design problem is represented by a set of given alternatives of action (utility), the external or 'outer environment' is represented by a set of parameters, which may or may not be known with certainty (probability). The design process involves movement and adaptation between internal and external environments, which are defined by alterative internal actions and external variables (Simon, 1996:114). For example, a problem of optimizing operational funds for a non-profit children's arts organization might entail alternative actions of developing new revenue-generating programs, licensing existing services to third parties, or reducing operational costs (internal). The intersecting variables might involve identifying new consumer markets, expanding strategic partnerships, or converting employees into trained contractors (external).

Many scholars agree with Simon's theory and explicitly define design as a learning process (Beckman & Barry, 2007; Fong, 2003; Owen, 1998, etc.). People construct new knowledge through observations that yield insights. These insights support frameworks that inspire ideas

that lead to innovative solutions (Beckman & Barry, 2007; Dong, 2005; Owen, 1998). Building on Schön's reflective learning and Kolb's experiential learning theories, and Simon's theory of design, Beckman and Barry (2007) describe innovation as a learning process in the form of knowledge creation. It is through the design process, as movement between concrete experiences and abstract conceptualizations, that reflective observation and active experimentation transform into a new practice.

For this dissertation, *design* is a theory and a method of disciplined inquiry that allows us to: (a) explore current contexts, gain understanding of existing values and assumptions, and to identify how they affect present and future situations; (b) characterize our future-thinking ideals; and, (c) develop a concept, model or map of how to get to that future state (Montuori, 2003:17). On the basis of Bloom's revised taxonomy of educational objectives (Anderson & Krathwohl, 2001), the emerging design methods also reflect critical forms of cognitive activities including remembering, understanding, applying, analyzing, evaluating, and creating.

Design in this dissertation reflects an integrative process that comprises a network of linked and intersecting events. Design integrates thinking, pure research, and practice and applied research. Friedman (2000) offers a taxonomy of design knowledge as skills for learning and leading. They include: problem solving; interaction method; coaching; mind mapping; research skills; analysis; rhetoric; logic; mathematics; language; editing; writing; and presentation skills (Friedman, 2000:11). Simply put, a designer is a thinker whose job it is to move from thought to action.

One emerging discipline applying Simon's *design* theory is strategic design. Strategic design has been widely defined across many disciplines including architecture, engineering, psychology and business management. It is described as: establishing the scope and requirements of a project (Zmud, 1979); a strategic attitude towards built environments (Nutt, 1988); a psychological design of animal communication signals and response systems (Guildford and Dawkins, 1991); designing and facilitating transition strategies to support sustainable social and technological innovations (Boyer et al, 2011; Manzini, 2001; and Ceschin, 2012); a comprehensive approach for forecasting changes in markets and devising responsive artifacts to these changes (Seepersad

et al., 2002); human centered design-driven innovation (Liem, 2011; Brown and Katz, 2011; Boyer et al, 2011); describing an organization's configuration and structure, systems and processes (Chorn, 1991); a journey of creation and a creative process (Banathy, 1990).

Strategic design is an important construct arising from Simon's *theory of design*, as it explicitly engages in strategic and reflective thinking (Mintzberg, 1994) and creative action. It is a design construct that embeds both theory and practice, and is the method under investigation for this dissertation.

The strategic design method (SDM) employs tools and language to invent ideas, artifacts and institutions through recognizable phases that typically begin with research, analysis and understanding, and move towards synthetic phases of experimentation, invention and development (Owen, 1998). Buchanan (1992) suggests that strategic design is an integrative discipline focused on connections and consequences, in which need/problem exploration is designed as a sequence of chaotic events that descend into unity, resulting in innovations. SDM is a framework that initiates diverse conversations, experiences and social relations between people and enables transformation to emerge into innovation. Similar to Rogers' innovation-development process (1962-2010) and Tarde's imitation-invention theory (1890), strategic design is a complex communication process. All are cyclical, not explicitly planned, and involve numerous and diverse conversations, power relations, creativity and trust. SDM is introduced as the controlled independent variable, as an imitation of Rogers' innovation-development process (dependent variable), and is experimented with for two field studies.

Strategic design embeds experiential and active learning strategies from social learning theories, with *design thinking* techniques (Faste, 1987). Design thinking is also referred to as *ambidextrous* thinking (Faste, 1994), *lateral* thinking (De Bono, 1970), and *integrative* thinking (Douglas, 1994, Martin, 2007). The strategic design method (SDM) enables social and active learning through a designed process of creative and critical thinking activities, using both right and left hemispheres of the brain.

Strategic designers move between the right and left sides of their brain and balancing craft skill or vocational knowledge with professional knowledge. They are also referred to as 'intelligent designers' (Friedman, 2000), who understand the humans whose needs the design process must serve. Their process spans the human to include social, cultural, environmental and economic contexts. Friedman (2000) argues intelligent designers develop general knowledge of industry and business, which enables them to focus problems in a rich, systemic way to achieve desired change." (pp:17). Roger Martin (2006), from the Rotman School of Management at Canada's University of Toronto, would suggest strategic designers possess the core qualities of analytical, design and intuitive thinking. This discourse on business designers supports Leonard-Barton's argument about developing "deep smarts" for innovation (Leonard-Barton, 1995).

Strategic design as a teaching method promotes empathy and contributes to the character development of students (Barry & Meisiek, 2015; Rowland, 2004, Quayle, 2014). Unlike scientific thinking that regards uncertainty and ambiguity as threats to knowledge development, design methods thrive on ambiguity and uncertainty; broadening the student's educational experience by encouraging innovative and reflexive thinking, self-awareness, and social consciousness. In short, strategic design and its associated practice of design-thinking foster many of the desirable traits identified as 21st century competencies (Voogt & Roblin, 2012). These competencies include: problem solving; creativity; analytical thinking; collaboration; communication; and, ethics, action, and accountability. They also reflect the competencies associated with key innovation process activities.

Social learning theorist Albert Bandura (1977) might agree with my proposition that the strategic design method (SDM), which embodies active learning methods, provides the necessary conditions for effective social learning to occur. SDM offers a mediating process between stimuli (process) and responses (e.g. artifacts), and a framework for learned behaviour resulting from the environment and the process. SDM also provides an evaluative approach to measure social learning that is adapted from Reed et al (2006), which includes:

(1) Observing if a change in understanding has taken place in the individuals involved. This may be at a surface level, e.g., via recall of new information, or at deeper levels, e.g., demonstrated by changes in attitudes, world views or epistemological beliefs;
(2) Observing if the individual has become situated within wider social units or communities of practice; and,
(3) Observing the social interactions and processes between actors within a social network, either through direct interaction, e.g., conversation, or through other media, e.g. mobile or internet-based communications.

This evaluative approach is embedded within the comparative process analysis framework discussed in Chapter 4.

From the literature reviewed for this chapter, there is a strong inference that SDM shares similar philosophies and methods with the innovation process. Both engage in a sequence of events that involve people, their networks, environments, and techniques (technologies). Both follow divergent paths, integrate convergent activities and result in situation-based learning and adoption. Rogers' IDP and the SDM model will be compared through document analysis and two action research experiments which seek to examine levels of understanding about, and participation in, the innovation process, and the competencies needed to innovate.

I interpret the discourse to suggest a direct link exists between the innovator and designer. Both the innovator and designer are thinkers whose job it is to move from thought to action. The innovator and designer both use appropriate and empathic ways to identify and solve problems for clients. For organizations, the innovator as designer works to meet customer needs, test the outcomes and follow through on solutions.

With a better understanding of the key activities and associated competencies with the innovation process, individuals and organizations can begin to benefit from the knowledge and practice of innovating. For nations like Canada, this new knowledge and practice responds directly to the need for improved innovating capabilities for individuals and organizations, leading to improved social, cultural and economic prosperity.

2.6 Rogers' IDP and Innovation Process Competencies Classification

This section offers an initial classification of competencies affiliated with the innovation process. Innovation-related competencies are generally described as knowledge-based capabilities, aptitudes and skills integrated within organizational innovation management activities and systems (Leonard-Barton, 1995; Schmitt & Chan, 1998). Competence and competency generally denote a person's ability to understand or perform a certain task.

The concept of 'core competence' was first introduced by Prahalad and Hamel (1990). They defined it as the integration of the skills, techniques, specialty knowledge, experience and technology an organization possesses. They argued that core competence is the engine for effective product and service innovation. Pavitt (1991) then asserted that organizations could gain innovative advantage through building up their competencies, which are costly and difficult for competitors to imitate. Leonard-Barton (1992) offered four dimensions of innovation-related core competencies. They included: (1) employee knowledge and skills (2) embedded into technical systems; the process of knowledge creation and control are guided by (3) managerial systems; and, (4) the values and norms associated with various types of embodied and embedded knowledge and knowledge creation processes. (113). Tidd (2000) adapted Leonard-Barton's classification to "market competencies", grouping people's knowledge, managerial systems and norms together in a broader dimension to cover the organization's ability to understand and develop markets.

The competencies identified and explored in this dissertation focus on the individual and are mapped onto Rogers' innovation development process (IDP) phases. The proposed competency framework is adapted from van Dam et al's (2010) model developed from their teaching entrepreneurial behaviour studies. It comprises three categories of innovativeness competencies: knowledge, aptitudes and skills. Knowledge refers to the information, understanding, or skill that one develops from experience or education (Merriam-Webster, 2016). For this framework, knowledge is concerned with topics relevant to the innovation process and the context, along with the ability to successfully integrate it into specific task-related behaviour (Hayton and Kelley, 2006; Nordhaug and Gronhaug, 1994). Aptitude refers to the ability to do something or

to learn something (Merriam-Webster, 2016). Skill refers to the ability to use one's knowledge effectively and readily in execution or performance (Merriam-Webster, 2016).

The competencies framework below (Table 2.2) proposes a typology of the knowledge, aptitudes and skills associated with Rogers' six-phase innovation development process (IDP). The types of *knowledge* identified, include: domain and procedural knowledge; inquiry methods; design knowledge; production; market knowledge; innovation management; technical knowledge; and, reflective practice knowledge. The *aptitudes* identified include: empathy, need and problem finding; qualitative and quantitative research and systems thinking; prototyping and design thinking; operations management and marketing; decision-making; data analysis; evaluation; and, mixed methods research. The *skills* identified include: creative and critical thinking; problem identification and visual thinking; collaboration and decision-making; project management and package design; business analysis, reflective thinking; and, communication.

The aptitudes and skills that repeat across multiple phases in this proposed framework include: decision-making; communication; creative and critical thinking; design thinking; collaboration; and, project management. These competencies reflect the innovation process literature, and in particular, Rogers' (1993) description of the innovation process "as a communication process".

Rogers' IDP phases	**Associated Competency Framework**		
	Knowledge	**Aptitudes**	**Skills**
1. Needs/Problems: *Recognition or inquiry into a condition or situation that requires investigation and resolution.*	• **Domain knowledge:** Content and information processing knowledge required for the task or situated challenge (Glynn, 1996). • **Procedural knowledge**: Process-based knowledge required for the acquisition and analysis of new information; or to combine existing information in new ways. (Glynn, 1996; Steinberg, 1985).	• **Needs finding**: a need is best described as a perceived lack, or something that is missing (Faste, 1987 and Maslow, 1943). Needs finding requires *empathy*. • **Empathy:** involves ones reactions and recognitions of these reactions to the observed experiences of others (Davis, 1994) • **Problem finding**: is a process of inquiry that involves scanning the environment to find and define the problem in such a a way that it can be solved.	• **Creative thinking:** the ability to think imaginatively and deliberately in ways to approach problems. • **Critical thinking:** the ability to think clearly and rationally, understanding the logical connection between ideas; to engage in reflective and independent thought. • **Communication**: the ability to listen and speak effectively, present ideas appropriately, and write clearly and concisely.

	Knowledge	Aptitudes	Skills
2. Research: *Original investigations for knowledge production or to solve practical problems.*	• **Inquiry Methods:** Ways to develop information processing and problem-solving skills. Involves identifying the problem or which resources are needed to better understand the problem; evaluating the gathered information, and using it effectively to address or solve the problem.	• **Quantitative research:** the ability to collect and manage unstructured and field note data, think analytically and synthesize information into reportable and understandable formats. • **Quantitative research:** the ability to collect, manage and analyze structured data into quantifiable terms. • **Systems thinking:** the ability to understand how concepts regarded as systems work and how they influence one another within a larger system. • **Decision-making**: the ability to make a critical decision to begin the development process of the innovation to potential adopters.	• **Problem identification:** involves identifying and effectively communicating the problem statement. • **Visual thinking:** the ability to model and visualize concepts before all the information is available. • **Creative thinking:** (see above) • **Critical thinking:** (see above) • **Collaboration:** the ability to participate in group tasks, and facilitate effective group-based work. • **Communication**: the ability to listen and speak effectively, present ideas appropriately, and write clearly and concisely.
3. Development: *The process of putting a new idea in a form that is expected to meet the needs of potential adopters.*	• **Design Methods**: Ways of putting a new idea in a form that is expected to meet the needs of an audience of potential adopters.	• **Prototyping:** the ability to generate concrete samples or models for the purpose of testing the concept or process to learn and then replicate from. • **Design thinking:** the ability to work at varying levels of abstraction; to recognize a broad range of potential solutions from a given problem statement. • **Decision-making**: (see above)	• **Collaboration:** (see above) • **Decision-making:** the ability to choose between two or more alternatives or courses of action; engage in an intuitive and reasoned process. • **Design thinking:** the ability to to recognize a broad range of potential solutions from a given problem statement. • **Communication**: (see above)
4. Commercialization: *The production, manufacturing, packaging, marketing, and distribution of an innovation.*	• **Production Methods:** Engineering and operations management knowledge to create and fabricate innovation. • **Design Methods**: (see above) • **Market Intelligence:** Supply chain and market development knowledge to identify production, manufacturing, marketing, and distribution partners.	• **Operations management:** the ability to understand the process and functions relating to the manufacturing, packaging and delivery or distribution of the innovation. • **Market research**: the ability to plan, design and implement market development strategies; to apply knowledge of the principles and tools of R&D to solving problems relating to the consumer, user or market. • **Decision-making**: (see above)	• **Project management:** the ability to understand and navigate a project initiation through to completion; to communicate and manage phases and outcomes with teams and leaders. • **Design thinking:** (see above). • **Package design:** the ability to create an aesthetic form or design for the innovation. • **Creative thinking**: (see above) • **Critical thinking**: (see above) • **Communication**: (see above)

	Knowledge	Aptitudes	Skills
5. Diffusion and adoption: *The crucial decision in the entire process to begin diffusing the innovation to potential adopters.*	• **Market Intelligence:** See above. • **Innovation management:** Knowledge of product and organizational innovation processes, tools and measures.	• **Marketing**: the ability to plan, design and implement market development and communication strategies; to apply knowledge from the R&D and production process and communicate to the target adopting market. • **Decision-making**: (see above)	• **Project management:** (see above) • **Creative thinking**: (see above) • **Critical thinking**: (see above) • **Communication**: (see above)
5. Diffusion and adoption: *The crucial decision in the entire process to begin diffusing the innovation to potential adopters.*	• **Market Intelligence:** See above. • **Innovation management:** Knowledge of product and organizational innovation processes, tools and measures.	• **Marketing**: the ability to plan, design and implement market development and communication strategies; to apply knowledge from the R&D and production process and communicate to the target adopting market. • **Decision-making**: (see above)	• **Project management:** (see above) • **Creative thinking**: (see above) • **Critical thinking**: (see above) • **Communication**: (see above)
6. Consequences: *The original problem/need that began the entire process either is or is not solved by the innovation.*	• **Innovation management:** (see above) • **Reflective practice:** Ways to reflect on processes and actions to ensure continuous learning. Methods of examining and evaluating standards and consequences (King, 2005).	• **Data analysis:** the ability to assess the validity, reliability and trustworthiness of data; and, analyze and interpret the data. • **Evaluation**: the ability to frame evaluation questions, determine criteria, and define evaluation methods (quantitative, qualitative or mixed). • **Mixed methods research**: The ability to observe the performance measures; and, evaluate if problem/need that began the entire process either is, or is not, solved by the innovation; and, quantitative and qualitative data sources. • **Decision-making**: the ability to make a critical decision to begin the development process of the innovation to potential adopters.	• **Business analysis:** the ability to review and critically evaluate the process, output and impact of the innovation; to create clear and concise documentation. • **Critical thinking:** (see above) • **Reflective thinking**: the ability to relate new knowledge to prior understanding; and, to think in abstract and concrete terms. • **Communication**: the ability to listen and speak effectively, present ideas appropriately, and write clearly and concisely.

Table 2.3 Typology of Innovation-Development Process Competencies

The proposed typology of competencies associated with each phase of Rogers' innovation-development process guides my investigative process to further identify the critical or key competencies necessary to effectively engage in the early or pre-diffusion phase of the innovation process. These *key* competencies when understood and practiced, may directly affect an individual's or organization's level of innovativeness.

The key innovativeness competencies can be interpreted as Leonard-Barton's "signature skills" and "deep smarts" (Leonard-Barton, 1995). Innovation management scholar, Dorothy Leonard-

Barton (1995) proposed *signature skills* as individual preferences for tasks, cognitive approaches and techniques or technologies that are interdependent. She defined *deep smarts* as "a potent form of expertise based on first-hand life experiences, providing insights drawn from tacit knowledge, and shaped by beliefs and social forces. They are based on know-how more than know-what – the ability to comprehend complex, interactive relationships and make swift, expert decisions based on that system level comprehension" (1995:7). She introduced the concept of core capabilities for organizational innovation.

Leadership and innovation scholar, Roberto Verganti (2009) introduced innovation capabilities associated with creating 'radical' new meanings and incorporating these into the design of new products and practices. He suggested organizations need to engage in socio-cultural research and to get closer to "interpreters", the artists, designers and cultural organizations, those who can provide insight into changing socio-cultural trends and help identify latent meanings, ripe for innovation. He cited Nintendo, as an example for how it 'radically innovated' computer gaming by introducing the Wii, which made gaming a more social and active activity than had hitherto been the case.

Business management scholar, Roger Martin (2009) identified three key modes of thinking as competencies for strategic business innovation that include analytical thinking, design thinking and intuitive thinking. Through in-depth interviews with Fortune 100 companies (i.e. McDonald's, RIM, P&G, Cirque de Soleil and Target) he described their growth patterns and management styles. He suggested that design thinking has been suppressed as a victim of historical and organizational bias towards a reliability or "proof-based" system for most global companies. He provides evidence on the value of design thinking skills for business innovation, and competence with observation, imagination and configuration (Martin, 2009).

Phillips (2010) proposed that an innovation capability is based on defining these attributes and aligning them to the strategic goals of the organization with the intent or purpose to innovate. Through case study examination of successful innovators Apple and Google, the author proposed that Apple uses a directed model to focus on disruptive change, primarily in discrete projects,

while Google uses a more suggestive model informed by the company strategy to develop incremental and disruptive products in a more sustaining way.

2.7 Innovativeness Constructs, Competencies and Innovators

Individual innovation is a term less frequently used or studied. Amabile (1988) first introduced a correlation between individual innovation and creativity. She described innovative people as problem solvers with domain relevant and creativity relevant skills, and intrinsic motivation. The personality traits and characteristics included: domain expertise, risk-oriented, logical, independent, self-disciplined, perseverant and self-motivated. (1988:132). Her creative problem-solver seems to share similar characteristics to the dimensions of innovativeness.

Innovativeness is an integral element and the central construct of diffusion of innovations studies. Rogers' innovativeness theory (1962-2003) is based on who (or what) adopts the innovation and when. Innovativeness characterizes individuals and organizations who are relatively early in adopting new ideas or change within their social system. Innovativeness has also been broadly defined as: the ability to generate new ideas and combine existing elements to create new ideas and value (Stalk et al, 1992); the ability to be receptive to new ideas (Hurley and Hult, 1998); the capacity and inclination to buy new products and services (Foxall, 1984); the propensity to adopt new technologies and adapt to different environments (Kitchell, 1995) and; a product's degree of newness (Garcia and Calantone, 2002). Organizational innovativeness has been defined as the propensity for a firm to innovate or develop new products (Ettlie et al., 1984); and the propensity for a firm to adopt innovations (Damanpour, 1991).

The innovation management literature on 'innovativeness' describes it as a precursor to innovation and representing a firm's ability to innovate (Wang and Ahmed, 2004; Hult et al. 2004; Hurley and Hult, 1998; Avlonitis et al. 1994). Walsh et al (2009) and Manu (1992) suggest that innovativeness should be viewed as an organization's strategic and competitive orientation, with innovation as the vehicle, which it uses to achieve its competitive advantage. They distinguish innovativeness as an *input,* and innovation as the *output* or situation (Walsh et al, 2009). Menguc and Auch, (2006: 65) argue innovativeness is a means to an end and it is this

"idiosyncratic aspect that captures the significant difference between innovativeness and innovation". For Midgley and Dowling (1978), innovativeness is in fact a standalone construct, and should not be used synonymously with 'innovation'.

Individual innovativeness is described by innovation studies scholars as: a willingness to change (Hurt, 1977); a form of innate personality traits (Midgley and Dowling, 1978; Roerich et al, 2002); the propensity of an individual to exhibit innovative behavior within a specific domain (Goldsmith and Hofacker, 1991); being associated with creativity and productivity (Leonard-Barton, 1995); conveying some behavioural change in response to a stimulus (Hjalager, 1997); and, demonstrating open-mindedness, enterprising, willingness to change, the ability to innovate or to be creative (Berthon et al., 1999).

There is a growing interest in studying individual innovativeness as demonstrated by the emerging studies spanning diverse domains. These include: the acceptance of IT-based innovations (Yi et al, 2006); university research networks (Casanueva and Gallego, 2010); reflective thinking and student teachers (Önen and Koçak, 2014); critical thinking and education (Gay, 2015); Generation X and Generation Y behaviour comparisons (Yigit and Aksay, 2015); R&D collaborations (Cimenler et al, 2016) and teacher training (Gökçearslan et al, 2016). Innovativeness in both individuals and organizations, as observed by Akgün et al's (2007) study of 106 firms, share three interdependent patterns: (1) a firm's level of emotional capability (including the dynamics of display freedom, experiencing, reconciliation, and identification constructs) has a significant effect on the firm's learning capability (composed of the managerial commitment, systems perspective, openness and experimentation, and knowledge transfer and integration); (2) a firm's emotional capability influences its product innovativeness via learning capability; and, (3) a firm's product innovativeness, influenced by emotional and learning capability, significantly impacts the firm's performance.

Outside the innovation discourse, the dictionary definitions of innovativeness include "the skill and imagination to create new things" (Merriam-Webster, 2016) and "the quality of being innovative" (Collins Dictionary, 2016). The dictionaries appear to reflect Midgley and

Dowling's (1978) observations of innovative behavior as actualized innovativeness. They argued that innate innovativeness might be affected by psychological traits such as empathy, motivation, dogmatism, and intelligence, and social character (Midgley & Dowling, 1978).

Innovativeness in this dissertation is focused on individuals and is investigated through a design-based instructional method. It integrates interdisciplinary works from Amabile (1988), Rogers, (1993), Midgley & Dowling (1978), Leonard-Barton (1995), and Matthews and Brueggemann, (2015). I propose innovativeness is the willingness to experiment with new approaches of inquiry, the commitment to master new knowledge, and the ability to exhibit innovative behaviour over time. The willingness to experiment with new approaches of inquiry describes the desire to learn problem finding and problem solving techniques, and to develop a system of thinking strategies and skills applicable to the innovation process. The commitment to master new knowledge describes the concentration and deliberate practice of information gathering, analysis, and translation. The ability to exhibit innovative behaviour over time suggests actively engaging in observation, and self and group reflection in the pursuit of insights.

Most studies on innovativeness suggest a correlation with those characteristics associated with entrepreneurship. Harvard Business School's Professor Howard Stevenson (1983) was the first to define *entrepreneurship* "as the pursuit of opportunity beyond resources controlled". Entrepreneurship has been also been defined as a capability for exploiting successfully innovative ideas in a commercially competitive market; and a source of flexibility and innovation, a creator of jobs for the economy, and an interesting opportunity for individual career development (Onstenk, 2003). Generally, *entrepreneurship* reflects the capacity and willingness to develop, organize and manage a business venture along with the risks and uncertainty to make a profit. *Intrapreneurship* is the capacity and desire to practice entrepreneurship inside an organization. Entrepreneurs are characterized as risk-takers who are innovative and competitive.

The discourse on entrepreneurship is centred in the economics and business domains. The origin of the term reflects the French verb "entreprendre" or to undertake, suggesting the entrepreneur undertakes to make things happen, and is effective in doing so. In this capacity, the entrepreneur

may work for him/herself or may be employed in a large organization. Timmons (1989:1) argues that entrepreneurship is the ability to create and build something from practically nothing. It is initiating, doing, achieving, and building an enterprise or organization, rather than just watching, analyzing or describing one. It is the knack for sensing an opportunity where others see chaos, contradiction and confusion.

Common competencies associated with entrepreneurship include: recognizing, envisioning and taking advantage of opportunities (Timmons *et al.*,1987:87; Stevenson, 1983); selecting high quality opportunities to pursue (Hofer and Sandberg, 1987:42); possessing drive and willingness to work long, hard hours (Hofer and Schendel, 1987:43); the capacity for intense effort (MacMillan *et al.*, 1985:55); the ability to concretely conceptualize an entrepreneurial insight or opportunity (Miles and Snow, 1978:62); and, the ability to analyze, operationalize and remain committed to a new venture (Man *et al.*, 2002).

Matthews and Brueggemann (2015) argue that innovation becomes actionable through entrepreneurship and strategy. They offer 12 innovation and entrepreneurship competencies observed from the individual, interpersonal and network dimensions. They include: a) *individual*: innovative behaviour, innovative thinking, problem solving and knowledge building: b) *interpersonal*: creativity, culture building, innovation theory, and entrepreneurship; and, c) *network*: strategy, catalytic leadership, ecosystems and technology accelerators.

For this dissertation, the development of innovation-related or innovativeness competencies is proposed as one way for regional and national systems, such as Canada, to create a competitive advantage (e.g. retain and attract talent) and prosper. The proposed innovativeness competencies framework reflects the idea that innovation is achieved by, and operates through, individuals and their institutionalized systems (Glynn, 1996).

Researchers have identified that innovators involved in the early stages of the innovation process have the cognitive agility to combine and recombine existing knowledge in new and different

ways. Amabile (1988) describes the process of creativity, innovation, and change requiring a fluid ability to collect, understand and mobilize procedural knowledge (Glynn, 1996:1097).

I propose entrepreneurs are *one* type of innovator typically studied at the end of the initiation stage and beginning of the implementation stage of the innovation development process. My research is concerned with an inclusive innovator as an *active participant* involved in any aspect of the innovation-development process – pre, during and post diffusion phases.

Innovators have been studied as inventors (Tarde, 1890), entrepreneurs (Schumpeter, 1934), creatives (C. Rogers, 1959) and the earliest adopters (E. Rogers, 1962). They are characterized as having the capacity to: design changes and to introduce new products quickly to the market and invest more heavily in R&D (Miller and Roth, 1994); face continuous change and believe creativity and innovation have primary roles to play for survival (Martins and Terblanche, 2003); lead organizations to support the generation of novel ideas and encourage risk taking (Simons, 1995); encourage innovation through giving employees the freedom to think and act on their own ideas; take risks and accept failures; and, seek diverse stimuli and ideas (Salavou, 2004). Some have been categorized as 'serial innovators', distinguishing them as "individuals who have conceived ideas that solve important problems for people and organizations, have developed those into breakthrough products and services, inventing new technologies to do so as needed, then have guided those products and services through commercialization and into the market (e.g. Bill Hewlett, Elon Musk, Steve Jobs, Paul McCartney, etc). This type of innovator "uses his/her interpersonal, organizational and political skills – in addition to their business and technical skills – to bring their innovative vision to commercial fruition" (Griffin *et al*, 2012:2).

The most common innovator characteristics include creativity, entrepreneurial spirit and intrinsic motivation. Kelley and Littman (2006) suggest an innovator classification entitled "*The ten faces of innovation",* which they observed from case studies from global design consultancy, IDEO. The authors group innovators into three categories: learners, organizers and builders. Through described personas, they argue *learners* are anthropologists, experimenters and networked cross-pollinators (knowledge); *organizers* are huddlers, collaborators and directors (process); and,

builders are experience architects, set-designers and storytellers (place and product/service). (Kelley and Littman, 2006). They argue that these innovative traits and types are not expected to reside all in one individual, but should be reflected across the innovation process team, and associated network or social system.

Personality traits associated with innovators include: curiosity, intuition, creativity, and systems thinking, along with independence, confidence and perseverance (Griffin *et al*, 2012). Common motivations observed with innovators include: the need to achieve autonomy, mastery and purpose; using their curiosity and technology to solve problems; the desire to rejoice from new discoveries; and the satisfaction from making a difference in other people lives. Innovators "go to great lengths to learn and prepare to innovate" (Griffin *et al*, 2012:115). They determine what they do and don't know, resulting in their behaviour to actively seek information across disciplines. Studies on innovators support an archetype who engages in problem finding and understanding, learning and acting. They demonstrate the need to understand 'why'. Essentially, innovators approach problems from different viewpoints and then reframe or redefine the problem, in order to solve it. Their creativity then allows them to frame issues in new ways in order to solve them. (Griffin *et al*, 2012:120). Griffin et al (2012) argue the 'innate' combination of traits, skills and abilities of 'serial innovators' is rare and challenging to develop through training programs. I respectfully disagree, as traits, skills and abilities are transformable and adaptable through experience and learning.

As discussed earlier, government organizations along with private firms are challenged with navigating change associated with interactions and unforeseen events between phases of the innovation process. These challenges are rooted in the lack of skills necessary to engage in and respond to transformative activities that involve uncertainty and change. Therefore, understanding how to think, act and work in innovative ways requires skills and capabilities that go beyond entrepreneurship and intrapreneurship. I suggest *innovatorship* may be a better way to describe individual and organizational innovativeness. I propose that *innovatorship* is the capacity and willingness to participate in the knowledge exploration, interpretation and recombination activities of the innovation process. I suggest that it is an essential quality of

globally competitive organizations and nations and that *innovatorship* can be assessed through demonstrable abilities and characteristics. The characteristics include: willingness to adopt new knowledge and ideas, think creatively and critically, and cope with uncertainty throughout the innovation process. I discuss *innovatorship* in more detail in Chapters 6 and 7.

Rogers argues that individual innovativeness is challenging to predict as it involves a variety of prior conditions affecting the rate of adoption. From his extensive research, Rogers proposes three overarching characteristics associated with innovation adoption: socioeconomic status, personality values and communication behaviour. Organizational innovativeness, as studied by Rogers and Van de Ven (Rogers, 1995:379), is concerned with diffusion and adoption of an innovation and is considered a social process *within* the organization. Innovativeness inside organizations is characterized as having a moderately centralized structure, employing members with high levels of knowledge and expertise, structured processes for innovation activities, interpersonal networks, and a positive attitude towards change and openness. All diffusion scholars agree that innovativeness indicates behavioural change (e.g the goal), rather than cognitive or attitudinal change (e.g. the rate of adoption of an innovation is observable).

My dissertation argues that innovativeness can be learned through the development of specific innovation-related competencies. I agree with Midgley (1978) that innovativeness can be characterized by personality traits, as an "innate construct", and observed and measured as "actualized" innovative behaviour. Innate innovativeness, Midgley argues, is associated with sociological and psychological dimensions, and is not explicitly visible. Actualized or innovative behaviour is innovativeness made visible in the context of a communication experience and the response to new ideas and change. The following table (Table 2.4) summarizes the critical constructs associated with innovativeness between Rogers' and Midgley.

Innovativeness variables and attributes (Rogers 1962-1995)	Innovativeness traits (Midgley 1978-2004)
Rate of adoption variables: Earlier adopters (e.g. innovators and early adopters) have greater empathy, thinking and communication skills; are open to different beliefs and can deal with abstraction; are cosmopolitan, exposed to mass media channels and interpersonal channels; actively seek information; belong to interconnected systems; have a favorable attitude towards change; greater ability to cope with uncertainty and risk; favorable attitude toward education and science; are less fatalistic; and, are motivated by higher achievement and aspirations for education, occupations.	*Psychological traits include*: empathetic, dogmatic, achievement-oriented, self-monitoring, and intelligent.
Socio-economic variables: Earlier adopters have more formal education, higher social status in their relative social system, seek upward mobility of higher status, large social systems, commercial orientation (in terms of product innovation), borrow money, and, work in specialized occupational roles.	*Sociological traits and communication experience and sociological traits*: social participant, socially integrated, cosmopolitan, and social networker in local and non-local social systems.
Innovativeness and innovator attributes: venturesome, progressive, experimental, cosmopolitan, ultra adopter, risk-taker, curious, and aspirational.	*Attributes*: self-confident, social character, and self-monitoring.

Table 2.4 Innovativeness Variables, Attributes and Traits.

Midgley suggests *innovativeness* is associated with making innovation decisions independently of the communicated experience of others. He generally agrees with Rogers in that innovators have the highest degree of innovativeness. Individual innovativeness is characterized as actively seeking knowledge, networking across diverse social systems, ability to cope with high levels of uncertainty, and the willingness to quickly adopt new ideas or change. Hurt et al (1977) supports Midgley's argument, and argues personality traits associated with innovativeness and innovators are: openness, inventiveness and curiosity. From the literature reviewed, an innovativeness construct is proposed (Table 2.5), but this dissertation's research is limited to the innovation process competencies as presented in Table 2.2. My post-doctoral research will evolve this innovativeness construct with a larger student population sample.

Innovativeness competency construct (variables, attributes and traits)
Variables as competencies: empathy, communication skills; abstract thinking; openness to change; socially integrated and networked; education-oriented; achievement motivated; opinion leader; risk-taking; critical thinking; and, creative thinking. *Attributes and traits*: self-confident; social; venturesome; progressive; experimental; decision-maker; cosmopolitan; curious; risk-taker; inventive; and, aspirational.

Table 2.5 Basic Innovativeness Competency Construct.

This innovativeness competency construct is proposed as a way to observe the skills learned and knowledge acquired to effectively participate in the innovation process. Competency models can

help educators align their learning objectives, and help organizations align their initiatives to their overall business strategy.

Matthews and Brueggemann (2015) in their book entitled "*Innovation and Entrepreneurship: A Competency Framework*" offer a new innovation and entrepreneurship competency framework that seeks to provide an understanding of the knowledge, skills, attitudes and experiences that are needed to increase imagination, creativity, innovation and new venture creation capability. The authors argue that by learning and applying the innovation competencies, new venture start-ups and existing organizations are better able to innovate, create, develop competencies in current and future talent, and become more effective and efficient in both strategic directions and operations. (2015: 2). They provide a list of twelve innovation-related elements and competencies, positioned as the building blocks that inform our path toward how innovation plays a role in economic development. The elements include: innovation degrees, innovation types, innovation direction, risk, principles, thresholds, criteria, processes, diffusion, pacing, value, and, disruption (2015:3). They repeatedly identify the need for *deliberate practice* in learning and developing innovation-related competencies.

The competency framework proposed by Matthews and Brueggemann (2015) combines both elements and competencies associated with the innovation process of new firms. My proposed construct for *innovatorship* and *innovativeness competencies* supports their findings, while situating it within individual innovativeness and pre-diffusion activities. These activities are inclusive of innovation processes involving inquiry first, followed by development of new ideas, products, practices and new firms.

2.8 Summary

The innovation process is complex. This is evidenced by the selected literature describing the word *innovation* as a process, and also, as a product of its process. I explicitly distinguish the word *innovation* from the term *innovation process.* I propose the *innovation process* is generally understood as a sequence of activities involving an intention to solve a problem specific to a particular context, the development of something perceived as new, and the adoption of the new

element, over a period of time. It is characterized as a communication process, which involves actors and their social systems, both intersecting with technological infrastructures and economic forces, making decisions on the adoption or rejection of new ideas. The innovation process literature, spanning multiple disciplines, theories and discussions, has focused on the output or product of the process (i.e. solution) in a social system, and less on the process itself. My research centres on understanding the critical elements that comprise the innovation process phases, and the individual competencies that impact an innovation's further development and consequent adoption.

An interdisciplinary triangulation of core theories is presented as the foundation for my research. Rogers' *Diffusion of Innovations* (1962-1995) provides the foundational theoretical framework for this dissertation. Integrated with Rogers' theory are learning theories from Schön and Kolb, and Simon's *theory of design*. Together, these seminal concepts, theories and models inform the research investigation of the strategic design instructional method. The strategic design method (SDM) purports to simulate the innovation process as it guides the subjects from problem exploration to problem solving (Figure 2.9). The SDM is an important construct particularly arising from Simon's *theory of design*, as it explicitly engages in strategic and reflective thinking, and creative action. It is a design construct that embeds both theory and practice, and is the method under investigation for this dissertation.

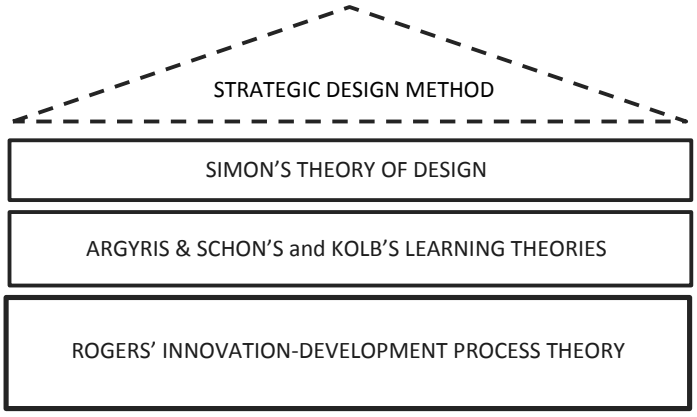


Figure 2.9 Theoretical framework for dissertation research

Individual innovativeness is reviewed across disciplines and is synthesized as the willingness to experiment with new approaches of inquiry, the commitment to master new knowledge, and the ability to exhibit innovative behaviour over time. Competencies that align across Rogers' innovation development process theory (Figure 2.10) are first identified, and then observed and mapped from the SDM investigation. Innovativeness competencies attributed to both the problem-focused and solution-focused phases are discussed in Chapter 6 and 7.

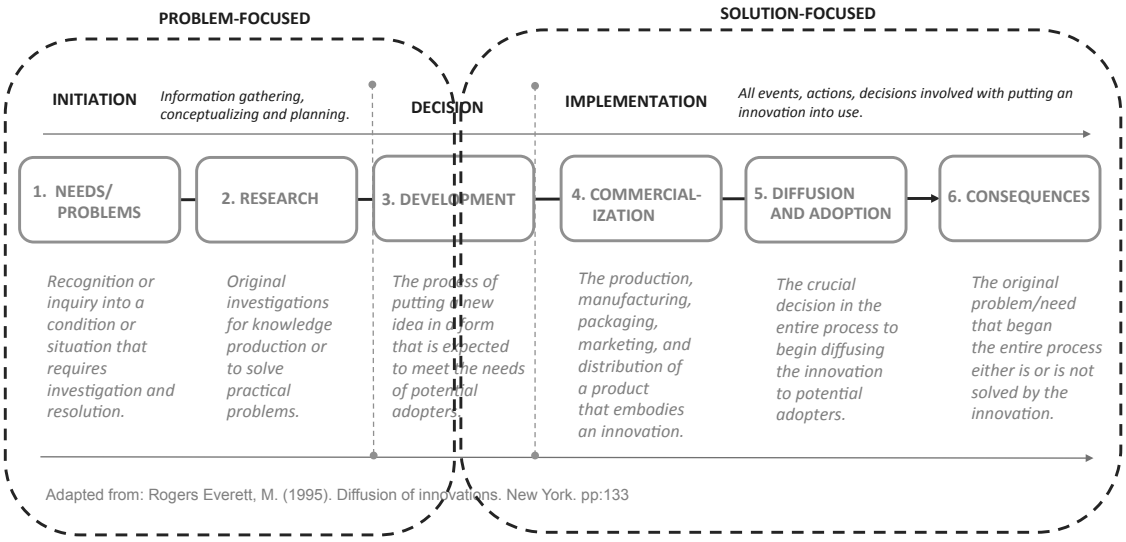


Figure 2.10 Rogers' Six-Phase Innovation Development Process

Chapter 3: Methodology

Two qualitative research methods were employed to investigate how a design-led innovation pedagogy develops innovative capacity: document analysis and action research.

3.1 Document Analysis

Document analysis generally involves the interpretation of documents to provide understanding and meaning of a specific topic. It is a systematic approach for reviewing and evaluating documents, and examining and interpreting data, in order to gain understanding, elicit meaning and develop empirical knowledge (Bowen, 2009 and Corbin & Strauss, 2008).

The documents analyzed for this research involved: journal articles, books, industry reports, website-based government reports, course syllabus, participant observation notes, student-generated reflection blogs, and subject-generated artifacts. This method facilitated the extraction and organization of data into categories, classifications and frameworks through content and process analysis.

The rationale for employing the document analysis method is that when used in combination with other qualitative research methods, it provides an effective way to draw upon multiple sources of data and confirm, converge and corroborate patterns of observations and insights. This dissertation combines document analysis with an action research method to triangulate the data, providing 'a confluence of evidence that breeds credibility' (Eisner, 1991:110). According to Patton (1990), triangulation helps the researcher guard against the accusation that a study's findings are simply an artifact of a single method, a single source, or a single investigator's bias (Bowen, 2009).

Specifically, document analysis provided the following benefits to my research:

- Documents describing past-studies of the innovation-development process provided empirical evidence and historical insights on how it occurs and how it is recalled;

- Documents defining the phases and stages of innovation process and innovation associated competencies helped refine the research question framework for process and competency analysis;
- Documents created from participant observation notes and participant-generated artifacts provided contextual data;
- Documents in the form of student-generated reflection blogs provided a means of tracking student-assessed experience with learning, change and development;
- Documents in the form of innovation-solutions (e.g. new products, services, process or strategies) provided insights into the design and delivery of an instructional method to simulate the innovation process; and,
- Documents analyzed from the various sources and formats surfaced insights, contradictions and comparative findings in terms of the innovation process analysis and competencies analysis.

The document analysis method's aim was to observe a convergence (or not) of information from different sources in order to generate confidence in and credibility for the research findings. The systematic review of documentation provided important background information that informed my understanding of the socio-cultural and socio-economic context of the innovation development process. The documentary data served to ground the research in the context of the process and related competencies being investigated. Information contained in documents also suggested events or situations that needed to be further observed and analyzed. Although potentially considered incomplete, the reviewed documents did augment the observational data and thus served a useful purpose to identify patterns and generate insights. Specific documents generated and analyzed from the two action research studies included:

Document Types	**Data analyzed**
Teacher-generated Artifacts	Syllabus, lesson plans, lecture presentations, class assignments, readings, technique frameworks, and rubrics.
Facilitator-generated Artifacts	Workshop plan, lecture presentations and technique frameworks..
Participant Observation Field Notes	Descriptive and behaviourial observations of subjects in-situ.
Subject Generated Artifacts	Visual thinking generated notes and prototypes, written and presented assignments and team discussions.

Table 3.1 Document types and data collected for analysis

3.2 Action Research

Action research methodology is an interactive method of collecting information to explore topics of teaching, learning, curriculum development and student behaviour in the classroom. The purpose of action research is to improve processes (action) and collect and analyze data (research) for the purpose of modifying the practice. Action research has been employed as a method for teacher development (Noffke, 1996), positive social action (McTaggart, 1994), knowledge production (Borg et al, 1993), and as an inquiry into an instructional method (Feldman and Minstrell, 2000). Introduced by Kurt Lewin (1946), action research is a qualitative research approach that combines theory generation with changing the social system through the researcher acting on or in the social system under study. The act itself is presented as the means of both changing the system and generating critical knowledge about it (Sussman et al, 1978). Lewin characterized action research as "comparative research on the conditions and effects of various forms of social action and research leading to social action" (Lewin, 1946:202-203). Social action for this dissertation refers to the steps taken by individual actors involved in introducing new ideas and processes for doing things better in the future, reflecting the innovation development process.

For this study, a design-led instructional method is investigated as an approach to develop innovative capacity (i.e. innovativeness). The instructional method purports to simulate the innovation process commonly experienced by individuals inside organizations. Both the instructional method and the innovation-development process are human centred. Both reflect a system of human action in which the means and ends are guided by values and competencies, which can be observed effectively through action research (Susman et al, 1978).
The action research methodology is selected for this dissertation for the following reasons:

a) It combines practical problem-solving approaches with scientific research methods to investigate an intervention and its contextual effects. SDM is the instructional method and intervention under investigation.
b) It is situational, collaborative, participatory and self-evaluative. The instructional method is designed and delivered in the same location (Vancouver, Canada) and in similar spaces (classroom studio and occupational studio).

c) It has the researcher actively involved and collaborating with the subjects. The instructional method is taught by me, the researcher-teacher, to students (Study A) and facilitated by me, the researcher-facilitator, to occupational workers (Study B).
d) It addresses complex real-life problems, social practices and change processes (Hult and Lennung, 1980). The theoretical frameworks and the instructional method under study are centred on the complex innovation process as a transformative experience and social practice.
e) It aims to enhance the competence or training of the respective actors. The instructional method under investigation seeks to improve competencies associated with innovativeness and the innovation process.
f) It has roots in educational, social and organizational sciences. As an interdisciplinary researcher, I study and investigate phenomena across disciplines.

This methodology facilitates the improvement of a teaching or coaching practice, and of the student learning experience. This is achieved by an improved understanding of the theoretical and applied frameworks, and situated conditions. Action research offers a systematic, organized and reflective investigation (Stringer, 1999). Although sometimes attributed as a grounded theory construct, action research for this study is used to specifically identify improvements with the design-led instructional method as an innovation process-focused learning experience. Similar to participant observation, action research positions the researcher as a privileged observer, analyst, and critic.

An important limitation imposed by the action research method is the lack of empirical evidence generated from its unique situated contexts and subsequent improbability for replication. Investigating an instructional method within a complex social system (i.e. classroom and organization) will impose a unique set of variables difficult to measure across participant populations. To mitigate these variables, the instructional method is replicated as the learning construct (i.e. repeated communication), the intervener-researcher is the same individual, and the studio environment provides a concrete setting in which action is contemplated, generated and observed. Both deviating and comparable actions from the subjects were captured from

participant observation and analyzed from subject-generated artifacts, thus aiming to provide indicators (i.e. towards evidence).

The action researcher is described as a co-producer (Ackoff and Emery, 1972) of solutions through collaboration with the social system. Friedmann (1973) argues the action researcher brings theoretical knowledge as well as breadth of experience to the problem-solving process. The participants bring practical knowledge and experience of the situations in which they are trying to solve problems. The action researcher collaborates with participants and clients in diagnosis, selection of alternative actions, and evaluation of those actions (i.e.a solution or innovation). Susman argues "empathy, taking the role of the other, participant observation, etc. may be the most effective means for making the theoretical or practical knowledge the researcher possesses really useful and accepted by clients" (1978:598).

Organizational development scholars argue action research is an important methodology for the practice of organizational development and education (Van Eynde and Bledsoe, 1990:27). Susman (1978) states "action research constitutes a kind of science with a different epistemology that produces a different kind of knowledge, a knowledge which is contingent on the particular situation, and which develops the capacity of members of the organization to solve their own problems." (Susman,1978:601). It is the method employed for this dissertation for understanding and managing the affairs of individuals inside social systems, such as a classroom or organization.

3.3 Researcher Bias

As the researcher, I acknowledge an contextual bias in terms of the literature selected and documents analyzed both classroom and organizational studies. The documents aligned with corporate or university policies and procedures, and with the pro-innovation learning agenda associated with the instructional method. As the researcher-instructor-facilitator, I acknowledge a personal bias of interested observer. For both studies, I clarified my intentions to investigate the instructional method for potential improvement or evolution.

Chapter 4: Research Design

My central research question is *can a design-led innovation pedagogy develop innovative capacity?* To answer it, the following supporting questions require investigation: How does innovation happen?; What are the related innovation, learning and design theories?; and, Which competencies associated with the innovation process are critical to developing innovative capacity or innovativeness?

To learn how innovation happens, I undertook an interdisciplinary literature review of the most influential theories and models of the innovation process. Everett Rogers' innovation-development process theory (1993) was selected as the foundational theoretical framework for the innovation process, based on the empirical evidence of its human-centred approach to move from problem recognition to problem solving phases and its social learning construct. The document analysis provided a systematic review of learning and design theories, and methods that help understand the sociocultural, economic, and educational context in which innovation processes are initiated and implemented. Further document analysis was applied to the artifacts generated and collected from the two action research studies.

To investigate the competencies associated with the innovation process, a document analysis and two action research studies were conducted. The strategic design method (SDM) served as the instructional method (intervention) and as the controlled independent variable to two populations: students and occupational workers. The SDM was documented, observed and compared with Rogers' innovation-development process (dependent variable) as an innovation learning process, and as a method to identify competencies associated with *innovativeness* (i.e. innovative capacity).

This chapter is organized in the following sections: (4.1) research design and participant population and (4.2) data collection and diagrammatic analysis.

4.1 Action Research and Participant Population

Action research methodology involves three basic steps: (1) identifying a problem (i.e. lack of innovativeness), (2) designing a research plan (i.e. innovation process as instructional method and population) and (3) implementing the plan (i.e. two action research case studies). The entire process involves reflection and borrows from social science research techniques. The observational methods for this dissertation involve two research studies:

a) **Study A (Case Study A): Individual action research**: observing and analyzing students in a classroom working independently and in teams on an innovation development project; and,
b) **Study B (Case Study B): Individual and Collaborative action research**: observing and analyzing a group of individuals within an organization and sector ecosystem, working together to explore and solve an organizational problem.

The goal of the methodology is to explicitly improve the practice of innovation-process teaching and facilitation. The objectives are to improve the understanding and representation of the innovation process in order to develop innovation-related competencies. The first study involves a traditional action research study inside a classroom, and the second study replicates the instructional practice inside an organization. The action research method reflects the intervention method of bringing together theory and tacit knowledge with real-world situations, issues and experiences. For both students and occupational participants, the secondary goal was to assist them in broadening their perspectives and help them better understand fundamental and shared problems, by raising their collective consciousness (Holter & Schwartz-Barcott, 1993).

This method allowed me to adopt the perspective of both researcher and teacher in my field studies. It granted me the ability to inquire as well as see *learning* happen – which is immensely satisfying in both the classroom and occupational settings. However, it also introduce a pro-innovation bias by way of instructing or facilitating subjects to learn methods to identify problems and generate new ideas, practices or solutions.

Action and case research strategies are considered among the best in human-centred design research. They investigate holistic and meaningful characteristics of real-life events and make the research practical, and methods usable. To observe and identify the key competencies individuals need to innovate, the action research methodology was employed in the design of the two field studies, and presented as two cases (i.e. Case Study A and Case Study B).

For both research site studies, the action research methodology is supported by a case study strategy. Although I am the researcher-teacher (i.e. Case Study A) and researcher-facilitator (i.e. Case Study B), I investigate the intervention as an objective observer. I am able to be objective about the instructional method, as I am not the original designer, however engaged in its continuous improvement. The case study strategy is applied for the following reasons:

a) As the investigator, I have a deep tacit knowledge of the innovation process from my professional practice;
b) As the researcher, I actively seek unexpected issues or patterns during data collection; and,
c) As the researcher-teacher-facilitator, I explicitly seek to improve the current method and the student/subject learning experience.

The case study strategy supports the action research methodology as it is an effective tool for carrying out research with small sample populations and small to medium-sized firms. It enables the examination of the pre-diffusion, adoption and diffusion of innovation as a dynamic process. This method records and analyzes patterns of behaviour, in addition to observing and listening to verbal information in response to the intervention (instructional method) and environment (classroom or occupational room). The two action research case studies aim to predict either similar or contrasting results for future research and potential theoretical replication, respectively. Specifically, an illustrative case study analysis is used to compare the two case studies with Rogers' *Diffusion of Innovations* theory founded on his innovation-development process. The illustrative case study is used to describe the event (i.e. instructional method) under study. As a primarily descriptive study, this strategy typically utilizes one or two instances of an event (i.e. instructional method as intervention) to show what a situation is like. The illustrative

case studies strategy (i.e. Case Study A and Case Study B) aim to make the unfamiliar familiar (i.e. instructional method as intervention) and to give readers a common language about the innovation process and developing innovativeness competencies.

Two approaches for using the case study strategies involve testing theory (Yin, 1989) and/or to develop theory (Eisenhardt, 1989). For my research, the two case studies are used to develop an innovativeness learning theory. The case study strategy examines 'why', 'how' and 'what' questions to explain events and behaviours over a period of time. They identify the reasons *why* certain decisions were made, *how* they were implemented and with *what* result. To study how students and occupational workers learn innovativeness, a multiple-case approach is useful. It allows for theoretical testing, and for theoretical development and adaptation.

The two studies provide the necessary populations and social systems to explicitly examine a pedagogy focused on the innovation-development process. Rogers' social system is a kind of collective-learning system in which the experiences of the earlier adopters of an innovation, transmitted through interpersonal networks, determine the rate of adoption of their followers. Such learning-by-doing in a social system can take both positive and negative turns. Rogers encourages field experiments, suggesting they determine a time order and observation of dependent variables on independent variables. "As such, field experiments are an ideal design for evaluating a diffusion program" (Rogers, 2003:70). For this dissertation, the exposure to field experiments and variables are examined on the early phase or pre-diffusion stages of the process.

The first study is a system of individuals (undergraduate students) within an academic social structure. The second study is an intermediary organization (practitioners) system, and its extended ecosystem, within an occupational social structure. The strategic design method (innovation) is introduced into the two social systems at a deliberate rate to allow for careful balancing of the system's ability to adjust to changes. The participant population (social systems) for the cases included:

- Case Study A: (n=140): students registered for undergraduate course (COMM388). Students are both male and female, aged between 20 to 25 years, multi-disciplinary,

and racially diverse. *Note: a segment of this population (n=64) provided their reflection documents for content analysis*.

Age	Gender	Academic disciplines
54.8% (20-21 yrs)	Females: 56.25%	68% BCOM
39.2% (22-23 yrs)	Males: 43.75%	16% EXCHANGE (International)
3% (24-25 yrs)		12% SCIENCE (BAS/BCS/BSGR)
2% (19-20 yrs)		4% ARTS (BA)

Table 4.1 Case Study A participant population

- Case Study B: (n=80): members of one organization (n=16) and one sector (n=64) Subjects are both male and female, aged between 20 to 65 years, employed in same sector, and racially diverse.

Age	Gender	Organizational roles
39.7% (40-49 yrs)	Females: 61.9%	54% as executives
31.7% (50-59 yrs)	Males: 38.1%	18.8% directors
14.3% (30-39 yrs)		7.8% supervisors
12.7% (60 yrs +)		12.7% non-management employees
1.6% (20-29 yrs)		6.3% as contractors

Table 4.2 Case Study B participant population

The intervention or instructional method (SDM) was originally created at the University of British Columbia (UBC) to develop students with the capacity to think critically and creatively, problem solve and "apply a process that guides them from chaos to thoughtful solutions" (Quayle, 2014). As an undergraduate methods course, it aims to implicitly develop an individual's innovative capabilities for:

- the creation of transformational and sustainable business models;
- the learning processes that will enable adaptation to changing markets;
- the effective response to evolving economies; and,
- the development of new strategic design competencies for future leadership.

Both field participant groups interacted with the instructional method (SDM) over a sequential period of multiple weeks:

- Case Study A: Introduction, practice and experimentation with the intervention (SDM) to a sample population of commerce and non-commerce undergraduate students for 13

consecutive weeks, collected after four academic terms; with a total population of (n=140).

- Case Study B: Introduction, practice and experimentation with the intervention (SDM) to a sample population comprised on one non-profit organization and members of their stakeholder ecosystem (n-80), over 14 consecutive weeks.

The case analysis framework borrows from Rogers' *Diffusion of Innovations* innovation theory, and is comprised of four main elements. Table 4.3 outlines the elements with comparative elements from the case studies.

Main elements: Rogers diffusion of innovations	**Comparative elements: action research case studies**
(1) Innovation: an idea, practice, or object that is perceived as new by an individual or other unit of adoption.	*Case Study A:* Strategic Design Method Curriculum (SDM) *Case Study B*: Strategic Design Method Curriculum (SDM)
(2) Communication channels: the means by which messages get from one individual to another.	*Case Study A*: SDM delivered in classroom setting *Case Study B*: SDM delivered in occupational setting
(3) Time: comprised of three sub-factors are: (a) innovation-decision process (b) relative time with which an innovation is adopted by an individual or group, (c) innovation's rate of adoption.	*Case Study A*: (a) One three-hour session, per week over 13 weeks; (b) directed change events over 13 weeks; (c) measured at the end of 13 week study. *Case Study B*: (a) Combination of four six-hour sessions and three hour-sessions over 14 weeks; (b) directed change events over 14 weeks; (c) measured at the end of 14 week study.
(4) Social system: a set of interrelated units that are engaged in joint problem solving to accomplish a common goal.	*Case Study A*: Undergraduate students are united by course, shared classroom, campus location and geography. *Case Study B:* Creative industry occupational workers are united by sector, ecosystem and regional geography.

Table 4.3 Analytic elements for process analysis

The action research studies reflect Rogers' critical elements for analysis which include: (a) adopters comprised of individuals and individuals in groups; (b) the target as innovation (strategic design method); (c) the process as communication (strategic design tools); the means of communication channels (lectures, presentations and artifacts); the context of innovation as a social system (classroom and occupational industry); and, a change over time (adoption of method) (Rogers, 1995). Tables 4.3 and 4.4 outline the elements required to lead a comparative study on the innovation-development process.

Critical elements: Rogers	**Comparative elements: Case Study A**	**Comparative elements: Case Study B**
(a) The *adopters* comprised of individuals and individuals in groups.	Unit of analysis (n=140): adopters are students registered for COMM388.	Unit of analysis (n=80): adopters are members of one organization (n=16) and one sector (n=64)

(b) The *target* as innovation.	Target: The SDM is delivered in three-hour sessions, weekly for 13 weeks.	Target: The SDM is delivered in three-hour sessions and four six-hour sessions bi-monthly over 14 weeks.
(c) The *process* as communication and the *means* of communication channels.	Process: The SDM delivered through active learning techniques. Means (events): Lectures, generative activities, presentations and idea and concept generation.	Process: The SDM delivered through active learning techniques. Means (events) Lectures, generative activities, presentations and idea and concept generation.
(d) The *context* of innovation in a social system.	University campus classroom	Occupational office space
(e) *Change* over *time*.	Adoption of method over 13 weeks	Adoption of method over 14 weeks

Table 4.4 Analytic elements for innovation-development process study

4.2 Data Collection and Diagrammatic Analysis

Document analysis was performed on the SDM based on the theoretical framework comprised of Rogers' innovation-development process (IDP) theory (1962-1999) and Argyris and Schön's social learning theory (1978) and Simon's theory of design (1969-1996). In addition, five types of data were collected from various documents to answer the research questions and included: participant observation field notes; student generated artifacts; teacher-student artifacts (syllabus, lesson plans, assignments and grading/evaluation notes); facilitator-subject artifacts (workshop plan, techniques and prototypes); and teacher-researcher data (field notes to document classroom observations).

The action research studies sought to accomplish three analytic tasks: (1) provide evidence or tangible results whether the instructional method does, or does not, simulate the innovation process; (2) identify comparable competencies between Rogers' IDP and the instructional method (SDM) that reflect innovativeness behaviour; and, (3) provide tangible results of whether the instructional method is or is not an effective individual innovativeness learning model.

(1) ***Process analysis framework: comparative analysis***

A process analysis combining document analysis and action research observations of the instructional method's process phases were compared with Rogers' six-phase innovation-development model. The data was collected from participant observation and SDM documents for both Case Study A and Case Study B.

(2) ***Innovativeness competencies framework: comparative analysis***

A competencies analysis combining document analysis and action research observations of the instructional method (SDM) with Rogers' IDP model was performed. A simplified innovativeness competencies table generated from document analysis, reflecting the Rogers' IDP phases and associated key activities (Table 4.5), serves as the initial framework for the comparative analysis. The phase and activity based competencies include knowledge, aptitudes and skills. The data was collected from participant observation for both Case Study A and B were mapped and compared.

Rogers' IDP phases	**Phase and activity based competencies:**		
	Knowledge	**Aptitudes**	**Skills**
1. Needs/Problems: *Recognition or inquiry into a condition or situation that requires investigation and resolution.*	• Domain • Procedural	• Empathy • Needs finding • Problem finding	• Creative thinking • Critical thinking • Communication
2. Research: *Original investigations for knowledge production or to solve practical problems.*	• Inquiry methods	• Qualitative research • Quantitative Research • Systems thinking • Decision-making	• Problem identification • Visual thinking • Critical thinking • Collaboration • Decision-making • Communication
3. Development: *The process of putting a new idea in a form that is expected to meet the needs of potential adopters.*	• Design methods • Market intelligence	• Prototyping • Design thinking • Decision-making	• Collaboration • Creative thinking • Critical thinking • Decision-making • Communication
4. Commercialization: *The production, manufacturing, packaging, marketing, and distribution of an innovation.*	• Production • Design methods • Market intelligence	• Operations Management • Design thinking • Decision-making	• Project management • Package design • Creative thinking • Critical thinking • Decision-making • Communication
5. Diffusion and adoption: *The crucial decision in the entire process to begin diffusing the innovation to potential adopters.*	• Market intelligence • Innovation management	• Marketing • Decision-making	• Project management • Creative thinking • Critical thinking • Decision-making • Communication

	Knowledge	Aptitudes	Skills
6. Consequences: *The original problem/need that began the entire process either is or is not solved by the innovation.*	• Innovation management • Reflective practice	• Data analysis • Evaluation • Mixed methods research • Decision-making	• Business analysis • Critical thinking • Reflective thinking • Decision-making • Communication

Table 4.5 Proposed innovativeness competencies framework

The types of *knowledge* proposed for each phase include: domain and procedural knowledge; inquiry methods; design knowledge; production; market knowledge; business management; technical knowledge; and, reflective practice knowledge. The *aptitudes* proposed include: empathy, needs and problem finding; qualitative and quantitative research and systems thinking; prototyping and design thinking; operations management and marketing; decision-making; data analysis; evaluation; and, mixed methods research. The *skills* proposed include: creative and critical thinking; problem identification and visual thinking; collaboration and decision-making; project management and package design; communication; business analysis, critical and reflective thinking; and, communication.

(3) ***Instructional method analysis framework***

The combined document analysis and action research methods were integrated into a case study narrative format to describe the instructional method's effectiveness as an *innovativeness* learning model. The data was collected from a variety of qualitative methods and instruments:

- Case Study A: data collection from participant observation; workshop-based group interviews; and, from in-class student-generated artifacts (n=140). An additional document analysis is performed for a segment of this population (n=64) who consented to having their reflection documents analyzed for research purposes.
- Case Study B: data collection from participant observation; questionnaire; workshop-based group interviews; and, document analysis from participant generated artifacts (n=80).

To demonstrate if innovativeness was learned, the following evaluative framework is proposed, comprised of: competence facets (i.e. knowledge, aptitude and skills), associated claims or skills, and evidence of examples. This framework (Figure 4.1) is borrowed from Weber et al's (2014)'s evidence-centred design model and is adapted for this dissertation.

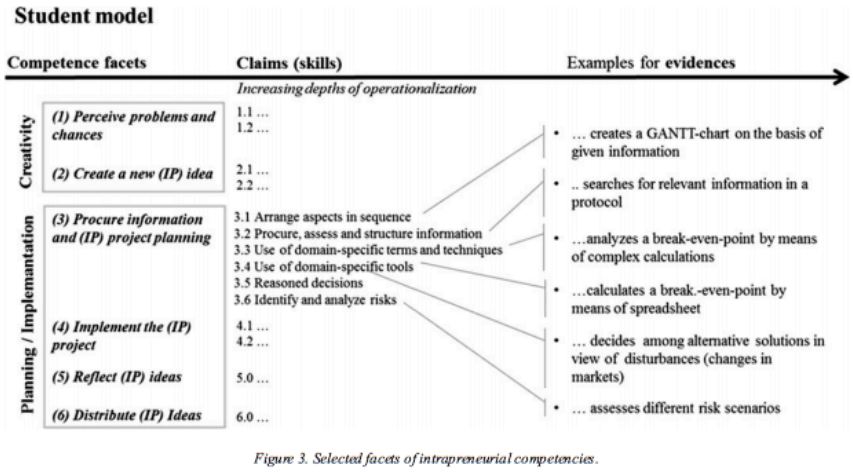


Figure 3. Selected facets of intrapreneurial competencies.

Figure 4.6 Example of a Competence Evaluation Framework

The data analysis process involved interpreting field notes, questionnaire data and workshop-generated artifacts and mapping them onto a series of diagrams. The diagrams contextualize the instructional method (SDM) and compared it with Rogers' innovation-development process. Diagrammatic analysis (i.e. reasoning or modeling) was used, as it offers an "understanding of concepts and ideas by the use of diagrams and imagery, as opposed to linguistic or algebraic representations...and allows us to gain insight into the way we think" (Simon, 1995:2).
The data analysis process for the next chapter is presented in a visual or 'diagrammatization' of textual patterns observed and collected from the document analysis and action research studies. The documents were instrumental in offering ideas and patterns, identifying conceptual classifications, and proposing competency categories.

Chapter 5: Research Sites, Case Studies and Instructional Method

A document analysis and two action research studies were conducted to answer the central research question concerning a design-led innovation pedagogy's effectiveness with developing innovative capacity. The literature review from Chapter 2 provided the knowledge on how innovation happens and the theoretic frameworks supporting the design of an innovation process learning model. The theories include Rogers' IDP model, Kolb's *Experiential learning* theory, Schön's *Double-loop (reflective) learning* theory and Simon's *Theory of Design.*

The problem statement for both the classroom and occupational action research studies concerns innovation-related learning. Incorporating innovation theories and learning models into the instructional and facilitation method could benefit both students and occupational subjects, if the learning outcomes are comparable with innovativeness competencies.

In relation to innovation education and management literature, relatively few studies have investigated individual competencies associated with participating in the innovation process (Midgley, 1978; Hurley & Hult, 1998; Timmons, 1989; Griffin et al, 2012; Matthews et al, 2015). No research could be sourced at this time that investigated a design-led instructional method explicitly focused on developing innovativeness competencies inside a classroom or an occupational environment.

In order to provide a meaningful integration of innovation theories, learning models and practical methods, four questions were addressed. First, which competencies can be identified from Rogers' innovation-development process theory? Second, which competencies from the instructional method map onto the innovation-development process theory? Third, did students obtain innovation-related knowledge, aptitudes or skills from their experience with the instructional method? Fourth, did the occupational subjects obtain innovation-related skills from the facilitated instructional method? Only when these questions can be answered positively can the incorporation and integration of the theoretical frameworks and models be considered successful.

The action research studies designed to examine these four questions involve two cases. Case Study A observes and engages undergraduate students in the introduction and experimentation with the instructional method (SDM) over a 13-week period. Case Study B observes and engages a non-profit organization, and members of their ecosystem, in the introduction and facilitated interaction with the instructional method (SDM) over a 14-week period.

This chapter is organized into the following sections: (5.1) Case Study A: COMM388; (5.2) Case Study B: Creative BC; (5.3) researcher-teacher-facilitator; and, (5.4) the strategic design method (SDM) as the instructional method.

5.1 Case Study A: COMM388 and UBC's d.studio

The curriculum designed for COMM388 is based on a strategic design method and is delivered through Sauder School of Business at the University of British Columbia. This undergraduate elective course is sometimes referred to as the 'd.studio'. Studios are considered place-based educational environments where local knowledge, needs and peers teach each other how to live, learn and sustain themselves and their communities. Studios located inside business schools, also referred to as 'business studios' (Barry and Meisiek, 2015), have embraced the studio-learning heritage, and expanded the educational task to offer interdisciplinary topics that range from entrepreneurship, business development, management, leadership, organization design, strategy and policy, and innovation.

The studio learning experience, commonly used in architecture, landscape architecture, interior design, and industrial design faculties, consists of a variation of problem-based and project-based learning, where the students' work centres on design problems grounded in professional practice. This type of place, combined with a design-studio learning method is emerging as an effective approach to learning innovation, rooted in organizational practice. "Managing the complexity of ill-structured, open-ended problems is key to design work where the work of a designer involves working with uncertain parameters in particular settings that evokes meta-knowledge, a sense of how to go about building an understanding of the problem at hand" (Brandt et al, 2013).

Barry and Meisiek (2015) discuss how the 20th century design studios were places where craftsman designed industrial products, architects designed built environments, and communicators designed marketing campaigns and corporate identities. The notion of design and business innovation has emerged recently in the form of *business studios*. Barry and Meisiek (2015) provide a summary of these *studios* that include Copenhagen Business School's Studio at CBS, DesignWorks at Rotman School of Management, Case Western's "Managing as Designing" at the Weatherhead School of Management, Aalto University's Design, Media and Service Factories, the Cass Business School Learning Laboratory, RMIT's business school studios, and the former Imagination Lab, in addition to UBC's d.studio at the Sauder School of Business in Vancouver, Canada.

There were no studies identified in my search that provided empirical evidence on the performance of design methods with developing *innovativeness competencies*, as the business studios have only recently emerged inside academe. However, the consultancy, IDEO has successfully influenced industry to conclude that design thinking is critical for business innovation (Brown, 2009).

The d.studio located inside the Sauder School of Business, is a relatively new studio that is both a physical place and symbolic concept for design-centered education within the business school. Co-designed and launched in 2010 by Professors Moura Quayle and Ronald Kellett, the d.studio provides a space where undergraduate commerce students and industry sponsors discuss and collaborate, redefine and redesign various pathways to innovation. Quayle, a landscape architect and educator, envisioned the Sauder d.studio as a teaching business studio. It would provide a studio experience and designerly techniques aimed at changing the way business students think and solve problems. The first d.studio course was piloted in 2010, and then was successfully adopted into the business school elective courses in 2011. Today, it is positioned as a studio methods course that advances the practice of strategic design for business innovation. COMM388 is offered to both commerce and non-commerce 3rd and 4th year students, who elect to engage in different collaborative projects with industry clients and learn to be researcher-

consultants. They are required to identify a problem or need, then design a strategy and solution to resolve the problem. The students are engaged in three-hour long studios that combine theory with practice. Working in topic-based groups of three to five members, they co-create concepts using methods, tools and techniques throughout the semester. A few examples of techniques used include: *Assumption Dumption*, *Story Share*, *Scenarios*, *Improv*, and *Service Journey*. (d.studio, 2015).

COMM388 is delivered inside the 'd.studio' space which offers whiteboards on walls and on rolling carts to create group workspaces. Physical tool-kits are provided that contain paper, Lego blocks, pencils, string, and other crafting materials are available for each workgroup. The open one-room d.studio makes all students visibly aware of who is doing what through vocal, visual and body communication. It also offers sharable resources such as writing and drawing tools, whiteboards and paper, movable chairs and accessible computer screens at every table. COMM388's curriculum, the strategic design method (SDM), is the instructional method under investigation for this study. The d.studio space serves as the physical research site for Study A.

The SDM curriculum was designed for the studio-based learning environment. Schön (1985, 1987) first introduced the idea that studio-based design instruction could benefit *all* students. Since then, the studio method has been used as a means of teaching a variety of content areas such as mathematics (Shaffer 2005), chemistry (Gottfried et al. 2007), physics (Dori and Belcher 2005), and human-computer interaction (Reimer and Douglas, 2003). Quayle (1985) examined numerous theories and would develop the SDM in her earlier work on the Awareness Development Studio. This theoretical approach to design education offers: instructional emphasis on increasing the sensitivity of students to self reflection; an approach based in behavioural/social science techniques; the development of and social consciousness in the student; little emphasis on traditional design; a loose structure; and, an emphasis on self-understanding (Quayle, 1985:51). Quayle defines design as the common area between science and the humanities (Quayle, 1985). Design bridges theoretical knowledge (i.e. observation, measurement and hypotheses), with interpretive knowledge (i.e. contemplation, criticism, evaluation and discourse). Design is the collective body of practical knowledge (i.e. sensibility,

invention, validation and implementation) (1985:108). Quayle integrates Cross's (1980) suggestion that design methods may accomplish abilities for problem solving, citizen action processes, and improved environmental awareness as it relates to an individual's personal and professional contexts. Quayle explicitly integrates reflective practice, as recommended by Schön (2012), after each lesson.

Problem Statement for Case Study A:
Design and deliver a course that introduces design theory and methods for business innovation.

Subjects: All students enrolled in COMM388 in both fall and winter terms, from 2010 to 2014 were eligible to participate in the action research study. All participated (n=140) and were observed. In addition, a segment of the total population (n=64) also provided their final reflection blogs for analysis. The subjects were heterogeneous; mix of female (approx. 55%) and male (approx. 45%); diverse in age and ethnicity. These factors were not assessed for this study. Over 70% of students were third-year Bachelor of Commerce undergraduate students with the remaining population representing applied science and arts faculties. Students' backgrounds were not assessed.

Initiative/Process description: The COMM388 course delivered inside the d.studio entitled *Design Strategies for Business Innovation: Studio Practice*, is focused on strategic design principles and practices. Over 13 weeks, students actively learn how to: research and frame the problem or opportunity; identify design criteria to guide idea generation and evaluation; create and test potential solutions through rapid prototyping; and, select and implement a tested solution. It is offered to senior undergraduate business students (3rd and 4th year) and promoted as an elective course that will provide strategies for thinking through complex problems, working creatively and collaboratively, managing projects, embracing change and ambiguity, and engaging with partners across sectors – skills that are transferable and marketable. The course uniquely offers commerce students, along with other non-commerce undergraduates, the opportunity to apply strategic design techniques to real-world problems provided by a variety of cross-sector industry 'project-sponsors'. The syllabus states, *"The course will challenge teams of*

students to deliver real-world solutions that create economic, social, and environmental value using strategic design." The course goals are to: introduce design strategies for business and innovation in a post-carbon economy; foster a culture of creativity, risk-taking, personal enrichment and team-work; build problem-solving capacity and develop business thinking processes; and, develop leadership and capacities for self-expression.

The d.studio environment is also designed for students to engage in co-creative and collaborative techniques with their industry sponsors. The techniques and tools provide the means for learners (students and sponsors) from different backgrounds to productively explore common ground that benefits them individually and as organizations. Holman and Devane (1999) suggest that the physical space enables a way to satisfy the human need to connect with other people, productively identify problems, and co-design solutions. The d.studio aims to combine strategic design processes inside a studio environment with the goal to effectively develop future 'innovative' leaders. This dissertation provides the first case analysis of Sauder's d.studio COMM388 curriculum and highlights observations on its effectiveness and challenges with meeting its goal.

5.2 Case Study B: Creative BC

Creative BC is an independent, not-for profit agency created in 2013 by the province of British Columbia to build the capacity of BC's creative sector. Creative BC (crBC) has an important mandate to champion BC's diverse creative sector, and connect BC's creative workforce and projects, to local, national and global markets. CrBC employs fewer than 20 employees, has $2 million in operating capital, and offers programs and services to hundreds of creative sector clients in the film, television, animation, digital media and publishing industries. According to Creative BC, in 2009, the creative sector has generated over $4 billion dollars in annual GDP and supported over 85,000 skilled jobs in BC, putting the province's creative economy slightly ahead of other industrial sectors such as mining, agriculture and forestry (Creative BC, 2014).

Creative BC operates as an intermediary for British Columbia's creative industries. It is an organization that supports and brokers innovation development activities across BC's creative

sector. Creative BC is instrumental in addressing critical economic development of BC's creative sector and facilitates inter-organizational collaboration by bringing together firms, governments, and universities to address multi-dimensional problems and opportunities. Creative BC, as the second research site offers an interesting population to examine, as they broker knowledge between creative industries and across local, national and global social networks. They also play an important role in the region's creative economy development.

Building on prior creative economy research initiatives with the University of British Columbia's Sauder School of Business, Creative BC established a partnership with Sauder's d.studio research team in December, 2015 to design an experiment resulting in a service innovation output. UBC's d.studio team led a research-driven design process involving 80 participants with the goal of creating a service innovative plan for BC's creative industries. The strategic design method was employed as an action research method and to facilitate the articulation of needs for the project. The needs identified included: to gain a new understanding of the complexities of BC's creative sector; to learn how creative industries overlap, collaborate and co-exist; and, to adopt a flexible, cross-disciplinary and strategic approach to respond to a volatile and competitive environment.

Industries that participate in the creative economy are entitled 'creative industries' and are "those which have their origin in individual creativity, skill and talent, and have a potential for wealth and job creation through the generation and exploitation of intellectual property" (DCMS, 1998). The World Bank identifies the creative industries as being those involved in software, digital media, film, music, video games, industrial design, fashion, publishing, and research and development (Foord, 2008). These firms generate intellectual property, patents and copyrights through creative content, product and services.

The strategic design method (SDM) was the intervening approach with the following objectives: to engage staff, board of directors and key stakeholders from across BC's creative sector; to improve Creative BC's understanding of its province-wide ecosystem (diversity and assets); to diagnose the strengths, weaknesses, limitations and gaps across creative industries; to identify

common, unifying and catalyzing opportunities; and, to develop a client-centric strategic and service innovation plan for BC's creative industries. SDM proposed a creative and critical approach to engage stakeholders in productive consultation, ideation and problem solving.

Problem Statement for Case Study B:
Engage a diverse sampling of Creative BC's stakeholder population in the co-creation of a multi-year business growth strategy.

Subjects: All employees from Creative BC were asked to participate (n=16). Additional members of Creative BC's social system (ecosystem) was asked to participate (n=62).

Initiative/Process description: The process relied on information visualization tools to more effectively engage creative industry stakeholders in the analysis of what can be intimidating amounts of textual and numerical data. Expressive and effective visualizations offer an alternative to the numerically intensive economic visualizations typically offered by government and industry consultants. To understand the current creative economic climate, it helps to first make sense of the language, values and motivations of all those involved in the building and growth of a region's creative industries.

The process provided Creative BC with an introduction to and active learning from the SDM. Participants were involved in prototyping concepts, scenarios and action plans as a way to quickly determine whether a concept, strategy or action should be pursued or discarded. Each idea was presented, discussed and considered for further investment and stages of refinement. A final service innovation plan (the innovation) was diffused to the members of Creative BC's social system in April 2016.

5.3 Researcher, Teacher and Facilitator

As discussed in Chapter 4, an action-research study is concerned with investigating participant interactions with an instructional method and involves an instructor as facilitator, intervener and researcher. For both studies, I was the researcher, teacher and facilitator. After 20 years as a

practitioner in the private and public sector, engaged in designing and implementing new processes, products and services, I decided to pursue a graduate degree to gain, produce and mobilize knowledge of the innovation process. My motivation was (and remains) to provide an improved understanding of the innovation process to individuals and organizations, in order to help them develop innovative capabilities – such as, openness to new perspectives, new ways of thinking and acting towards a common goal. For the past four years, as a sessional instructor at the Sauder School of Business, I have delivered the instructional method (SDM) to predominantly commerce undergraduate students at the University of British Columbia. During the same period, I also facilitated the same method 'in-the-field' to over 15 private and public sector clients, engaging them to learn and practice how to think, act and work in innovative ways.

As an interdisciplinary graduate student, I combined methods and theories from sociology, cognitive and computer science, and design. From sociology, I studied the causes, processes and consequences of innovation. From cognitive and computer science, I studied behavioural patterns nascent to social systems and discovered patterns using visual analytics (technological) techniques. From design, I researched how students and occupational subjects observe, think and learn innovativeness, and created prototypes of new models. As the researcher-teacher-designer, I drew upon existing and emerging models of learning to document and measure the way participants learned the instructional method, then theorized and conceived of an adaptation to improve the experience.

As an interdisciplinary scholar, I have interpreted the innovation process literature and ways of learning as a constructivist. Constructivism theory suggests that people create their own understanding and knowledge of the world through experiences and reflection on those experiences. It suggests that when encountering something new, one integrates it with previous ideas and experiences by connecting the new knowledge to something already known. It may result in completely new knowledge or rejecting the idea completely. The theory assumes that we are active creators of our own knowledge requiring students to ask questions, explore, and assess what is known or learned (Rogoff, 1990). For this dissertation, I am creating my own understanding and knowledge of the innovation process through my disciplinary study choices.

My professional practice, classroom and field studies have granted me a uniquely magnified and detailed visibility into the innovation process. It is with this form of visibility or seeing (i.e. referred to as 'real medicine' or empirical science) that the research findings are interpreted and translated. The aim of my translated research is ultimately to offer the greater public an understanding and literacy of the innovation process, without having to have an advanced degree in statistical analysis, economics or sociology.

From my experience as a practitioner, scholar and teacher, I acknowledge the biases I might be injecting in my research. I introduce mature methods and evidence-based theories in an attempt to mitigate these biases.

5.4 Strategic Design Method (SDM) as the Instructional Method

The strategic design method (SDM), investigated in the two action research studies, has been taught at the University of British Columbia and delivered to undergraduate and graduate students and government and industrial organizations over the past six years. It engages learners and participants in productive consultation, problem finding and problem solving. The SDM is concerned with the articulation and integration of both individual and organizational practices (i.e. communication and knowledge production) and externally-oriented practices (i.e. societal value, market needs recognition and competitive positioning). Designed, taught and practiced at the University of British Columbia Sauder School of Business, the SDM is taught in a place called the 'd.studio'. The SDM offers a suite of design techniques and tools that constantly undergo adjustments and revisions to meet real-world client objectives. It is a structure that not only supports thinking and doing, but what to think about and how to "do" or act. SDM is about problem identification (asking why), problem setting (trying and testing) and problem solving (doing and evaluating). Its role is primarily to open and explore new issues before trying to understand how to solve them, using only available resources (Quayle, 2014).

The SDM at the University of British Columbia was originally conceived by landscape architect and professor Dr. Moura Quayle and described as a studio-learning method. Quayle cites

influences from design problem solving disciplines (e.g. architecture) and business design methods developed by the Helsinki Design Lab (Boyer et al, 2009).

Upon further investigation, I discovered that the SDM can be considered an emerging design method founded on Armand Hatchuel's Concept-Knowledge (C-K) theory (Beausoleil, 2012). The C-K theory argues a *concept* is the proposition or initiation of a process without an intended logical sequence. It is interdependent and interacts with *knowledge*, which offers objects, truths and logic to the concept. The interactions between concept and knowledge result in a final concept articulated as new knowledge. The iterative theory reflects creative thinking and innovation as part of design theory's central core. Creative thinking involves an imaginative process for problem solving (Osborn, 1953). The theory argues design is a process by which something unknown can intentionally emerge from what is known. It defines "*design* as the process by which a concept generates other concepts or is transformed into knowledge" (Hatchuel and Weil, 2003). The theory underlines the importance of intentionality in design-based innovation processes that thoughtfully and purposefully fulfill some requirements. It characterizes the broad world "intention" in design as a class of endeavours, deeds and actions that bring a concept to some form of reality, logic and knowledge. Design and sociology scholar Lucy Kimbell (2014) adapted the C-K theory into an intersecting 'four modes of action' framework for service innovation education and practice. She applies a strategic design process to service and policy design challenges. She extends the C-K theory to include both research and use, inside and *outside* organizations. The 'C" or Concepts mode includes studio inquiries and use, participation and adaption; and the 'K' or Knowledge mode includes R&D lab research and fieldwork/data gathering. Kimbell (2014) combines C-K theory with mixed methods research, highlighting ethnography, participatory design and quantitative data analysis. The C-K theory and its adaptations are inherent in the SDM for this dissertation. SDM is experimented with as a comparative innovation-development process, with the intent to increase the innovative capacity of individuals and organizations.

The SDM also engages in collaborative communication techniques. Through conversation we form and reform our life experiences and events; we create and recreate our meanings and

understandings; and we construct and reconstruct our realities and our selves. In his seminal work entitled *The Innovation Journey*, Van de Ven (1999), describes the innovation process as a framework and offers techniques that can be directly attributed to strategic design. Van de Ven offers, "teams identify and transform tacit knowledge into explicit understandings of alternative conditions in which to pursue possible actions and outcomes in the development of their innovations; under the conditions of ambiguity, innovation discoveries generate information about the social relationships and dependencies among participants and resource providers as well as information about the environment; nonlinear dynamic processes facilitate learning by discovery; transitions from chaotic nonlinear dynamics to more orderly periodic patterns in the innovation journey are triggered by the external institutional constraints and by self-organizing processes" (Van de Ven et al, 1999).

The SDM reflects the core principles found in the design research literatures, comprised of iteration, the capacity and knowledge to modify the intervention when it appears not to work or could be improved (Kelly, 2003). Ceschin (2014) suggests strategic design methods, techniques and tools are particularly important in the first phases of the innovation journey in which experimentation is key. He argues that these experiments should not to be undertaken inside one company's laboratory, but involve wide socio-technical experimentations outside an organization. Buchanan (1992) suggests that strategic design is a design discipline focused on connections and consequences that affect the course and structure for action. He argues that designers seek to explore and organize experiences through the sequence of a chaotic descent into unity, resulting in a form of symbols, images, signs, things or actions. He suggests that the interconnection of designerly thoughts with actions and symbols, has surprising consequences for innovation.

Although entitled "*Design Strategies for Business Innovation: Studio Practice*", the SDM taught within the COMM388 classroom, does not acknowledge innovation development process theories from innovation management literature. However, it does introduce students to design-led innovation-centric frameworks and innovation-development related activities.

The SDM does reflect Argyris and Schön's (1996) double loop learning theory, involving students in both collective learning and individual learning over a three-phase process. The phases involved in the SDM are described as: *Ask*, *Try*, and *Do* (Figure 4.1). The first phase (*Ask*) involves asking questions relating to observations and insights for the purpose of finding facts, meaning and inspiration. The second phase (*Try*) involves ideation, creation and prototyping for the purpose of testing and experimenting with assumptions, ideas and concepts. The third phase (*Do*) involves decision-making, implementation and evaluation, for the purpose of designing impactful solutions. Reflective practice is central to each phase to enable self and peer-based critique, and to encourage iterations of proposed ideas and concepts.

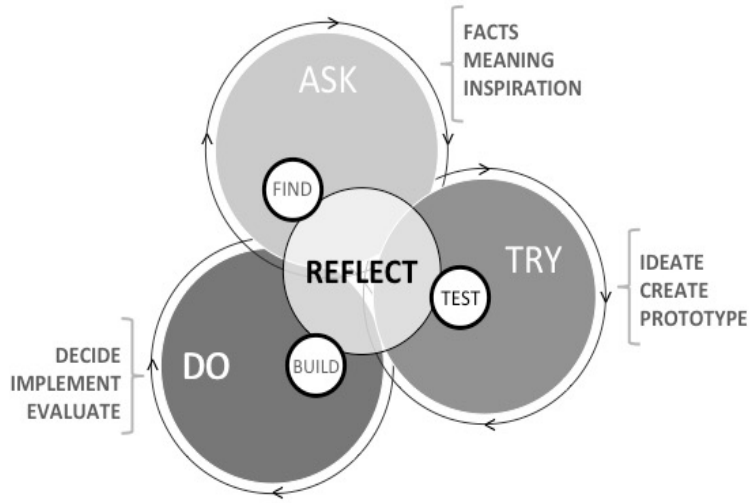


Figure 5.1 Strategic Design Method Adaptation

The SDM curriculum is the instructional method under study. It was originally created at the University of British Columbia (UBC) to introduce business students to design methods. Its aim is to provide them with the capacity to think critically and creatively, problem solve and "apply a process that guides them from chaos to thoughtful solutions" (Quayle, 2014). As an undergraduate methods course, it aims to: develop an individual's organizational capabilities; create transformational and sustainable business models; learn processes that will enable adaptation to changing markets; respond more effectively to evolving economies; and, to develop new strategic design competencies for future leadership. It is also positioned to facilitate the development and testing of innovation-oriented educational models combining studio place with strategic design method pedagogy. Table 5.1 outlines the similarities and differences in the

strategic design method used as the comparative method between the two cases, for this dissertation.

Case Study A: Strategic Design Method	Case Study B: Strategic Design Method
Learning objectives: Understand the role for design and thinking strategies in business, process, product and service innovation; Use the strategic design method and tools effectively in a sustainable business context; Co-create, present and critique innovative ideas with local businesses; Integrate critical and creative thinking processes; Work effectively in teams in a studio practice environment. **Course goals:** Provide students with strategic design method and techniques tool-kit; Practice creative ideation, critical analysis, systems and innovative thinking to identify business challenges/problems and design relevant and sustainable solutions. Work with clients on real world innovation projects. **Format:** 3-hr studio/classroom over 13 weeks. Delivered readings, techniques and real business innovation cases. Weekly over 13 weeks.	**Objectives:** Understand the role for design and thinking strategies as it applies to the organization under study; Use the strategic design method and tools to generate sustainable strategies; Co-create, present and critique innovative ideas for the organization and members of its social system; work effectively in teams and in collaboration with members of the social system in occupational studio/workshop environment. **Goals:** Provide non-profit organization with strategic design method framework and techniques tool-kit; Engage organization and social system participants to practice creative ideation, critical analysis and systems thinking to identify organizational and sectorial challenges/problems and design relevant and sustainable strategic and innovative solutions. **Format:** 3-hr studio/workshop over 14 weeks. Delivered applied theories and techniques for real business innovation case. Bi-weekly over 8 weeks, bi-monthly over six weeks.

Table 5.1 Strategic Design Method for Case Study A and Case Study B

5.5 Summary

In order to provide a meaningful integration of innovation theories, learning models and practical methods, four questions guide the research design. First, which competencies can be identified from Rogers' innovation-development process theory? Second, which competencies from the instructional method mapped onto the innovation-development process theory? Third, did students obtain innovation-related knowledge, aptitudes or skills from their experience with the instructional method? Fourth, did the occupational subjects obtain innovation-related skills from the facilitated instructional method? The methodologies selected for this dissertation involved document analysis and action research, narrated into a case study.

The action-research sites and case units comprised of two social systems geographically situated in Vancouver, British Columbia, Canada. The first social system (Study A) was from September

2010 to April 2014 and observed 140 participants in an undergraduate business class. Participants in this first study averaged 23 years of age, 56% were female, and 44% were male. The second system (Study B) was an occupational system comprised of an intermediary organization (practitioners) and its extended ecosystem within an occupational social structure. This study was from December 2015 to April 2016 and observed 80 participants in an occupational context. Participants in this second study averaged 45 years of age, 62% were female and 38% were male.

Study A involved the introduction, practice and experimentation with an instructional method to a sample population of undergraduate university students over 4 years (n=140). Study B involved the introduction, practice and experimentation with the instructional method to a sample population comprised on one non-profit organization and members of their stakeholder ecosystem (N=80).

As researcher, teacher and facilitator, I acknowledge existing biases, yet aimed to objectively investigate COMM388's curriculum (i.e. academic plan) focused on the strategic design method (SDM). The SDM is a design-led instructional method intended to teach and guide students through innovation-related frameworks. As a method, it is compared with Rogers' innovation-development process theory in order to reflect innovation-learning attributes and innovativeness competencies.

Chapter 6: Findings

This chapter provides findings from the document analysis and action research studies, and is organized into the following sections: (6.1) Comparative process analysis: instructional method and Rogers' innovation-development model; (6.2) Comparative competency analysis: instructional method and Rogers' IDP model; (6.3) Behavioural observations; (6.4) Evaluative framework of instructional method; (6.5) Factors and conditions; (6.6) Summary; and, (6.7) Limitations of the dissertation research.

The chapter also presents findings in a diagrammatic modeling format. The selected modeling language is the Business Process Modeling Notation (BPMN) method, as it illustrates business processes in the form of a diagram similar to a flowchart. BPMN is a standardized notation for creating visual models of business or organizational processes and offers over 40 different elements (White, 1984). For this dissertation, I used the most common elements: key events and activities objects (i.e. circles and rounded rectangles), connecting objects (i.e. arrows), data-objects (i.e. document icon), and grouped artifacts (i.e. dotted line rounded rectangle).

6.1 Comparative Process Analysis: SDM and Rogers' IDP Model

The data collected from the document analysis indicates that SDM does reflect comparable attributes with Rogers' innovation-development process theoretical model (Figure 6.1).

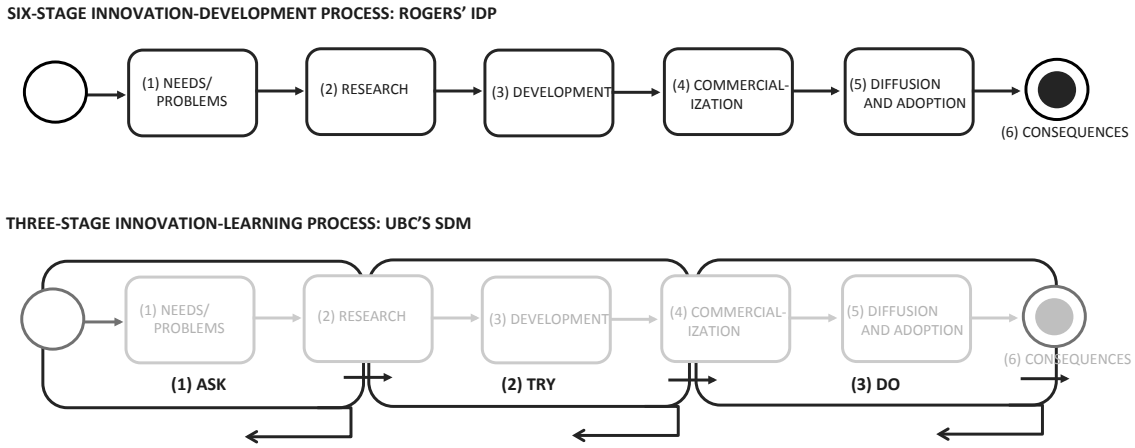


Figure 6.1 Comparative Multi-Phase Innovation Process Analysis

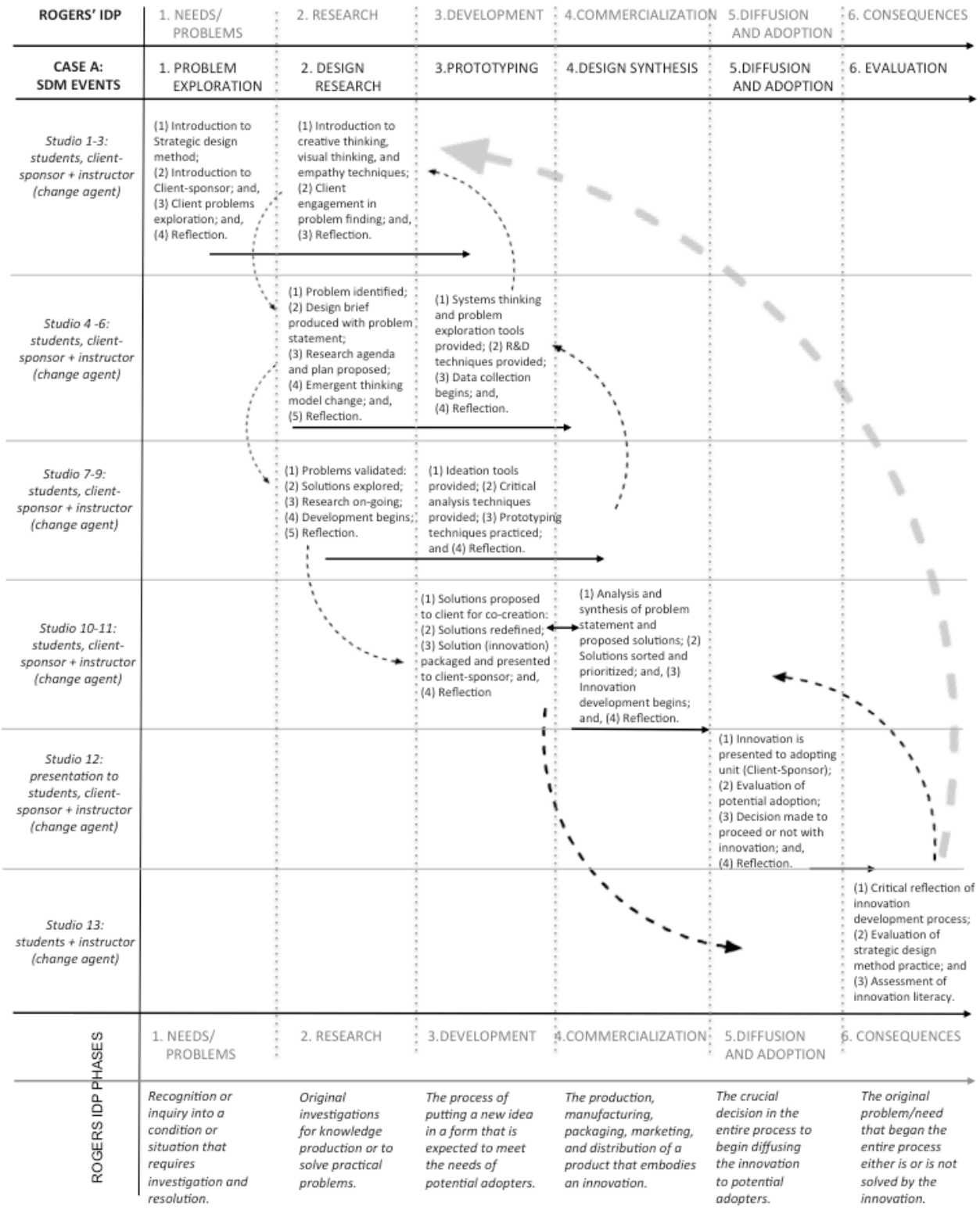
The curriculum design and delivery of SDM, when explicitly compared with Rogers' IDP's phases, share common attributes. Descriptive phases reflecting the innovation process include:

(1) *ASK: Problem exploration*: introduction of potential problems for exploration; and, *Design research*: user/adopter-focused problem investigation, identification and analysis;
(2) *TRY: Idea Generation and Prototyping*: prototyping and testing of conceptual solution(s);
(3) *DO: Design synthesis*: designing and packaging of final solution; *Diffusion and adoption*: presenting solution (innovation) to early adopter; and, *Evaluation*: assessment of whether the implemented innovation solves the problem.

The diagram (Figure 6.1) maps how the SDM phases reflect similar tasks and intended outcomes as Rogers' IDP, but they use a different descriptive language. Both involve initiation and implementation phases and sub-phases, suggesting similar activities and tasks that involve a recognized problem to be solved by an innovation, which is then diffused and evaluated. The next analytic task is to map the details of the instructional methods (SDM) to events (classes and workshops), for each phase.

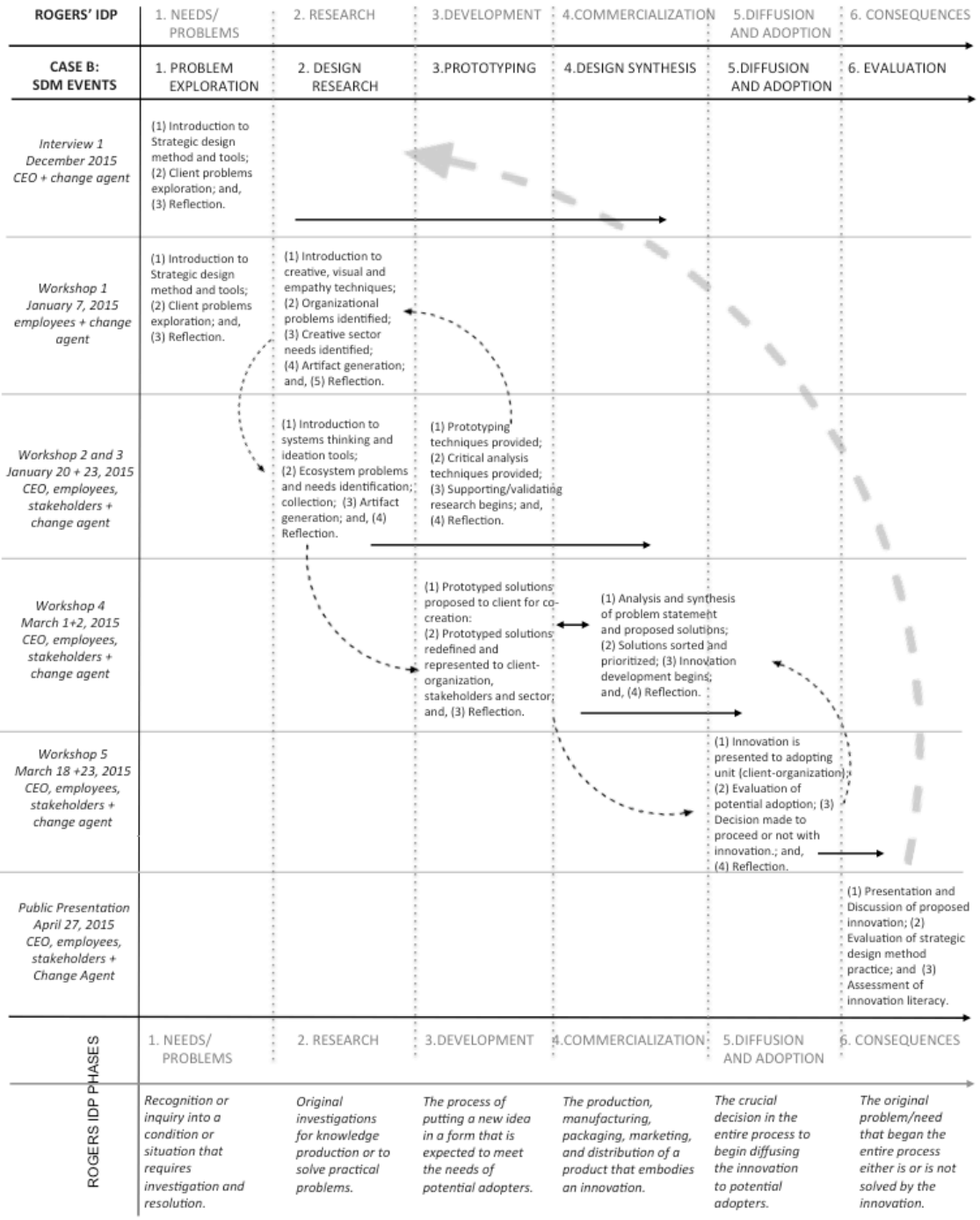
6.1.1 Initial Mappings of SDM onto Rogers' IDP

Although the SDM's structure positively correlates with Rogers' IDP, the process phases are not precisely linear. The phases do appear somewhat sequential -- however the SDM events and interactions appear more iterative and cyclical. For Study A, the events (classes) centre on grouped units of learning modules associated with the process phases (see Figure 6.2). For Study B, the events (business workshops) describe both single focused and grouped units of learning modules associated with process phases (Figure 6.3). The following diagrams illustrate and explain the instructional method's complex concepts:



Adapted from: Rogers Everett, M. (1995). Diffusion of innovations. New York. pp: 392

Figure 6.2 Case Study A: SDM compared with Rogers' IDP



Adapted from: Rogers Everett, M. (1995). Diffusion of innovations. New York. pp: 392

Figure 6.3 Case Study B: SDM compared with Rogers' IDP

Both Figures 6.2 and 6.3 present a descriptive process mapping of SDM introduced in Study A and Study B. The events represent comparable formats (classroom/studio and workshop) and units of time, and the activities are classified within each phase.

6.1.2 Business Process Model Notations of SDM from Detailed Observations

Below the Business Process Model Notation (BPMN) is used to chart Rogers' innovation-development process (Figure 6.1).

Rogers' innovation development process (IDP) depicts the six-phases that comprise the two overarching phases of *initiation* and *implementation*. The *initiation* stage centres on needs and problems recognition and exploration, and traditional research and development (R&D) stages. The *implementation* stage spans commercialization, diffusion and adoption and consequences activities. The first two phases of the SDM (Ask and Try) directly reflect the *initiation* and the early stages of the *implementation* stage. The SDM's *Ask* and *Try* phases combine design research, focused on human-centred needs and problem finding activities, with traditional R&D activities. The three SDM phases of *Ask, Try and Do* first appear to align with Rogers' six-phases as shown in Table 6.1, but the after mapping the activities against Rogers' IDP, I've found that the SDM phases aren't fully aligned with the six phases. Instead, they overlap along the innovation development process and across the initiation and implementation stages. However, the SDM does generally provide a framework and active learning tasks for individuals to understand and engage in the innovation process.

From the process notation analysis, the differences between the SDM and Rogers' IDP become more evident. First, its non-linear visual model shows how it is a circular, iterative process across the linear IDP model. Second, it integrates the explicit task of individual and group reflection after each event, suggesting thoughtful decision-making occurs at every stage and phase. Third, it guides subjects to engage in both initiation and implementation stages at the same time, across the first two phases. These differences are significant as they depart from the innovation management literature that clearly separates the initiation activities (i.e. R&D) from the implementation activities (i.e. commercialization and diffusion).

These two phases are commonly divided by a critical decision point, as observed from thousands of studies (Rogers 1995, van de Ven, 1999, etc.). The decision point involves making the choice between adopting or rejecting the innovation (Rogers 1993, 1995). For organizations, the

decision point involves significant risk. The risk involves investing the necessary resources to commercialize and diffuse the innovation to return a profit or create value for the intended adopters. Therefore, a criticism of the SDM in its current design, is that it may not be an effective method for organizations who require that decision point to avoid significant risk. Further research is required to experiment with this method inside an organization.

6.1.3 Reframing the SDM as an Innovation Process Learning Model

Combining the findings from the literature review and the two studies, this section provides a sequence of diagrammatic explanations of how the instructional method (SDM) can be adapted to teach individuals how to effectively participate in the innovation process. Tufte (1991) suggests that conveying meaningful relationships through a diagram can be done insightfully and in a concise way, representing the relationships that are of interest to explore.

Applying the standard process graphic notations, a comparative diagram (Figure 6.4) is used to highlight the similarities and differences between the initial mapping of Rogers' IDP and the SDM. Additional graphic notations include: dotted lines as secondary message flow; larger rounded rectangle as grouped sub-processes; diamond with circle as a gateway point; and, circle with an X as cancellation. This visual analysis makes visible the tasks to be completed within phases, their interrelations and inter-dependencies and overlaps over time, and introduces sub-groups of tasks across phases.

When mapping the two case studies involving the SDM onto Rogers' IDP, certain phases reflected higher interdependencies (Figure 6.4). These observations strongly suggest that the six distinct phases could be regrouped into four co-dependent phases. The proposed four phases include: (1) needs/problems; (2) research and development; (3) commercialization, diffusion and adoption; and, (4) consequences and evaluation. A larger diagram is provided in Appendix E.

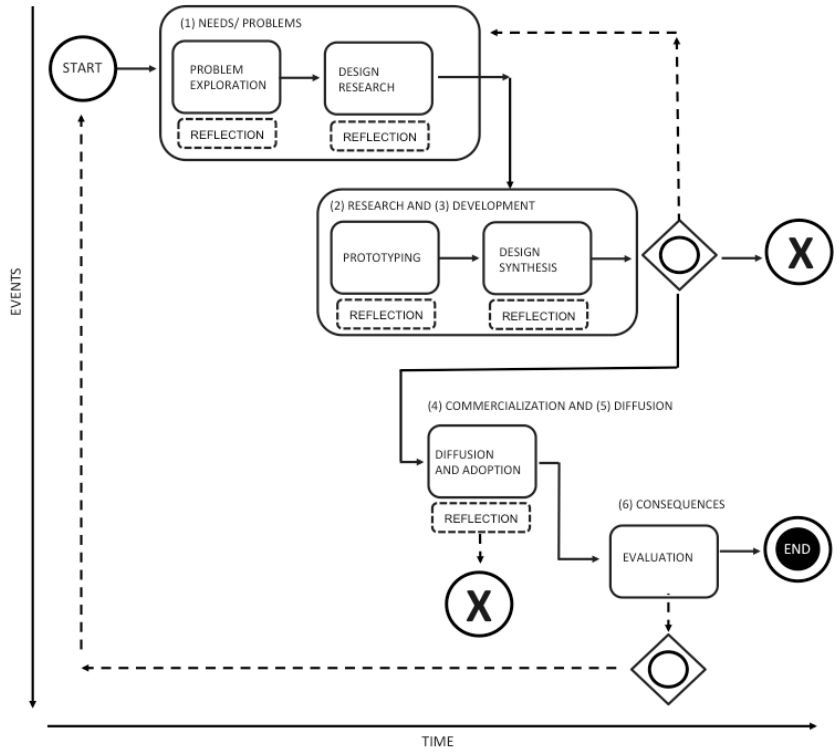


Figure 6.4 BPMN of SDM and Rogers' IDP

Each phase involves an explicit task of reflection or reflective practice. The four phases can be described as the following:

(1) *Needs/problems*: Recognition or inquiry into a condition or situation that requires investigation and resolution; involving user/adopter or design research.

(2) *Research and development*: Original investigations, or to solve practical problems. The goal is to put a new idea in a form that may meet the needs of potential adopters.

(3) *Commercialization, diffusion and adoption*: The production, manufacturing, packaging, marketing, and distribution of a product that embodies an innovation; and, the crucial decision in the entire process that begins to diffuse the innovation to potential adopters.

(4) *Consequences and evaluation*: The original problem/needs that began the entire process either is or is not solved by the innovation; and is assessed.

The diagrams aim to explain the phases in a more relevant way. To increase understanding of innovation process for the purpose of learning how to think and act innovatively, the phases

require clearer and more descriptive titles. The proposed titles for the four-phased SDM are: (1) Intention; (2) Investigation; (3) Integration; and, (4) Implementation:

(1) *Intention* is the act of willfully conceiving of or imagining new realities, with the purpose of improving them. I propose that *Intention* should propel the initiation stage of the process. It involves the explicit intent of first discovering, and then identifying the needs or problems before setting out to solve them.

(2) *Investigation* is the formal examination of the need or problem and continues the act of inquiry from the intention phase. It aptly describes the research, development and testing activities. It is proposed as the second phase that involves validating the needs or problems, and conceptualizing and prototyping solutions for them.

(3) *Integration* involves combining elements into an integral whole. The concept of integration permeates the innovation discourse, since innovations commonly reflect a combination or recombination of ideas that are perceived as new. *Integration* is the third phase, and involves designing, producing and packaging the problem-solving solution as an innovation.

(4) *Implementation* characterizes the final phase in most innovation process studies (Rogers, Van de Ven, von Hippel, etc.) and the majority of design processes (Brown, Cross, Chen, Drucker, etc.). *Implementation* as the fourth phase involves diffusing and evaluating the innovation (solution) as solving the need or problem. Reflection, which involves thinking and decision-making is positioned between phases.

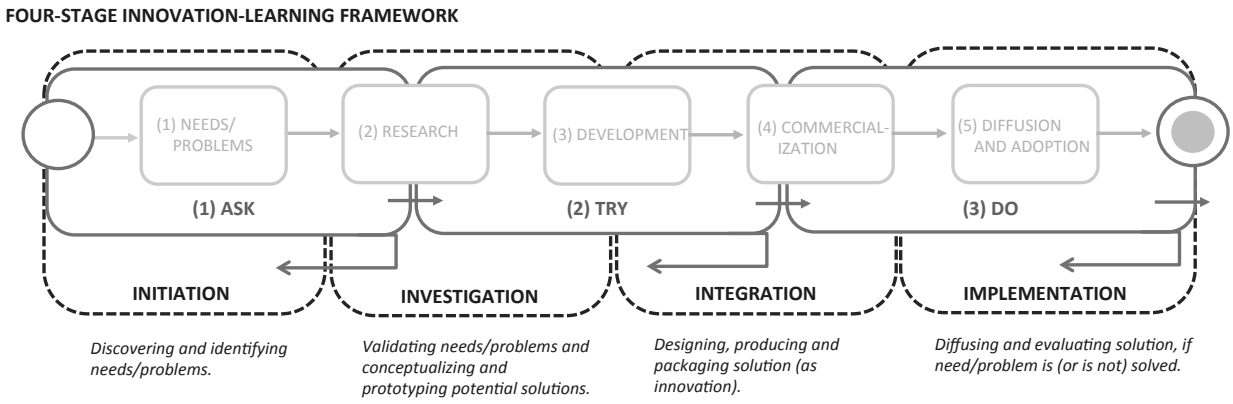


Figure 6.5 Adaptation of SDM Phases as a Four-Phase Innovation Learning Process

6.2 Comparative Competency Analysis: UBC's SDM and Rogers' IDP

The findings from the initial process analysis positively confirm the instructional method does emulate Rogers' innovation-development process (IDP). This section proposes a competency analysis that highlights the instructional method's process phases, activities and competencies, compared with Rogers' IDP model. The data was collected from participant observations and document analysis for both Case Study A and Case Study B.

The document analysis of the materials and artifacts developed for Case Study A, and reflected in Case Study B provides the list of competencies for Table 6.1. The materials include lesson plans, lectures and syllabus (see Appendix E) for Case Study A, and lectures and workshop plans for Case Study B.

The competencies in this section refer to the intended knowledge, aptitudes and skills, relating to each phase of the instructional method (SDM) and compared with Rogers' innovation-development process (IDP). The comparable competencies proposed by the SDM include:

a) *knowledge*: domain, procedural, inquiry methods, and reflective practice;
b) *aptitudes*: empathy, needs and problem finding, systems thinking, design thinking, prototyping, and evaluation; and,
c) *skills*: creative and critical thinking, communication, problem identification, visual thinking, collaboration, project management, and reflective thinking.

SDM's Three-Phase Process	**SDM's proposed competencies that are comparable to Rogers' IDP competencies [*]**		
	Knowledge	**Aptitudes**	**Skills**
1. Ask: *involves asking questions to discover needs and problems and to find facts, meaning and inspiration.*	• Domain ***** • Procedural ***** • Inquiry methods *****	• Empathy ***** • Needs finding ***** • Problem finding ***** • Qualitative research • Quantitative research • Systems thinking *****	• Creative thinking ***** • Critical thinking ***** • Communication ***** • Problem identification ***** • Visual thinking•
2. Try: *involves ideation, creation, designing and prototyping of concepts and solutions.*	• Design methods ***** • Market intelligence	• Prototyping ***** • Design thinking • • Decision-making	• Creative thinking* • Critical thinking• • Collaboration ***** • Decision-making***** • Communication *****

	Knowledge	Aptitudes	Skills
3. Do: *involves deciding, implementing and evaluating the problem, solution and innovation.*	• Production • Design methods ***** • Market intelligence • Innovation management • Reflective practice *	• Operations Management • Marketing • Data analysis • Evaluation • Mixed methods research • Decision-making *****	• Collaboration ***** • Creative thinking * • Critical thinking* • Project management * • Package design • Business analysis • Communication* • Reflective thinking*

Table 6.1 Comparative Analysis: Competencies of Innovation Process

The competencies that differ between Rogers' IDP and the SDM include:

a) *knowledge*: market and production knowledge, innovation management, marketing, and technical knowledge;
b) *aptitudes*: qualitative and quantitative research, operations management, marketing, data analysis, mixed methods research; and,
c) *skills*: package design and business analysis skills.

In summary, the SDM proposes an extensive set of competencies relating to business innovation and its innovation process. The *knowledge* areas of domain, procedural and design knowledge are offered with aspects of inquiry methods knowledge. However important areas such as market, product and innovation management knowledge are not provided. Both processes share *aptitudes* for empathy, needs and problem finding, prototyping, decision-making and evaluation. However, the SDM does not provide explicit lessons on qualitative, quantitative and mixed methods research. The SDM does offer design thinking lessons, which Rogers' IDP does not explicitly identify or practice.

The findings indicate a majority of the skills associated with the innovation process are common to both the SDM and IDP. Notably, the skills considered critical to the innovation process are common between the SDM and IDP. They include creative and critical thinking, communication, collaboration, decision-making, and reflective thinking. The findings also suggest that the SDM intends to develop competencies from its first two phases (*Ask* and *Try*) and less on *Do*. This correlates with learning more about the initiation stage of the innovation process, and less on the implementation stage.

6.3 Behavioural Observations

The participant observations and artifact analysis provided visibility into innate and actualized behaviours. Innate behaviour is the inherent inclination of individuals to behave in response to a particular situation (e.g. moving head towards a sound, eating when hungry, etc.) Actualized behaviour is learned by practice and exposure to a particular situation (e.g. not eating peanuts if allergic, raising a hand in class, speaking a specific language, etc.)

6.3.1 Case Study A: the SDM as the Intervention in a Classroom

Data collected from both participant observation and student-generated artifacts of the population (n=140) provided findings on individual learning experiences with the instructional method. An additional textual analysis of student-generated artifacts (n=64) was performed. Only 64 artifacts, generated between 2012 and 2014, could be located and sourced for this analysis. The corpus comprised of a total of 47,329 words, collected from 64 student reflection blogs (n=64), over four years from 2010 to 2014. The reflection blogs were the students' final assignment where they traced back their learning journey and described their learning experiences. These blogs were aggregated as student generated artifacts and combined to form a corpus for text mining. A sentiment analysis was also generated from the corpus, combining word frequency patterns resulting in a generally very positive (84%) neutral (14%) and negative (4%) student experience. The positive descriptors authored by the students were: *creative, experiential, designing, innovative, learning, like, love, real, realistic, relevant, respectful, studio, strategic,* and *valuable*. The neutral descriptors included: *critical, different, feel, new, student, team, time,* and *process*. The negative descriptors included: *ambiguous, challenging, complex, frustrated, messy,* and *hard.*

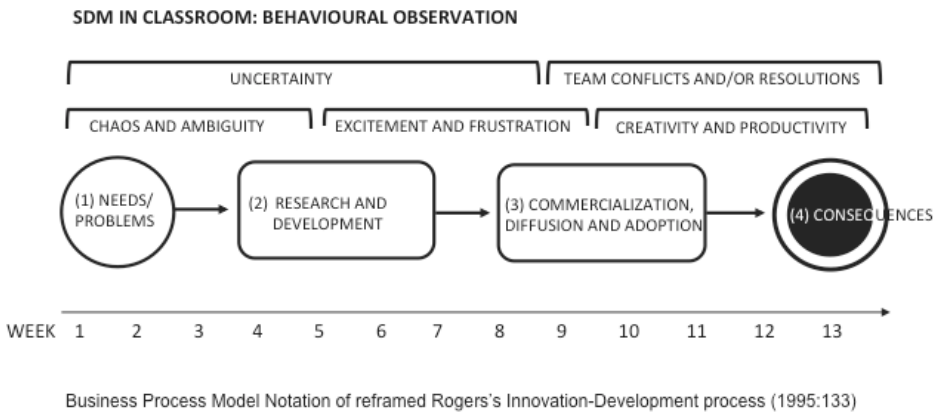


Figure 6.6 BPMN of Observed Behaviours: Case Study A

The student learning progression, observed and captured in field notes, and from student-generated artifacts, was generally consistent across all seven cohorts. The reflection blogs, recalling the student experience with SDM over 13 weeks, describe consistent characteristics, conditions and observed behaviours during critical phases of the process. The textual and field-note analysis provided the following findings: during the first five weeks, the students wrestled with ambiguity; during the first 9 weeks, the majority would move between excitement and frustration with problem exploration; between week 7 and 12, almost half would encounter team-based conflicts and challenges; and, from week 10 to 13, all teams would progress toward unified productivity and creatively crafted solutions, during the last three weeks (Figure 6.6).

From the group interviews, the conditions introduced by the SDM were described as 'chaotic and ambiguous' and the process described as a 'journey' where thinking constructs (styles) were challenged, however where productivity and transformation were ultimately achieved. The majority of students (over 65%) described their experience as learning about the principles of teamwork, design thinking (external reference influenced from external social systems) and quality solutions. Through the explicit use and practice of reflection, three important factors were identified: a) the concept of *learning by doing*, b) a new awareness that *design and creativity can be learned*, and c) that *conflict* can lead to better solutions. The learning environment (studio-based classroom) facilitated student debate, critique and identification of real-world problems. The one-room open space, with movable tables and chairs, facilitated the practice of techniques and tools resulting in transformed thinking styles associated with creative problem solving.

The tangible artifacts reflecting the behaviours described in the field notes are detailed in Appendix D. A selection of quotes extracted from the reflection blogs (n=64) are presented below. They were selected as explicit examples of the students' personal description of their learning experience. They provide tangible results that support this paper's document analysis. The students described their COMM388 experience with the instructional method as:

- *"embracing the unknown and allow it to catalyze our creative process"*
- *"understanding how co-creation is a key ingredient for discovering ground-breaking ideas"*
- *"it is a long process of trial and error"*
- *"we experienced interpersonal friction because we have different ways of learning"*
- *"by visualizing complex ideas, we get a better learning and understanding of our final results"*
- *"it teaches that creativity is something that can be learned"*
- *"the failures and mistakes are all part of the learning process, which is valuable for our future and real business career"*
- *"no course at the Sauder has altered my style of learning and thinking like d.studio"*
- *"I learned that while strategic design is exactly what business needs, it is also exactly what business does not have time for".*

6.3.2 Case Study B: the SDM as the Intervention in an Organization

The second research study observed the SDM as the innovation process intervention within the context of an organization and representatives of their social system. The unit of analysis comprises homogeneous and heterogeneous subjects. The subjects are homogeneous as members of the same regional creative sector social system and heterogeneous in demographics (n=80). Respondents to the pre-workshop questionnaire (n=62) provided the following information:

Age	Gender	Organizational roles	Innovativeness Types
39.7% (40-49 yrs)	Females: 61.9%	54% as executives	Early adopters (59%),
31.7% (50-59 yrs)	Males: 38.1%	18.8% directors	Early majority (24%)
14.3% (30-39 yrs)		7.8% supervisors	Innovators (12%)
12.7% (60 yrs +)		12.7% non-management employees	Late majority (.05%)
1.6% (20-29 yrs)		6.3% as contractors	Laggards (0%)

Table 6.2 Case Study B Research Subjects: Self Reported Profiles

The data sources for Case Study B included: field notes from participant observation; results from questionnaire; notes from workshop-based group interviews; and, participant generated

artifacts. Results from the individual innovativeness questionnaire (n=66). The results express: innovators (12%), early adopters (59%), early majority (24%), and late majority (.05%). From both observations and the questionnaires, no individual reflected the laggard adopter type. The analysis reflects the personality traits and implied motivation of the participants for both cases, to learn a new method for innovation. The lack of self-reporting as a traditional or laggard adopter type is likely a reflection of self-reporting bias. Self-reporting bias is particularly likely in organizational behavior research because employees often believe there is at least a remote possibility that their employer could gain access to their responses. On average, employees reported favourably to being identified as innovators and early adopters (Table 6.2).

Although an organization is considered a stable system of individuals who work together to achieve common goals through varying ranks and divisions of labour, small disruptive innovation activity occurs all the time. From the action research study with Creative BC, an inherent conflict between organizational stability and uncertainty associated with innovation was observed. Uncertainty is evident throughout the study, as a directed innovation process. The subjects experience with SDM as observed and captured in field notes and from subject-generated artifacts, was generally consistent for every workshop.

The field notes analysis (Figure 6.8) provided the following observations:

a) During all six workshops, subjects wrestled with ambiguity;
b) During all six workshops, the majority would move between enthusiasm and frustration with techniques of problem exploration and prototype development;
c) During the first three workshops, all teams would progress toward unified productive and creatively crafted artifacts;
d) During the last two workshops, the intended innovation was presented to stakeholders for evaluation; and,
e) Throughout the entire process, uncertainty was observed: individuals expressing uncertainty with SDM program and tasks; and, individuals expressing organizational uncertainty of successful implementation of service innovation plan.

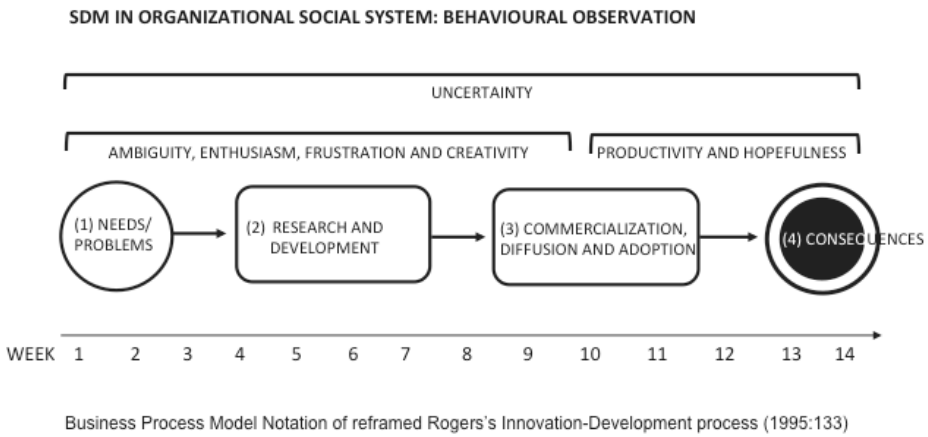


Figure 6.7 BPMN of Observed Behaviours: Case Study B

From the post-workshop survey responses (n=30), the following results provided a few indicators of the subjects' experience and engagement with the instructional method (Table 6.3) The responses selected demonstrate a minimum of 51% (as majority) in any category:

Question: The instructional method…	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
...facilitated open discussions for me to learn from.	0.0%	0.0%	0.0%	48.0%	52.0%
...helped me learn from others.	0.0%	0.0%	4.0%	56.0%	40.0%
…helped me to listen to others' views before speaking.	0.0%	0.0%	0.0%	36.0%	64.0%
…facilitated teams/groups to treat members as equals, regardless of rank, culture or other differences.	0.0%	4.0%	0.0%	36.0%	60.0%
…to encourage people to think from a global perspective.	0.0%	4.0%	12.0%	56.0%	28.0%
….to guide leaders to think and take actions, consistent with organizational values.	0.0%	0.0%	12.0%	60.0%	28.0%
…to assist with learning why, what and how to innovate.	0.0%	0.0%	25.0%	33.0%	42.0%

Table 6.3 Questionnaire Highlights: Self Reported Engagement with SDM

The behavioural observations for this section provide insights on both the innate behaviours and actualized behaviours associated with the instructional method over time. These behaviours do relate to some of the innovativeness competencies, identified from Rogers' IDP theoretical model. Innovativeness is concerned with how early in the process individuals adopt new ideas or practices, and thus accept change. Innovativeness is associated with personality traits of openness to experience and emotional stability (Table 6.1).

Rogers identifies four prior conditions that impact one's innovativeness during the innovation-diffusion process. These conditions are previous *practices*, the *needs* to be fulfilled or the

problem to be solved, *innovativeness* of the decision-making unit, and the *norms* of the social system (Rogers, 1995:163):

a) SDM encompasses a curriculum as a framework that employs tools and language to invent ideas and generate artifacts. It offers recognizable *practices* as phases that typically begin with research, analysis and understanding, and move towards synthetic phases of experimentation, invention and development.
b) The *needs or problem* to be solved in Study A combined both individual needs, (i.e. motivated to succeed with good grades,) and team-based needs, as in solving the problem posed in work groups from a real-world client. For Study B, the needs and problems focused first on the organization's need to develop an innovative strategy to compete nationally and internationally, and second on the individuals needing to improve their knowledge of their respective sector and general skills.
c) *Innovativeness,* as a dimension of innovation adoption, was observed and quantified for both studies. Generally, both studies had a higher representation of innovators and early adopters, not typically found in Rogers' social systems. This percentage may have skewed the innovativeness dimension, since motivations to engage in innovative thinking were a pre-existing condition.
d) The *norms* of the system combined personal norms with structured norms associated with the studio environment. Individual social systems could not be identified or correlated to the findings as they varied greatly for both populations under study. The norms imposed by the physical setting (studio) and the curriculum (SDM) certainly created a bias to the study, predicting a higher adoption rate of SDM as a method for innovation process learning and practice.

These findings suggest evidence of ambiguity and unfamiliar situations, resulting in uncertainty throughout the entire process. The instructional method (SDM) purposefully injected uncertainty (introducing a new curriculum, new techniques and a new structure of information) and recreated a realistic field condition through the interaction with real-world problems and networks (Case Study A=live client cases) and (Case Study B=actual organization), and then, through the deliberate use of a studio place, creative materials and open critique, aid in the reduction of

uncertainty. Responsiveness and management of uncertainty may be key factors to increasing innovativeness levels and learning how to innovate.

Overall, it is evident that the instructional method's curriculum (SDM) and environment does enable subjects to learn about and practice ways of problem finding, exploration and solving. The artifacts generated by the subjects reflecting the observed behaviour from this study are provided in Appendix D.

6.4 Evaluative Framework for the Instructional Method

This section reviews the findings from investigating the intended competencies with those observed and realized, from Study A and Study B. This study observed the subjects' response to the instructional method's curriculum design and syllabus structure for Study A and replicated the same structure and delivery for occupational workers for Study B. Competencies were identified from the activities and learning techniques lectured and practiced throughout the undergraduate course (Study A) and sessions (Study B).

For Study A, the data was collected from participant observation, workshop-based group interviews, and, document analysis from student-generated artifacts. For Study B, data was collected from participant observation; a questionnaire; workshop-based group interviews; and, document analysis from participant generated artifacts. A SDM competence framework is presented (Table 6.4) and is used to examine if innovativeness was learned.

SDM Phases	SDM competence dimensions
Ask: *involves asking questions to discover needs and problems and to find facts, meaning and inspiration.*	***Knowledge:*** • ***Domain*****:** *an individual's prior learning of a specific, situated or task-based knowledge.* • ***Procedural*****:** *an individual's information processing knowledge that facilitates adaptation to rules for acquiring new knowledge and combining prior knowledge.* • ***Design methods*****:** *knowledge on existing design methods for business innovation used in academe and industry.*
	Aptitudes: • ***Empathy*****:** *the ability to observe, understand and react to the concerns and needs of others; being aware of others' emotional responses, politics and actions.* • ***Needs finding:*** *the ability to perceive an individual or group need through observation and empathy.* • ***Problem finding****: the ability to productively ideate and define a workable task; to develop an attitude for discovery.* • ***Qualitative research*****:** *the ability to collect and manage data, think analytically and synthesize information into reportable and understandable formats.*

	Skills: • ***Creative thinking:*** *the ability to think imaginatively and deliberately in ways to observe, discover and solve problems.* • ***Critical thinking*****:** *the ability to think clearly and rationally, understanding the logical connection between ideas; to engage in reflective and independent thought.* • ***Communication*****:** *the ability to listen and speak effectively, present ideas appropriately, and write clearly and concisely.* • ***Reflective thinking*****:** *the ability to relate new knowledge to prior understanding; to think in abstract and conceptual terms; and, understand individual thinking strategies.*
Try: *involves ideation, creation, designing and prototyping of concepts and solutions.*	***Knowledge:*** • ***Thinking strategies:*** *knowledge on ways to understand information, question observations and assumptions, build insight and problem solve.* • ***Design critique:*** *knowledge on individual and team methods to review and discuss ideas quickly.*
	Aptitudes: • ***Systems thinking*****:** *the ability to understand how concepts regarded as systems work and how they influence one another within a larger system.* • ***Prototyping*****:** *the ability to iterate and build concepts, samples or models for testing, replication or to learn from.* • ***Design thinking*****:** *the ability to work at varying levels of abstraction; to recognize a broad range of hypotheses or potential solutions; and, to use form to communicate value.* • ***Teamwork:*** *the ability to effectively form and engage in team or group activities.*
	Skills: • ***Visual thinking*****:** *the ability to model and visualize concepts before all the information is available.* • ***Collaboration:*** *the ability to participate in group tasks; to help two or more people to work together and function well in project.* • ***Decision-making:*** *the ability to choose between two or more alternatives or courses of action; and engage in an intuitive and/or reasoned process.* • ***Communication:*** *see above.* • ***Reflective thinking*****:** *see above.*
Do: *involves deciding, implementing and evaluating the problem, solution and innovation.*	***Knowledge:*** • ***Decision-making:*** *process knowledge involving creating and agreeing on criteria used to measure and ensure that the most suitable outcome can be generated for a specific solution.* • ***Communication:*** *knowledge on conveying and co-constructing insights, assessments, experiences, or solutions through verbal, written and visual means.* • ***Reflective practice:*** *knowledge on how thinking, learning and action are intertwined****.***
	Aptitudes: • ***Data analysis:*** *the ability to assess the validity, reliability and trustworthiness of data; and, analyze and interpret the data.* • ***Strategic thinking*****:** *the ability to think logically and creatively; to develop clear goals and objectives; to design action plans; the ability to listen, observe and understand insights and convert them into strategic information and knowledge.* • ***Evaluation:*** *the ability to frame evaluation questions and criteria, and define evaluation methods (quantitative, qualitative or mixed).* • ***Mixed methods research***: *the ability to observe and synthesize performance measures from quantitative and qualitative research efforts.*

	Skills: • ***Project management:*** *the ability to understand and navigate a project initiation through to completion; to communicate and manage phases and outcomes with project team members and functional leaders within the organization.* • ***Business analysis:*** *the ability to evaluate multiple options for a solution; to listen to user or stakeholder needs; to create clear and concise documentation; to conduct analysis and deconstruct the problem or solution.* • ***Market research*****:** *the ability to plan, design and implement market development strategies; to apply knowledge of the principles and tools of research to solving problems related to consumer, user or market research.* • ***Communication:*** *see above.* • ***Collaboration:*** *see above.* • ***Reflective thinking*****:** *see above.*

Table 6.4 The SDM Competence Framework

From the SDM competence framework (Table 6.4), an evaluative table was developed that summarizes the competence dimensions observed and mapped to evidence of examples. The evidence was assessed using formative and summative assessment techniques. *Formative assessment* commonly refers to evaluating the progress of individuals along a learning process. *Summative* assessment commonly refers to evaluating what individuals have learned at the end of a unit of instruction (Harlen & James, 1995). *Formative* assessment techniques for this dissertation include observation, feedback and subject-generated artifacts. *Summative* assessment techniques include assignments and group-generated project artifacts. This dissertation is concerned with identifying key competencies and observing intentionality. The field research was limited in providing a comprehensive evaluation of full competence. However, indicators towards competence were observed. A detailed table associating specific examples to each competency dimension is located in Appendix D.

SDM Competence Dimensions	**Evidence (Study A)**		**Evidence (Study B)**		
KNOWLEDGE	FORMATIVE	SUMMATIVE	FORMATIVE	SUMMATIVE	EXAMPLES
Domain knowledge	X	X	X		*e.g. subjects created and submitted observations of their mini-ethnographic field trip experience; subjects engaged in Six Thinking Hats technique to experience different thinking modes; students were graded on their knowledge and understanding of lectures through reflection blogs; subjects reflected on their experience with the process and techniques and survey responses.*
Procedural knowledge					
Design methods	X				
Thinking strategies	X	X	X		
Design critique	X				
Teamwork	X		X		
Decision-making	X	X	X		
Communication	X	X	X		
Reflective practice	X	X	X	X	

APTITUDES	FORMATIVE	SUMMATIVE	FORMATIVE	SUMMATIVE	EXAMPLES
Empathy	X		X		e.*g subjects developed 'personas' and 'empathy maps' of intended target user or adopter; worked with the Value Proposition Canvas to identify user pain/needs; subjects generated 'scenarios as stories' and storyboards to conceptualize new services, products and policies.*
Needs finding	X		X		
Problem finding	X	X	X		
Qualitative research	X				
Systems thinking	X		X		
Prototyping	X		X		
Design thinking	X	X	X		
Data analysis					
Strategic thinking		X		X	
Evaluation			X	X	
Mixed methods					
SKILLS	FORMATIVE	SUMMATIVE	FORMATIVE	SUMMATIVE	EXAMPLES
Creative thinking	X	X	X		*e.g subjects discussed, sketched and developed problem statements and conceptual prototypes on whiteboards, paper and computers; students co-authored design brief assignments which were graded.*
Critical thinking	X	X	X		
Visual thinking	X		X		
Collaboration	X	X	X		
Decision-making	X	X	X		
Communication	X	X	X		
Reflective thinking	X	X	X		
Project management	X			X	
Business analysis	X			X	
Market research	X				

Table 6.5 Evaluative Summary: SDM Innovativeness Competencies

The evaluative table (Table 6.5) suggests that both students and occupational subjects engaged in innovativeness related activities. However it does not provide substantial evidence of innovativeness competency development for each competency dimension. The findings do suggest the SDM met its learning objectives to develop capacities to: articulate a role for design in the innovation process; use strategic design methods and techniques effectively in a real world context; practice creative, critical and reflective thinking; and, experience workings in teams in an uncertain environment. A longitudinal research study is required to generate empirical evidence.

In Case Study A, the students moved from a problem statement (i.e. design brief) to a solution (proposed innovation), as evidenced by their presentation materials and outputs, which include: business model canvases (Osterwalder and Pigneur, 2010); value proposition canvases (Osterwalder et al, 2014); user/customer experience maps; and marketing strategies. Their innovations are proposals to the ultimate adopters (in class client-sponsor organizations), thus the innovation process learning ends at the pre-implementation or diffusion stage.

However, the competency analysis does suggest the SDM, delivered as a 13-week instructional unit (COMM388) and as a series of design sessions (Creative BC workshops), does not completely develop innovativeness competencies within the allotted duration. It appears the academic term (13-14 weeks) may be too short to fully observe whether its participants developed knowledge, aptitudes and skills needed to participate in the complete innovation process.

The observed SDM activities associated with innovativeness competencies suggest that the SDM is an effective learning framework for individuals to be introduced to, and practice aspects primarily on the initiation and pre-implementation phase the innovation process.

6.5 Factors and Conditions

The findings also provided patterns of observed factors and conditions in both action research studies. A factor is a circumstance, fact, or influence that contributes to an outcome. A condition is the state of something with regard to its effect on people's behaviour. The factors and conditions include: a) change agent as facilitator; b) reflection in practice; c) empathy; d) contextual learning in a studio; e) uncertainty; f) managing the pro-innovation bias; and, g) design mediation.

a) **Change agent as instructor and facilitator**. Rogers proposed that the role of the change agent is positively related to the adoption of new ideas, but he or she may also attempt to slow the diffusion process and prevent the adoption of certain innovations (Rogers, 1993:312). He suggests an ideal change agent would represent a balance of competence and credibility. This combination is a change agent who is similar to his or her adopter-user in social characteristics (such as socioeconomic status, ethnicity, and the like) but different in regards to technical competence about the innovations being diffused. From the research findings, Rogers' ideal combination for a change agent was realized as the instructor and facilitator for the action research studies. In *Case Study A*, two instructors shared the teaching of the seven cohorts over four years, each represented both competence and credibility. In *Case Study B*, the facilitator reflected the change agent as 'insider', with the ideal profile of compatible

socioeconomic status and technical competence with the strategic design method. The SDM requires an instructor or facilitator who acts as Rogers' ideal change agent. As an active (transformative) learning method, SDM's instructor in the classroom functions more like a facilitator or provocateur, rather than as an authority on the problem-based subject matter. In an occupational context, the SDM's facilitator also engaged as a 'transformative' change agent (Mezirow, 1997:11), encouraging participants to create norms that accept order, justice, and civility in the learning space (occupational studio) and, provide equal opportunity for participation.

b) **Reflection as repeated practice.** Reflection and reflective thinking practice involves looking for commonalities, differences, and interrelations beyond their superficial elements. Dewey (1933), the originator of the concept of reflection, thought of reflection as a form of problem solving that chained several ideas together by linking each idea with its predecessor in order to resolve an issue. This type of thinking is implied in Rogers' work. He argues that developing the ability to "think hypothetically and counter-factually and to project into the future is an important mental capacity at the persuasion stage where forward planning regarding the innovation is involved" (Rogers, 1995:168). In *Case Study A* and *Case Study B,* subjects were exposed to a series of reflective thinking techniques that provided understanding, direction and then practice of this concept. The techniques used in *Case Study A* involved: *Assumption Dumption, Scenarios, Story Share, Five Whys and Six Universal Questions, and Bad Ideas* (Quayle, 2014). The techniques used in *Case Study B* included: *Scenario Creation, Story Share, Fishbone and Dotmocracy,* (Quayle, 2014). Rogers states "the innovation-decision process is predominantly a mental exercise and that the implementation stage involves overt behaviour change to see the new idea put into use and practice" (Rogers, 1995:172). The SDM framework sought to make the innovation-decision process more visible and concrete. Through its explicit visibility, it aims to facilitate understanding and empathy of individuals and teams as decision-making units. Reflective thinking (reflection) is an explicit task for each phase of the SDM, and is intended to promote thinking by linking recent

experiences to earlier ones in order to promote a more complex and interrelated mental schema. Reflection connects with both Tarde and Rogers' theories as a way of analyzing, reconsidering and questioning the experiences with SDM in the context of the class or occupational setting, and is critical for improving one's innovativeness.

c) **Empathy as a factor and condition**. Rogers' work suggests the importance of empathy in the diffusion of innovations. He defines empathy as "the ability of an individual to project him or herself into the role of another person" and argues empathy is an important quality of an innovator (Rogers, 1993:257). He also argues that earlier adopters have greater empathy, and that innovators and change agents must possess a high degree of empathy and rapport with their intended adopters, in order to assess their needs accurately (Rogers, 1993:225). He proposes empathy leads to credibility, trustworthiness and improved rapport between an innovator or change agent and their clients or users, particularly on an information-exchange relationship (Rogers: 1993: 317). Empathy is a competency practiced and observed throughout the SDM-based innovation process. Through the design research techniques introduced and practiced in both Case Study A and Case Study B, the subjects engaged in explicit activities focused on exploring potential adopter needs and problems, in prototyping concepts, enacting and implementing innovative concepts, and in critical thinking about the constraints, complexities, and trade-offs of innovative solution. The SDM enabled empathetic skill development in two ways, as described by Kimbell (2014, 215:77) "one is when someone imagines putting themselves in the position of another and ascribes the feelings and actions if in the other's place; and the other is one's ability to work out what is going on in the other's mind, seeking to share an emotional response to a situation such as fear or excitement from imagining being in that situation." The curriculum and environment are two factors influencing empathic opportunities to question one's assumption about a situation from various perspectives, leading to openness to experience and new ideas or innovations.

d) **Contextual learning in a studio environment**. Rogers defines system norms as "established behaviour patterns for the members of a social system. They define a range of tolerable behaviour and serve as a guide or a standard for the members. They tell an individual what behaviour is expected" (Rogers, 1995:26). The system norm imposed on both case populations was the intervention itself (SDM) and associated studio setting. The studio setting directly influenced individual and team behaviour in social interactions and learning integration inside a defined spatial boundary (Cross, 1982 and Chen et al, 1998). Study A's experiments were led inside a studio classroom, while Study B's experiments were led in various studio workspaces. The materials provided to all participants included white board walls and physical tool kits containing large presentation paper, markers, pencils, post-it notes, and other crafting materials typically found in an elementary school class. The studio space explicitly established specific system norms on how to behave in a defined physical location that can be described as one large open space, which makes all interactions visible. This imposed setting made participants aware of who was doing what through vocal, visual and body communication. The studio setting also made 'opinion leadership' explicitly visible, meaning the degree to which an individual influences another individual's attitudes or behaviour in a desired way with relative frequency. The studio, as an imposed system norm, appeared to be positive for innovation adoption as it manufactured a highly interconnected communications network within its physical boundaries. The SDM did combine both 'pedagogy and place' (Quayle, 2014), where the studio environment provided a naturalized social system, encouraging interconnectedness between and across interpersonal networks.

The findings support the need for more research on design methods and studio-based learning inside business schools, particularly studies that experiment with a broader and interdisciplinary educational task – such as entrepreneurship, business development, management, leadership, organization design, strategy and policy, and innovation. "The central aspect that sets studio work apart from other educational practices in management (e.g., problem-based or experiential learning; Kolb & Kolb,

2005), is the strong emphasis on participant-led inquiry through hands-on, creative engagement aimed at producing atypical results—imaginative problem reframing, innovative solutions, synthesis-oriented skill sets, integrative learning" (Barry and Meisiek, 2015:158). The SDM situated in a Barry and Meisiek's (2015) "business studio," is a place that integrates business concepts (e.g. management, leadership, organization and venturing) with processes that emphasize empathy, imagination, tangibility, playfulness, and, challenge basic assumptions (Barry and Meisiek, 2015:160).

e) **Ambiguity as a factor for uncertainty**. Ambiguity is anything that can have plural meaning or is not clear which meaning is meant. Over two-thirds of the student cohort and occupational subjects explicitly expressed concern with ambiguity during each class (or session), throughout the duration of both research studies. Ambiguity, as described by both students and subjects, corresponded to situations lacking enough information for them to form a belief or something to act upon (e.g. a visual thinking technique is proposed without clear guidance). Ambiguity was observed during both problem finding and problem solving phases, and could be referred to as messiness (e.g. a state of confusion and disorderliness). Those subjects who expressed their concern with ambiguity, preferred tasks with clear guidelines and outcomes, and less risk, suggesting a personal fear of failure. Uncertainty was observed as the reaction to the ambiguity. A central characteristic of the innovation process is uncertainty. When the subjects were confronted with a new situation (e.g. new knowledge or technique) or introduced to something perceived as new, they exhibited concern with making errors and the disorderliness with the techniques -- suggesting uncertainty was visibly present. Over time and after several trials and exposure to new knowledge, a learning capacity was reached, and uncertainty appeared reduced. Uncertainty is felt as an emotional reaction, affecting our ability to think, solve problems and act. However, one must recognize ambiguities and uncertainties in order to be able to deal with them. As the researcher-teacher-facilitator, I assumed the subjects expressing concern may have feared failure and preferred tasks with clear guidelines, explicit outcomes

and less risk. Uncertainty was observed in both cases and correlated to participants describing their experience with SDM's first few phases as ambiguous, unclear, frustrating, messy, and stressful. For *Case Study A* and *Case Study B*, both the intervention (SDM) and the experimental studio space may have contributed to higher levels of uncertainty than past diffusion studies have suggested, or perhaps encouraged the participants to express this emotion in their artifacts and to their peers, for the participant observer to note it as a pattern. This correlation requires further study to confirm if it is a generalization or a significant finding. By definition, innovation implies perceiving something as new, or creating the new when the new contains elements that we do not comprehend at the beginning and about which we are uncertain. The cross-case findings suggest the rate of adoption may be correlated to graduated levels of active learning, and prolonged experience with uncertainty during the process. Experiential (active) learning in small groups coupled with uncertainty may be important factors and conditions for an innovation's adoption and diffusion. Exposure to uncertainty within tolerant social systems (such as studio classrooms) may develop a level of comfortable with ambiguity, chaos and novelty -- characteristics of the early phases of the innovation process.

f) **Managing the pro-innovation bias as a factor.** *Diffusion of Innovations* theory scholars describe the pro-innovation bias as the *belief* that an innovation should be adopted, by members of a social system or greater society, without the need for alteration. I propose a 'managed' pro-innovation bias is required, that questions and considers the social and cultural impact of the innovation on the anticipated adopters or adopting social system. The directed events (classes and workshops) created an environment and supported activities focused on understanding potential adopters, and critically thinking if the innovation favourably or unfavourably solves the problem originally identified. The competence framework directed all subjects to find needs and /or problems before solving them. Although the duration and format of SDM limited my ability to observe diffusion and adoption of the various innovations proposed in both studies, positive indicators toward intention were observed. Positive

indicators included: in *Case Study A*, the cohorts provided new business models for a non-profit organization, new service designs for a visual technology firm and new employee engagement strategies for a private consulting firm; in *Case Study B*, subjects co-developed a five year strategic framework and new two-year service innovation plan to be implemented within the next three months. Managing the pro-innovation bias towards adopting the instructional method as a new practice was also evidenced for both studies. In *Case Study A*, students were motivated to adopt new practices as evidenced by earning top grades and providing real clients implementable ideas, however critical analysis of the method was equally discussed and graded. In *Case Study B*, the organization and its social system members were motivated to adopt new practices to gain market positioning and grow their sector, however their critique of the method and its outcome was also acknowledged and included in the final report.

g) **Design mediation as a factor.** The instructional method explicitly applied design techniques (research and artifact generation) and strategies (process and outcome) to the innovation development process. Design as both the noun (an object or system) and the verb (to create an object or system) was integral to the method, and experienced by all subjects. Design methods involve inquiry, keeping options open, exploring alternatives and embracing ambiguity (Cross, 1982). Subjects from both studies engaged in repeated creative thinking and creativity practice more commonly taught in the design disciplines (e.g. architecture, industrial design and graphic design). Creativity, rooted in the experience of making things, is a fundamental element of the instructional method. To foster creativity, the instructional method directed the subjects to make things through practice, experiments and strategic prototyping. Subjects learned to make very different kinds of things (e.g. new services, new processes, new products) increasing their insight into creative processes (Gross, 2009). The instructional method, as a *design-centred* creative approach to innovation development, reflects what Celaschi et al (2009) call ‘design mediation’ or ‘infrastructural design’. I suggest SDM offers a purposeful ‘design mediation’

curriculum, where subjects from both studies participated in experiential and active learning activities involving investigation, idea generation (problem and solution) and reflection. The SDM involved a set of events and actions to introduce and practice design techniques applied to the innovation process. The findings positively support a design-mediated method to navigate the innovation journey and to develop innovativeness competencies in individuals and organizations. They also confirm Herbert Simon's goal for design in terms of "devising courses of action aimed at changing existing situations into preferred ones" (Simon 1982:129).

6.6 Summary

The action research design sought to: (1) provide evidence or tangible results of the instructional method simulating the innovation development process; (2) identify comparable innovativeness competencies between Rogers' IDP theory and the SDM; and, (3) provide evidence or tangible results of the instructional method's effectiveness with developing individual innovativeness. In addition, (4) important factors and conditions for a design-mediated instructional method were also identified from the findings.

6.6.1 Evidence of the SDM Simulating the Innovation Process

The findings suggest the three-phase SDM reflects Rogers' six-phase innovation development process theory. When re-plotting the SDM across Rogers' IDP phases, they are proposed as: (1) *Problem exploration* (2) *Design research*; (3) *Prototyping*: (4) *Design synthesis*; (5) *Diffusion and adoption*; and, (6) *Evaluation*. When visually mapping the SDM's three phases of *Ask, Try* and *Do*, specific events, activities and certain tasks were observed as inherently co-dependent. The process analysis strongly suggests that fewer phases with interdependent activities can be proposed. An integrated model is suggested that reframed the SDM as a more explicit method to understand the innovation process and develop innovativeness competencies. The four-phase SDM model comprises: (Phase 1) *Intention*: involving needs and problems exploration; (Phase 2) *Investigation*: design research and prototyping; (Phase 3) *Integration*: production, package design and diffusion; and, (Phase 4) *Implementation*: evaluation and analysis. See Figure 6.4.

6.6.2 Comparable Innovativeness Competencies Between Rogers' IDP and SDM

The identified, classified and observed competencies associated with the SDM contrasted with Rogers' IDP in the *knowledge* and *aptitude* dimensions. However, they were comparable in the *skills* dimension. The skills developed from the SDM include creative and critical thinking, communication, collaboration, decision-making, and reflective thinking. These are deemed the '21st century skills' (Voogt & Roblin, 2012), necessary for today's knowledge economy workplaces. The research suggests the SDM offers a curriculum (pedagogy) and place (business studio) to develop individual competencies focused on the more ambiguous and less studied *initiation* stage of the innovation process. The examination of the instructional method provides a typology of innovativeness competencies dimensions, comprised of innovation-related knowledge, aptitudes and skills. They are summarized in Table 6.6:

KNOWLEDGE	APTITUDES	SKILLS	KEY INNOVATIVENESS COMPETENCIES
• Domain knowledge • Procedural knowledge • Inquiry methods • Thinking strategies • Design methods • Teamwork • Critique • Market research • Innovation Management • Reflective practice	• Empathy • Needs/problem finding • Qualitative research • Quantitative research • Systems thinking • Prototyping • Design thinking • Operations management • Marketing • Decision-making • Data Analysis • Evaluation • Mixed methods research	• Creative thinking • Critical thinking • Communication • Problem identification • Visual thinking • Collaboration • Decision-making • Prototyping • Project management • Strategic thinking • Reflective thinking • Business analysis	1) **Knowledge:** *Innovation process; Inquiry and design methods; Thinking strategies; and, Reflective practice.* 2) **Aptitudes:** *Empathy, Needs/problem finding; Systems and design thinking; and, Mixed methods research.* 3) **Skills:** *Communication: Innovative thinking; Strategic thinking; and, Reflective thinking*.

Table 6.6 Summary of Innovativeness Dimensions

Innovativeness or innovative capacity in this dissertation is proposed as: (a) the willingness to experiment with new approaches of inquiry, (b) the commitment to master new knowledge, and (c) the ability to exhibit innovative behaviour over time. Specifically, innovativeness as:

(a) *the willingness to experiment with new approaches of inquiry,* involves learning problem finding and problem solving techniques, and developing a system of thinking strategies and skills applicable to the innovation process;

(b) *the commitment to master new knowledge,* involves concentration and deliberate practice of information gathering, analysis, and translation; and,

(c) *the ability to exhibit innovative behaviour over time,* involves active observation, self and group reflection, and the patient pursuit of insights.

The competencies observed in the SDM that may enable proficiency with innovativeness along the early phases of the innovation process include:

a) the willingness to experiment with new approaches of inquiry, involves *knowledge:* of the innovation process domain; inquiry and design methods, thinking strategies, and reflective practice;
b) the commitment to master new knowledge involves *aptitudes*: for empathy, needs/problem finding, systems and design thinking and mixed methods research; and,
c) the ability to exhibit innovative behaviour over time involves *skills:* associated with creative and critical thinking, collaboration, communication, and reflective thinking.

A simplified framework is proposed that identifies the key innovativeness competencies (Table 6.6). The *knowledge* should include: innovation process, thinking strategies and design methods. The *aptitudes* should include: empathy, needs/problem finding, design thinking and mixed methods research. The *skills* should include: communication, innovative, strategic and reflective thinking. Innovative thinking integrates creative and critical thinking and behaviour (action). Strategic thinking integrates communication and decision-making skills. Reflective thinking integrates analysis and evaluation.

A summary of innovativeness competencies mapped across a new four-phase innovation learning model is provided in Figure 6.8 below.

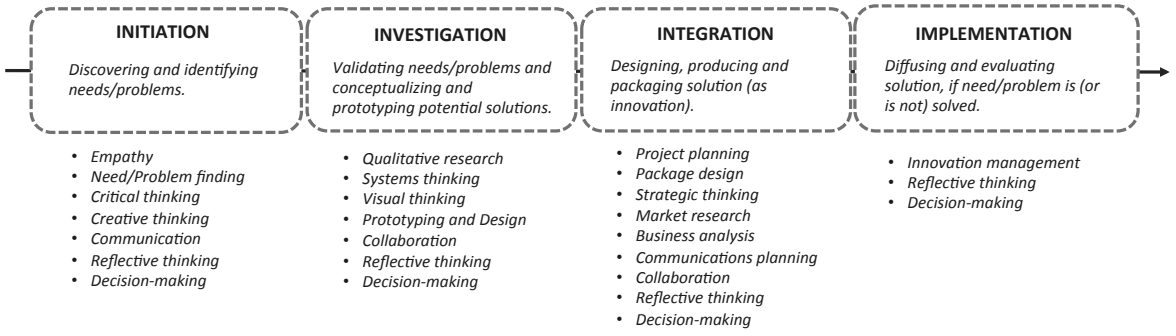


Figure 6.8 Innovativeness competencies across Four-Phase Innovation Learning Process

6.6.3 Evidence of the SDM as Individual Innovativeness Learning Model

The competencies observed as enabling the *knowledge* dimension were evidenced in the lectures and discussion of alternative design methods, thinking strategies and reflective practice. For Study A, the lectures and activities involved weekly readings on thinking methods and techniques throughout the 13-week COMM388 course. For Study B, each workshop introduced a thinking strategy topic and technique, followed by practice over the 14-week project with Creative BC.

The competencies observed as enabling the *aptitudes* dimension were evidenced by the repeated use of empathy, need/problem finding, and design thinking techniques, and decision-making. The SDM purposefully presented concepts without templates and ill-defined problems for subjects to navigate. The method attempted to create or simulate a realistic field condition through the interaction with real-world problems. For Study A, this involved various industry clients. For Study B, it involved Creative BC and its industry networks. Ambiguity, uncertainty and change are what most individuals and organizations are challenged to acknowledge and respond to. The SDM appears designed to simulate an experiential change process, reflected in all past innovation process studies. The findings provide empirical evidence of ambiguity and unfamiliar situations, resulting in uncertainty throughout the entire process.

The competencies enabling *the skills* dimension were evidenced by observing how individuals and teams (Study A) and work groups (Study B) behaved. Individuals and teams were supplied with the SDM tools and techniques to support their project work. The inherent complexity of the client-problems and needs required both an individual and team approach to examine the given problem from different perspectives. The peer-based design critiques surfaced the tensions amongst team members and across working groups. The design of the 3-hour studio and 3-hour workshops proved to be positive for instructor-student/subject interaction, but a portion of the students sought more individual feedback. The SDM introduced and explicitly engaged participants in social and group learning activities, which were observable behaviours also

referred to collaborative and integrative thinking (Martin, 2009), and innovative thinking (Matthews et al, 2015).

Although not explicitly studied in this dissertation, the SDM inside a business studio environment explicitly encouraged teamwork processes. In a team project, students interact with one another on various aspects of the assignment, collaboratively coming to a consensus and working together towards a common goal. The social process of a studio learning space requires a social environment, which encourages knowledge sharing among individuals and groups. However, the SDM did not adequately provide enough direction, guidance and supporting knowledge on team dynamics and teaming process. This needs to be highlighted in the critique of how the SDM can be improved. As innovation is a multidisciplinary and collaborative process, the SDM's live case approach resulted in new combinations of designed solutions that integrated a variety of social, cultural, educational, technological, and organizational responses to perceived organizational problems. These became imaginable, making for greater opportunity to experiment with different scenarios.

Generally, the findings suggest that the SDM, delivered in a business studio environment, encouraged all subjects to become aware of new and diverse practices, values, beliefs and worldviews. They also indicate that the SDM introduced students and occupational workers to innovativeness knowledge and aptitudes, and engaged them in developing innovative thinking skills. However, the findings did not provide sufficient evidence that key competencies with innovativeness were fully developed. A competence with innovation knowledge, aptitudes and skills require further practice, and a longitudinal study. Although SDM reflected the social modeling required for adoption of new knowledge, the length of action research studies did not provide enough time for sustained behavior modeling to be fully observed.

The findings were limited to observing individual innovativeness for the early or initiation phase of the innovation process, as the implementation phase would require an extensive longitudinal study to provide evidence of innovation adoption or rejection. Although the SDM enabled most participants to experience the innovation process from problem finding to solving in 13-14

weeks, their proposed solutions (innovations) were conceptual, therefore not completing the implementation stage of the innovation process towards commercialization and diffusion.

The findings do recommend the need to evolve the SDM to better deliver an innovation process curriculum inside the business studio environment. Currently, the SDM can be described as offering a design education course to business students, and facilitating a design-training workshop to occupational workers. It offers knowledge in the areas of thinking strategies and design methods, has demonstrated it develops aptitudes for needs/problem finding and prototyping; and skills associated with creative and critical thinking, visual thinking, collaboration (team/group-based), decision-making and reflective thinking.

6.6.4 Observed Factors and Conditions with the SDM

The action research findings also suggested factors and conditions to develop innovativeness that included: a) change agent as facilitator; b) reflection as repeated practice; c) empathy as condition, factor and competence; d) contextual learning in a studio environment; e) uncertainty as condition and factor; f) managing the pro-innovation bias; and, g) design as mediation.

In summary, the most significant findings from the document analysis and action research studies are how UBC's strategic design method (SDM) compares and contrasts with Rogers' innovation-development process theory. It compares with the innovation-development process in its general construct of sub-stages and activities focused on problem finding, problem verification and problem solving (e.g. in the form of an innovation). However, the SDM contrasts the same process in important ways, specifically:

a) it has three distinct phases to the innovation process (i.e. suggesting alignment with Van de Ven, 1999) which encompass problem finding, problem verification and problem solving (e.g. in the form of an innovation);
b) is concerned with both individual learning and social learning;
c) is focused on a design-mediated approach that presents a purposefully ambiguous environment to simulate the condition of uncertainty;
d) injects reflective thinking in every phase;

e) is concerned with rates of adoption of new knowledge through repeated practice (learning by doing) and less with the new idea, solution or innovation developed; and,
f) seeks to develop competencies with innovativeness for broader innovation applications (e.g. strategies, processes, policies and practices) and thus, beyond new product or service adoption; and,
g) is a very ambitious curriculum seeking to expose and engage participants in a suite of innovativeness activities, however is challenged by the constraints of a 13 to 14 week duration to effectively develop innovativeness competencies across knowledge domains.

Overall, the SDM as a design studio-based method compares well with the critical stages of the innovation process, however contrasts in its main phases associated with problem finding and verification, prior to problem solving. ‘‘Design operates within the contingent world of funding priorities, time pressures, conflicting biases, personal and institutional politics, and the like, and designers must know how to respond and take such influences into account’’ (Ankiewicz and De Swardt 2006:137). From the research findings, it was observed that SDM could bridge or broker the students’ movement between disciplines and between business courses, and potentially into professional practice. More research is required to gather further evidence of these observations.

Generally the findings in this chapter suggest the instructional method (SDM) does enable individuals and organizations to develop innovativeness skills, through ‘messy’ cycles of thinking, learning and doing. The findings positively suggest the SDM, as an instructional method, does embed both social and experiential learning theories (Argyris and Schön, 1978; Kolb, 1974) attributed to Rogers’ innovation development process theory. The research demonstrates that learning happens through the interaction of thinking, experience and action. However, the duration of the method under study appears to limit the students and subjects ability to effectively develop the key innovativeness competencies, as the breadth and depth of a multitude of knowledge domains is too vast to effectively learn and practice within a 13 or 14 week timeframe. The current format of SDM appears to expose the students (and subjects) to the variability of new knowledge typically presented throughout the innovation process. This introduction and repeated practice with a technique may provide the needed ‘familiarity’ for later

adoption of the method and resulting knowledge of its application or rejection. Further research is required to verify if the innovativeness capabilities observed in the studies are sustained after the completion of the course and the workshops. I recommend a longitudinal study with specific innovativeness scales be implemented to measure the SDM's actual impact on individual and organizational innovativeness.

The SDM could benefit from elements that Morris (2009) suggests are necessary for "robust innovation practice". He argues for a focus on learning, particularly when learning is applied to increasing the productivity of knowledge tasks. He suggests key infrastructure elements include proper methodology (SDM), effective collaboration (personal, interpersonal and team), attention to enablers and obstacles (pedagogy), and properly designed environments (place).
To explicitly engage students (and occupational participants) in developing key innovativeness competencies, the SDM could improve across all three dimensions. Suggestions include:

a) Providing more *knowledge* of the innovation development process literature, methods of inquiry, design methods, and thinking strategies;
b) Providing explicit lessons to develop *aptitudes* for empathy, needs and problem finding, systems thinking, data analysis and evaluation; and,
c) Maintaining the practice of techniques to develop *skills* with creative and critical thinking, strategic thinking, collaboration, communication, and reflective thinking.

An evolution of the SDM is proposed in Chapter 7.

6.7 Limitations of the Dissertation Research

Although the research findings provided significant insights into learning individual innovativeness, the dissertation has several limitations that include:

- A limitation of the literature reviewed. The works focused only on seminal and mature theories of the innovation process, social and experiential learning;
- The sample population size for the two action research studies may be too small to provide statistical replication;
- The representative population of the two studies may be considered too heterogeneous to be generalized;

- The context in which the studies were conducted must be considered. All participants were subjected to a studio environment, characterized by an open physical space where artifact generation and reflection activities were transparent and highly visible. Therefore, generalizing these results outside of a highly dynamic studio environment may be inappropriate;
- Incentivized performance bias was present in both studies. In Study A, students were encouraged to adopt the instructional method and demonstrate competencies through assignment grading. Participants in Study B were encouraged to adopt the instructional method as the facilitated process to co-develop the organization's strategic plan (innovation), which was deemed critical for the success of their industry ecosystem.
- And importantly, as the subjective interpreter of the data contained in documents and harvested from the action research studies, I tried to make the analysis process as rigorous and transparent as possible. However, I acknowledge projecting a pro-innovation bias towards the instructional method, considering my dual role as both researcher and instructor/facilitator, influencing the subjects to reflect and communicate their pro-innovation process learning.

Chapter 7: Conclusion

The aim of this dissertation was to investigate foundational innovation process and learning theories and observe a simulated innovation learning method, in order to: identify and validate common phases and stages; identify the innovative capacity (i.e. innovativeness) associated with each stage; translate the findings in a way to improve one's understanding and practice with innovative thinking and action; and, propose a pedagogical model and key competencies framework to help individuals and their organizations understand and learn how to innovate.

This chapter has the following sections: (7.1) contribution to innovation development and innovation education; (7.2) evolution of SDM as innovation education model; (7.3) implication of the model for classrooms and organizations; (7.4) reflection on innovator research; and, (7.5) concluding remarks.

7.1 Contribution to Innovation Development and Innovation Education

The aims of my research were met as evidenced by the following: an interdisciplinary typology of the innovation process literature (Chapter 2); a visual exploration of the innovation process to assist with understanding complex process models (Chapters 2 and 6); an ontology of the competencies associated with individual innovativeness (Chapter 6); and, a design-mediated innovation process pedagogy for further research (Chapter 6 and 7).

My dissertation contributes to innovation development and innovation education literature in four ways. Firstly, I interpreted the innovation-development process as learning process from an interdisciplinary discourse comprised of sociology-based innovation development process theory, organizational-based social and experiential learning theories, and applied science-based theory of design. Secondly, I translated the documentary and action research findings into a diagrammatic format (i.e. visual notation) to facilitate understanding of the complex, multi-phased innovation process. Thirdly, I developed a new ontology of competencies characterizing innovative capacity or innovativeness behaviour. Fourthly, I provided a systematic review of the Strategic Design Method and recommend improvements to the curriculum to further develop

innovativeness competencies. From this review, a design-mediated innovation pedagogy is proposed for further study.

7.2 Evolving The SDM As An Innovation Education Framework

From the research findings, I propose the SDM can be further improved to provide a more rigorous pedagogy for design methods based business innovation teaching and learning. A growing number of management school scholars (Martin, 2006; Barry and Meisiek, 2015; Kimbell, 2015) have argued business schools should integrate more design education and provide the students the skills of observation and inquiry (Dunne and Martin, 2006). From the multi-year action research studies in the classroom, the SDM may be an example for Canadian business schools to engage in what educationist Sir Michael Barber describes as *deep learning*. He argues "deep learning is more natural to the human condition because it more clearly connects with our core motivations: to directly and deeply engage in learning; and to do things that truly make a difference to our lives and to the world. In the best examples, teachers and students are teaming up to make learning irresistibly engaging, and steeped in real-life problem-solving" (Fullan and Langworthy, 2014:i).

The proposed innovation process pedagogy model (Figure 7.1) provides both meaning (understandable object) and the means for innovativeness competence development (actionable process). This diagram reflects Rogers' innovation-development process theory and reconstructs the SDM into a four-stage innovation education framework.

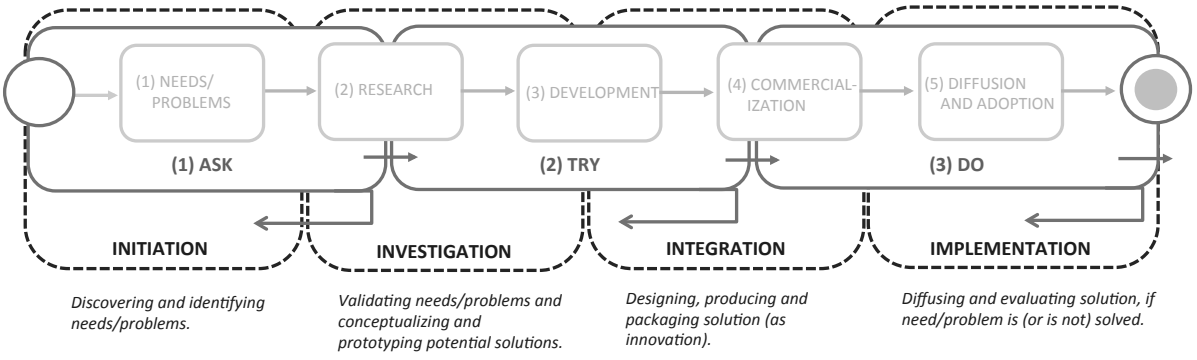


Figure 7.1 Four-Stage Innovation Education Framework

The research findings also provided observations and insights that I translated into an ontology of innovation process competencies. Mapped across the four-stage framework, they correlate to each stage's activities and anticipated outcomes (Figure 7.2). The proposed innovativeness competencies list is not complete, nor is it meant to suggest that each participant should develop expertise with each sub-competency. This list is intended to educate innovation process participants, leaders or managers of the diverse abilities and skills necessary to think, act and work in innovative ways.

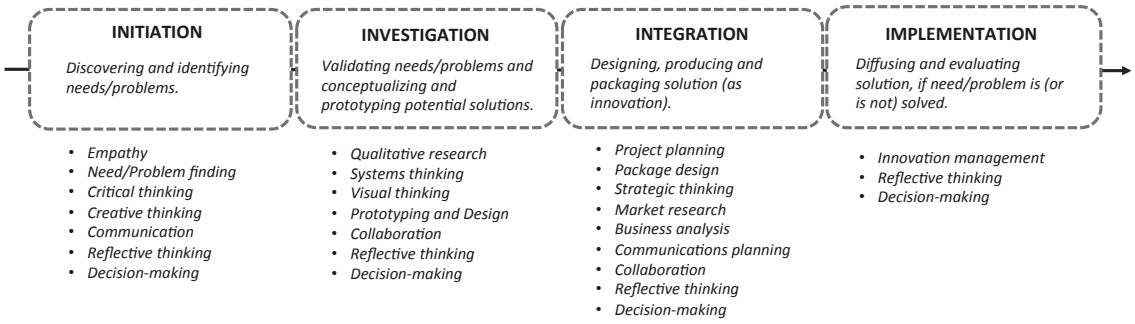


Figure 7.2 Competencies Across Innovation Education Framework

Upon further analysis, a list of critical or key innovativeness competencies is proposed for effective innovation process participation, across three dimensions: knowledge, aptitudes and skills (Figure 7.3). This conceptual competencies framework requires further testing in future action research studies focused on evolving the *Innovation Pedagogy* discourse.

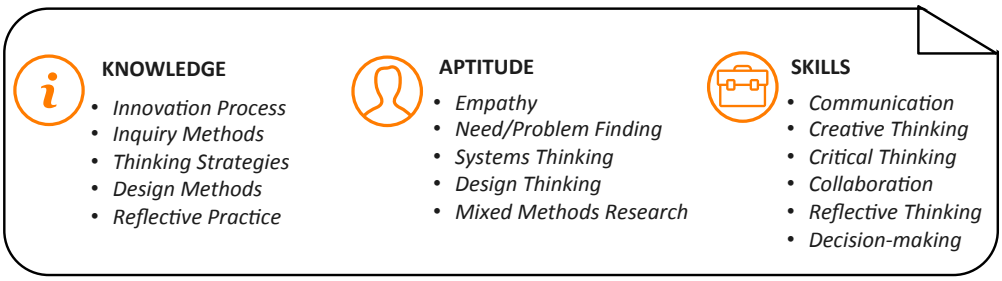


Figure 7.3 Key Innovativeness Competencies

The proposed four-stage pedagogical model visually represents the innovation process with the aim to increase understanding of its phases and competencies dimensions. This model does not claim to capture all the complexities associated with the innovation process. However, it does seek to provide a simplified framework and innovativeness competencies ontology for the less studied 'fuzzy' front end of the innovation process. Further research that observes and measures the stages along with innovativeness competencies is recommended. At the very least, it provides a better understanding of the inner workings and intra-dependencies of the innovation process. Through understanding, individuals and organizations will be confident in making better decisions when faced with new ideas and practices. It is with *innovative confidence* that individuals will build their voice and positively impact their organizations, their regions and ultimately, their nations.

> *"We need methods better suited for a constantly changing world that focus on activating student in learning and practice. The economy and the success of future organizations and enterprises are growing dependent on innovations, those created by innovative employees capable of not only inventing something new by themselves, but more importantly participating in the process where new solutions are created by working together (Penttilä et al, 2013)".*

With the proposed changes to the SDM pedagogy and framework, delivered inside UBC's business studio (d.studio), and potentially offered across other Canadian universities, future innovators could be developed to meet Canada's innovation agenda.

7.3 Implications for the Classroom and Organizations

The overarching hypothesis for my dissertation was that innovation-related skills could be learned from directly engaging in the innovation process. My motivation was to experiment with the strategic design method (SDM) as an instructional method simulating the innovation process. The SDM did provide an active and reflective learning method that facilitated the identification of competencies with innovativeness. However, it did not explicitly provide critical knowledge of the innovation process. With improvements in the domain knowledge and assessment measures, the strategic design method (SDM) could prove to be an effective method to teach innovativeness.

My research contributes to the emerging domain of *innovation pedagogy* described as "a learning approach focused on the development of innovation competences, defining how knowledge is assimilated, produced and used in a manner that can create innovations" (Putkonen, Kairisto-Mertanen, Penttilä, 2010; Kairisto-Mertanen, 2011). One *innovation pedagogy* framework that is part of the Innovation and Entrepreneurship Education (IEE) program was developed in Iceland for the Nordic countries. IEE emphasizes interactive dialogues between educational institutions, students, organizations and civil society, and offers an innovation pedagogy framework that includes:

- *Final learning outcomes*: the creation of innovations, production capabilities and participation in diverse innovation processes with civil society.
- *Learning of innovation competences*: combining a formal study program to develop specific knowledge, skills and attitudes with a real-world innovation challenge project.
- *Meta-innovations*: engaging teachers to use innovative learning methods with their students to enhancing both the creation of innovations and innovation competence (Penttilä, Kairisto-Mertanen & Putkonen, 2011).

Heinis, Goller and Mebolt (2016) recently proposed an innovation competency model, based on design education. It is comprised of what they describe as three 'trainable' competency dimensions. They include: (1) methodological competencies for team settings (being able to use decision techniques for shared decisions in a team); (2) social competencies for innovative teams: (cooperation with other team-members and being able to build and to maintain team-cohesion); and, (3) personal competencies for shared learning (awareness of team dynamics in order to be able to deal with team processes and steer them) (2016:762).

The SDM, delivered as the undergraduate course entitled COMM388, was designed as both the method and the platform to observe individual innovativeness and innovation competence development. Quayle (2014) refers to it as "a place and a pedagogy". Its pedagogical activities involved both broadly exploring and identifying a design problem and specifically exploring client-centred solutions through dialogue, presentations and critiques with student-peers, instructors and clients. While the instructor guides most of the pedagogy, students are expected

to lead mini-lectures on topics and learnings from the domains explored. Implicitly, the SDM as the pedagogy for the d.studio also offers some epistemological understandings (beliefs and values) about design knowledge that guide and determine the ways that students and faculty interact in the studio, observed by Shaffer (2007).

My proposition for key *innovativeness competencies* complements the IEE innovation pedagogical construct by focusing on models and methods that facilitate a degree of *innovatorship* -- the development of *innovative thinking and action* skills for students, practitioners and organizations.

For the classroom, the evolved SDM will be adapted for the COMM388 course, and will include key innovativeness competencies in its redesign and delivery to commerce undergraduate students. Positioned within the Entrepreneurship and Innovation stream at UBC's Sauder School of Business, I will continue to teach and lead active research studies on the innovation process and the development of key innovativeness competencies. The proposed models will be adapted and observed for the fall 2017 COMM388 syllabus.

For organizations, such as Creative BC (a non-profit organization examined for Study B), the research on innovativeness competencies will continue through a post-doctoral fellowship. The fellowship with Creative BC will support on-going field research that observes the impact of the proposed innovation learning model inside organizations, and in their wider social systems. A curriculum in the form of an innovation-learning toolkit will be piloted for managers and teams.

For society, this design-mediated innovation pedagogy model directly responds to the emergent need for innovation-related competencies. These competencies reflect societal needs to graduate students with skills to navigate uncertainty, engage in innovative and reflective thinking, and solve relevant problems. They are also necessary for organizations currently facing an uncertain economy, competition and new technologies.

7.4 Reflective Analysis on Innovator Research

Upon reflecting on my years as an innovation process practitioner, and the findings from my scholarly research, I return to the central actor of the innovation process -- the effective participant often described as an *innovator*. As individual innovators, they are learners. Inside organizations, individual innovators learn through a social system and as a collective. Through the innovation process, both individuals and organizations develop varying levels of innovativeness. Innovativeness involves learning and design. As participants learn something new, they also devise actions and ways to design solutions and engineer better situations in response to the new knowledge.

The contemporary innovator has evolved from the industrial and formal R&D systems. The industrial R&D innovators, from the 1950s to 1980s, were described as production engineers and 'shop floor' technicians and were the source for incremental innovations (Freeman, 1995). The formal R&D innovators would develop radical innovations resulting from market interaction (Lundvall, 1988), inter-firm relationships (NSF, 1973; Gibbons and Johnston, 1974), end users (von Hippel, 1988), and technological changes (Carter and Williams, 1957; Jewkes et al., 1958; Mansfield, 1968, 1971; Nelson, 1962; Schumpeter, 1934;). Common innovator characteristics include: actively seeking knowledge; networking across diverse social systems; the ability to cope with high levels of uncertainty; and, be quick to adopt new ideas or change. Personality traits associated with innovators are openness, inventiveness and curiosity. From the literature reviewed, I redefine the innovator to be: a person or company who adopts new ideas, thinks creatively and critically, and copes with uncertainty; a person or company that brings in new ideas and methods; and, a person who adopts a new practice or buys a product first.

Upon thoughtful consideration of the knowledge, aptitudes, skills and traits associated with innovators, I propose a redefinition. The innovator is one who discovers, interprets and recombines knowledge along the innovation process. The innovator is characterized by innovativeness and risk-taking, and plays an essential role in an organization and nation's ability to succeed in an ever changing and increasingly competitive global marketplace.

Upon further reflective analysis of the innovator, I conceived the term *innovatorship* as a way to observe and in the future, measure innovativeness. I propose a shift from *entrepreneurship* relating to entrepreneurs in the innovation process, to i*nnovatorship*, as a more inclusive concept for innovators. For individuals (and organizations), understanding what *innovatorship* entails and how one can improve capabilities with initiating, developing and implementing new practices, programs, services or products for society, can be empowering and impactful. The term *innovatorship* is not new, however my interpretation and proposed construct for developing this individual capacity is. Innovatorship has been discussed as an organizational attribute that drives the firm to be among the first to adopt a new product/service and is positively correlated to becoming a lead user (Angur and Madhukar, 1998). *Innovatorship* has been associated with entrepreneurship in rural areas (Kopp, 2008), describing traits of business leaders needed to experiment and offer new products for smaller demand cycles. Tito introduces (1950:3) *innovatorship* as a democratizing and socialistic concept. He provides evidence of factory workers encouraged to improve the means of production by providing them with training; and a study on Yugoslavian farmers offered to reclaim their land for personal economic sustainability, referred to as "Land to Peasants" concept. Tito (1950:4) argued in both cases, *innovatorship*'s intent was to leverage the immense creative forces from working people. Edmund Phelps, 2006 Nobel Laureate, distinguishes *innovatorship* from entrepreneurship, arguing innovators possess imaginativeness, or creativity, to conceive of things not conceived already "to depart from present knowledge to new knowledge requires imaginativeness, which is fundamental to successful change" (Phelps, 2013).

Individual *innovatorship* is not bound to any discipline or domain and is focused on the innovation process (new idea, practice, product, policy or service). *Innovatorship* denotes the quality or condition of being an innovator, and having the skills and confidence to act, such as early adoption of a new idea or change (innovativeness). Innovatorship reflects the competencies associated with *innovativeness*. I introduce the concept that *innovativeness* as an essential quality of a globally competitive organization, and nation. *Innovativeness* levels depend on individual characteristics (demographics and psychographics) and by the nature of their social system (sector and cosmopolitanism) (Rogers, 1993:106). In terms of an organization as the social

system, *innovativeness* can be attributed to similar characteristics and traits described for individuals. For example, the firm may be among the first to adopt a new product or service, reflecting the organization's collective nature to be open, inventive and curious.

Very few studies have observed organizational *innovatorship*, suggesting a form of entrepreneurship in rural areas (Kopp, 2008) and democratized leadership industrial settings (Tito, 1950). Edmund Phelps, the 2006 Nobel Laureate in Economic Science, suggests *innovatorship* draws on imaginativeness or creativity, to conceive of new ideas that a firm could try to develop and market (Phelps, 2013). He loosely situates the term within his concept of indigenous innovation, meaning that new ideas can spring from the various ranks within an established organization. His concept supports Kopp and Tito's studies, arguing *innovatorship* is similar to intrapreneurship, commonly understood as the capacity and desire to practice entrepreneurship inside an organization.

My interpretation of *innovatorship* complements previous scholarly explorations, however it is explicitly informed by and discovered from this research. The concept of *innovatorship* was conceived from reviewing my field study observations of the subjects' repeated experience with inquiry, creativity, reflection and transformation. It was through the directed and repeated events and activities, innovativeness behaviour was witnessed, and thus, the state of *innovatorship* may be achieved.

7.5 Concluding Remarks

This dissertation examined the innovation process through seminal literature and two action research studies for the purpose of understanding the educational construct and associated competencies necessary to learn how to innovate. It sought to provide new directions for future research on the innovation process as it relates to innovation pedagogy, innovativeness competencies, and *innovatorship*. I suggest, to effectively participate in the messy and complex innovation process, a degree of innovativeness is needed. The innovation process participant assumes the role of an innovator at any given stage of the process. Regardless of title, rank or department, an individual or workgroup is expected to display characteristics and behaviours of

an innovator. The innovator is a construct, commonly described as an inventor, earliest adopter or initiator of an innovation process. The innovator is characterized as curious, creative, informed, social, experimental, tolerant, and demonstrates high levels of innovativeness. I suggest *innovatorship* is an essential quality of innovative and globally competitive organizations and nations.

It was the observed lack of innovativeness or innovative capacity that motivated my research. To innovate, individuals, organizations and regions must simultaneously tolerate experimentation and mistakes, while insisting on operational excellence. Many leaders continue to struggle with this duality.

My research hypothesizes this lack of innovativeness may a result of the lack of an established innovation pedagogy at Canadian universities. An initial internet-based analysis of innovation education offerings in Canada and North America hints that few academic institutions provide innovation development coursework to their students. While some offer an 'innovation and entrepreneurship' track, they appear to offer graduate courses focused on entrepreneurial finance and business modeling, and new product development in partnership with applied science faculties. This perceived gap in innovation process pedagogy requires further study.

Canada's call for action (Canada, 2016) on developing a nation of confident innovators may be in response to a perceived lack of innovativeness. I propose an innovator-centred pedagogy might be one way increase innovativeness, by graduating more innovators in this country. In conclusion, if Canada's goal of education is to make every Canadian "innovation ready", both individuals and their organizations require the knowledge, aptitudes and skills associated with observational inquiry, creative and critical thinking, reflective practice and learning through uncertainty. I recommend exploring the concept of *innovatorship,* as one approach to build a nation of inclusive and confident innovators. By focusing on the skills and competencies required to think and act in innovative ways, we can move towards our goal of building Canada into a centre of global innovation.

Personal Reflection

Throughout my 25-year career in industry -- regardless of position, job title, sector or jurisdiction -- I consistently helped guide organizations through change and transformation. My years as a math and science secondary student, and then as an interdisciplinary undergraduate student (math, social science, art and business design), led to a career path that moved from communication and information designer, to strategist and innovation lab director for large firms. In every position, I practiced moving from thought to action to solve problems for clients in an appropriate, timely and empathetic way. In the late 1990s, I realized that I was a change agent. I was prone to investigate, experiment with, design and propose new processes and practices.
While facilitating and leading strategic planning efforts for clients (governments, non-profits and for-profits), I would observe that existing guidelines and rules did not allow room for individual initiative or system flexibility to effectively address changes in the form of new insights and/or economic shifts. Consequently, the new insights (unforeseen or undiscovered needs and problems) could not be properly addressed, nor potential opportunities capitalized upon. My strategic research and proposed development efforts would meet with significant resistance from senior executives. Why? I symbolized change. I exposed the rapidly changing environment to firms that were inflexible, and not designed to absorb, incorporate, and respond to new knowledge.

My observations and frustrations with the lack of adoption for new processes led me to pursue innovation-focused research. Over the past four years, as an interdisciplinary doctoral student and sessional instructor, I have observed the process of innovation and unpacked the conditions of human fear, risk-aversion and uncertainty associated with facing the unfamiliar or something perceived as new. My graduate course work, combined with teaching and professional experience, have prepared me to design and conduct experiments on *if* and *how* innovativeness can be learned. After much research and with conclusive evidence found in this dissertation, I suggest the fear of change personally observed over 25 years is a condition resulting from a lack of innovation-related competencies. I propose that *innovativeness* is not only the ability and

willingness to adopt new ideas, but a means of better coping with uncertainty throughout an innovation process.

Over the past four years, I have led documentary and action research studies with the next generation of innovation leaders (students) and existing knowledge-based industry workers (occupational workers). I have introduced and engaged subjects to an instructional method with the explicit goal of observing whether innovativeness capacities can be developed.

> *"Because innovation is both conceptual and perceptual, would-be innovators must also go out and look, ask, and listen. Successful innovators use both the right and left sides of their brains. They look at figures. They look at people. They work out analytically what the innovation has to be to satisfy an opportunity. Then they go out and look at potential users to study their expectations, their values, and their needs. To be effective, an innovation has to be simple, and it has to be focused. It should do only one thing; otherwise it confuses people. Indeed, the greatest praise an innovation can receive is for people to say, "This is obvious! Why didn't I think of it? It's so simple!"* (Drucker, 1998:8)

I can summarize my graduate journey as taking an interdisciplinary approach to observing a multidisciplinary phenomenon. The multidisciplinary process of innovation integrates both the humanities and the sciences. It engages individuals to explore the *art* of communicating a need into a solution, and the *science* of social, physical and behavioural economic systems.

The evaluation of my work's contribution will be the adoption and dissemination of the translated knowledge that I have produced. Success will be measured by the effectiveness of the proposed learning model, when practiced and observed over time, resulting in an improved innovation performance for individuals (students) and organizations in Vancouver, British Columbia and ultimately, Canada. A positive impact from my research will be achieved when my teaching colleagues, scholars, practitioners and policy makers review this conceptual model and state "This is obvious, why didn't we think of this?".

This dissertation is the synthesis of my multi-year research and a proposal for a design-mediated innovation pedagogy to help develop Canada's future innovators.

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Appendices

Appendix A: Supplemental Table: Summary of Notable Innovation Process Literature

Researcher	Discipline	Citation	# Citations	Geography
Everett M. Rogers	Sociology	Rogers, E. M. (1962-2010). Diffusion of innovations. Simon and Schuster	**68,586**	USA
Joseph A. Schumpeter	Economics; Sociology	Schumpeter, J. A. (1934). The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle (Vol. 55). Transaction publishers.	**30,203**	Germany
Wesley M. Cohen; Daniel A. Levinthal	Economics	Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: a new perspective on learning and innovation. Administrative science quarterly, 128-152.	**27,116**	USA
Herbert Simon	Computer Science	Simon, H. A. (1996). The sciences of the artificial (Vol. 136). MIT press.	**18,923**	USA
Tom E. Burns and G.M. Stalker	Sociology	Burns, T. E., & Stalker, G. M. (1961). The management of innovation. University of Illinois. Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.	**13,315**	UK
Clayton M. Christensen	Philosophy Economics	Christensen, C. (2013). The innovator's dilemma: when new technologies cause great firms to fail. Harvard Business Review Press.	**12,073**	USA
Henry Chesbrough	Economics; Organizational Theory	Chesbrough, H. W. (2006). Open innovation: The new imperative for creating and profiting from technology. Harvard Business Press.	**11,070**	USA
John Seely Brown and Paul Duguid	Computer Science; Economics	Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. Organization science, 2(1), 40-57.	**9,497**	USA
Peter Drucker	Political Science; Philosophy	Drucker, P. (2014). Innovation and entrepreneurship. Routledge.	**9,138**	USA
Chris Feeman and Luc Soete	Economics	Freeman, C., & Soete, L. (1997). The economics of industrial innovation. Psychology Press.	**8,198**	UK
Richard R. Nelson	Economics	Nelson, R. R. (Ed.). (1993). National innovation systems: a comparative analysis. Oxford university press.	**7,753**	USA
Dennis Gabor	Applied Science	Gabor, D. (1970). Innovations: Scientific, Technological, and Social. And Gabor, D. (1946). Theory of communication. Part 1: The analysis of information. Journal of the Institution of Electrical Engineers-Part III: Radio and Communication Engineering, 93(26), 429-441.	**7,763**	Hungary – UK
Eric Von Hippel	Economics	Von Hippel, E. A. (2005). Democratizing innovation.	**5,826**	USA
Stephen Kline and Nathan Rosenberg		Kline, S. J., & Rosenberg, N. (1986). An overview of innovation. *The positive sum strategy: Harnessing technology for economic growth*, *14*, 640.	**5,039**	

Researcher	Discipline	Citation	# Citations	Geography
Vilfredo Pareto	Economics; Sociology; Philosophy	Pareto, V. (1964). Cours d'économie politique. Librairie Droz. Pareto, V. (1971). Manual of political economy.	**5,021**	France – Switzerland
Abbot P. Usher	Economics	Usher, A.P. (1954) A History of Mechanical Inventions. Cambridge. Harvard University Press. 60	**4,967**	USA
James Utterback and W.J. Abernathy	Applied Science; Management	Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. Technology review (64) 254-228.	**4,193**	USA
Gabriel Tarde	Sociology; Psychology	De Tarde, G. (1903). The laws of imitation. H. Holt.	**3,588**	France
Geoffrey Moore	Humanities	Moore, G. A. (2002). Crossing the chasm. Harper Publications.	**3,307**	USA
Andrew Van De Ven	Organizational Theory	Van de Ven, A. H. (1986). Central problems in the management of innovation. Management Science, 32(5), 590-607	**3,117**	USA
John Gardner	Anthropology	Gardner, J. (1993). On leadership. Simon and Schuster. Gardner, J. W. (1995). Self-renewal: The individual and the innovative society. WW Norton & Company.	**2,778**	USA
Torsten Hagerstrand	Geography	Hagerstrand, T. (1968). Innovation diffusion as a spatial process. Innovation diffusion as a spatial process.	**1,958**	Sweden
H. G. Barnett	Anthropology	H. G. Barnett (1953). Innovation: The Basis of Cultural Change (New York: McGraw-Hill Book Company. p. 7.	**1,374**	USA
Roy Rothwell	Sociology	Rothwell, R. (1994). Towards the fifth-generation innovation process. International marketing review, 11(1), 7-31.	**1,308**	UK
Auguste Comte	Sociology	Comte, A. (1868). The positive philosophy of Auguste Comte. W. Gowans. + (1880 edition)	**1,205**	France

Appendix B: Supplemental Table: Innovation Process Models

Author	Contribution	Stages/Phases
Wilkening (1953)	The author offers the first visual model of the innovation process. The four-stage process reflects the introduction of a new practice (technology) to the agricultural industry.	1. Initial knowledge about the practice 2. Acceptance of the practice as "a Good Idea" 3. Acceptance of the practice on Trial Basis 4. Adoption of the practice
Simon (1969)	The author introduces a creative cognitive approach to decision-making for problem solving, applied to the innovation process.	1. Intelligence Gathering (environment) 2. Design (invention and development) 3. Choice (direction of course)
Utterback and Abernathy (1975)	The authors reflect a dynamic model of product innovation from 100 cases on radical innovation. Their model offers a two-by-two matrix consisting of a time-based axis and rate of innovation axis.	• Rate of Innovation • Stage of Development • Product Innovation (max. to min. performance) • Process Innovation (uncoordinated to systemic)
Abernathy and Utterback (1978)	The authors evolve their model of product innovation, followed by process innovation, and introduce a technological 'dominant design' element. This element is considered a competitive advantage.	• Rate of Major Innovation • Dominant Design • Stage of Development (fluid to specific) • Product to Process Innovation
Roberts and Fusfeld (1981)	The authors propose five critical functions that correspond to their five-stage model of innovation.	Stage 1: Idea generation Stage 2: Championing Stage 3: Project leading Stage 4: Gatekeeping Stage 5: Project sponsoring or coaching
Rogers (1983)	The author proposes an organizational innovation process comprised of two phases and five sub-stages. The two phases are divided by the Decision step to adopt or reject the innovation.	Phase 1: Initiation Stage 1: Agenda-Setting Stage 2: Matching Phase 2: Implementation Stage 3: Redefining/restructuring Stage 4: Clarifying Stage 5: Routinizing
Kline and Rosenberg (1986)	The authors propose a Chain Linked innovation model that combines market pull and technology push orientations. Through feedback loops of research and knowledge, the model suggests five paths towards product or process innovation.	1. Potential Market 2. Invention/Analytic Design 3. Detailed Design and Test 4. Redesign and Produce 5. Distribute and Market
Cooper (1990)	The author proposes a stage-gate model to assist manufacturers with new product development processes (product innovation).	Stage 0 - Discovery: Ideas Stage 1 - Scoping: Assessment Stage 2 - Build Business Case: New product Stage 3 - Development: Development Stage 4 - Testing and Validation: Stage 5 - Launch: Commercialization
Kelley (1991)	The author introduces a engineering-design methodology to innovation at Stanford University involving five steps.	1. Empathize 2. Define 3. Ideate 4. Prototype 5. Test

Author	Contribution	Stages/Phases
Trice and Beyer (1991)	The authors propose nine elements reflecting a cultural innovation process inside organizations. The process of cultural innovation is dependent on the leadership and follower relationship and integrating traditional and new forms, processes and vision.	• Personal Qualities (innovator) • Perceived Situation (crisis) • Vision and Mission (radical ideology) • Follower Attribution (leadership) • Leader Behaviours (role model) • Performance (success) • Administrative Actions (new strategies) • Use of Cultural Forms (values) • Use of Tradition (new traditions)
Buchanan (1992)	The author proposes a design process for innovation comprised of two phases.	1. Problem definition (analytic step) 2. Problem solution (synthetic sequence step)
Rogers (1993)	The author presents an innovation development process comprised of six phases.	1. Needs/Problems recognition 2. Research 3. Development 4. Commercialization 5. Diffusion and Adoption 6. Consequences
Rothwell (1994)	The author reviews the generations of innovation processes and proposes a fifth generation process with five main characteristics.	• Integration: organizational and systems • Flexibility: flat organizational structures • Technological assistance: product development. • Parallel information processing: databases Networking: technological linkages
Ulrich and Eppinger (1995)	The authors provide a five-phase normative process model that resembles Cooper's stage-gate-process for product innovation. They map the interdisciplinary activities involved in the development of an innovation.	Phase 1: Concept Development Phase 2: System-Level Design Phase 3: Detail Design Phase 4: Testing and Refinement Phase 5: Production Ramp-Up
Freeman (1996)	The author summarizes innovation process literature and proposes an aggregate linear model and a firm-specific linear models of the innovation process.	Aggregate Linear Model • Basic Research • Applied Research • Invention • Marketing Testing • Diffusion and Imitation Firm-Specific Linear Model • R&D • Production • Marketing
McGrath (1996)	The author offers a five-phase project management-oriented innovation process. The process moves from idea generation to concept development and test and release.	Phase 0: Concept Development Phase 1: Planning and Specification Phase 2: Development Phase 3: Test and Evaluation Phase 4: Product Release
Faste (1998)	The author introduces a design methodology project-based learning and innovation involving three steps.	1. Express (idea generation) 2. Test (prototyping and design) 3. Cycle (solution modification and development)
Goffin and Pfeiffer (1999)	The authors propose an Innovation Pentathlon Model that highlights five interdependent performance areas. Their distinctive approach from earlier models feature the human factor in product innovation.	• Ideas Management & Creativity Management • Prioritization, Selection and Portfolio Management • Implementation Management • Innovation Strategy • Human Resource Management

Author	Contribution	• Stages/Phases
Brown (1999)	The author evolved Faste's engineering (design-thinking) model and proposed a human-centred design approach to the product innovation process. This model comprises six phases.	• Observation • Ideation • Rapid Prototyping • User Feedback • Iteration • Implementation
Van de Ven, Polley, Garud and Venkataraman (1999)	The authors identify an innovation pathway resulting for a longitudinal study of a US research lab. The innovation path process highlights 12 stages and presents a chaotic perspective of organizational innovation.	1. Gestation 2. Shock 3. Plans 4. Proliferation 5. Setbacks 6. Criteria Shift 7. Fluid participation of organizational personel 8. Investor/top management 9. Relationship with others 10. Infrastructure develop 11. Adoption 12. Termination
Tidd and Bessant (2001)	The authors propose a four-phase organizational innovation model based on opportunities.	1. Search (for opportunities) 2. Select (key opportunity) 3. Implement (innovation) 4. Capture (manage and measure)
Hung (2004)	The authors conceives of technological innovation as a process formed by two interlinked dimensions. The dimension of action (a concept of disorder and change) and the dimension of structure (a concept of order and stability). This conceptual model reflects the interactivity and interdependency between functions, actors and systems.	Dimension one: action Dimension two: structure
UK Design Council (2005)	The authors developed the Double Diamond design process for business innovation. It comprises a four-phase visual diagram that reflects divergent and convergent thinking activities.	A. Discover B. Define C. Develop D. Deliver
Brown (2009)	The author builds upon Simon (1969), Faste (1987) and Rowe's (1987) methods and reintroduces a 'design thinking' methodology to innovation involving three phases.	1. Inspiration – the problem or opportunity that motivates the search for solutions; 2. Ideation – the process of generating, developing and testing ideas; and, 3. Implementation – the path that leads from the design studio, lab and factory to the market.
Kumar (2013)	The author proposes seven modes of the design innovation process. The modes offer a way to navigate the innovation process using structured design methods and techniques.	Mode 1: Sense Intent Mode 2: Know Context Mode 3: Know People Mode 4: Frame Insights Mode 5: Explore Concepts Mode 6: Frame Solutions Mode 7: Realize Offering

Appendix C: Supplemental Table: Summary of Notable Innovation Process Literature

Researcher	Description of Innovation as a process	Discipline	Citation	Ideology
Everett M. Rogers	Innovation is an idea perceived as new by an individual (Rogers, 1962:13); a unit of adoption (Rogers, 1983:11)	Sociology	Rogers, E. M. (1962-2010). Diffusion of innovations. Simon and Schuster	Tarde and Comte
Herbert Simon	Innovation is achieved through rational decision-making. It involves three stages: intelligence gathering; design; and choice or pathway.	Computer Science	Simon, H. A. (1996). *The sciences of the artificial* (Vol. 136). MIT press.	
Henry Chesbrough	Open innovation is a paradigm that assumes that firms can and should use external and internal ideas, and internal and external paths to market, as the firms look to advance their technology. It is about partnership and sharing risk and reward.	Economics; Organizational Theory	Chesbrough, H. W. (2006). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press.	
Dennis Gabor	Innovation is a methodical creation of the human spirit. It is a novelty that once created, can be usefully and repeatedly applied.	Applied Science; Physics	Gabor, D. (1970). Innovations: Scientific, Technological, and Social.	
Geoffrey Moore	Innovation process based on Rogers' innovation diffusion work.	Humanities	Moore, G. A. (2002). Crossing the chasm. Harper Publications.	
Joseph A. Schumpeter	Innovation is focused on doing things differently. Innovations are at the root of cyclical fluctuations through a multiplicity of gestation periods and adoption. They are realized as new products and processes and new markets, which are factors of 'creative destruction'.	Economics; Sociology	Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle* (Vol. 55). Transaction publishers.	Marx
Clayton M. Christensen	Disruptive innovation is a process that creates new markets by discovering new categories of customers, by harnessing new technologies, developing new business models or exploiting old technologies in new ways.	Philosophy; Economics	Christensen, C. (2013). The innovator's dilemma: when new technologies cause great firms to fail. Harvard Business Review Press.	
Chris Feeman and Luc Soete	Innovation is critical for increasing the wealth and prosperity of nations and fundamental to enabling people to do things, which have not been done before.	Economics	Freeman, C., & Soete, L. (1997). The economics of industrial innovation. Psychology Press.	
Richard R. Nelson	Innovation is broadly defined as the process by which firms master and get into practice product designs and manufacturing processes that are new to them, to their communities and nations.	Economics	Nelson, R. R. (Ed.). (1993). *National innovation systems: a comparative analysis*. Oxford university press.	
James Utterback and W.J. Abernathy	The innovative process of a firm's innovation attempts will vary systematically with differences in the firm's environment and its strategy for competition and growth, and with the state of development of process technology used by a firm and by its competitors.	Applied Science; Management	Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. Technology Review, 64, 254-228.	

Researcher	Description of Innovation as a process	Discipline	Citation	Ideology
Wesley M. Cohen; Daniel A. Levinthal	The innovating process focuses first on the cognitive basis for an individual's absorptive capacity including, in particular, prior related knowledge and diversity of background.	Economics	Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: a new perspective on learning and innovation. Administrative Science Quarterly, 128-152.	Bourdieu
Tom E. Burns and G.M. Stalker	Innovation reflects an environment for change and "organic" organizations are best suited. Organizational innovation refers to the creation or adoption of an idea or behaviour, new to the organization.	Sociology	Burns, T. E., & Stalker, G. M. (1961). The management of innovation. *University of Illinois Academy for Entrepreneurial Leadership*	
John Seely Brown and Paul Duguid	Innovating is highly situated and improvisational. It is the process that involves actively constructing a conceptual framework, imposing it on the environment, and reflecting on their interaction.	Computer Science; Economics	Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, *2*(1), 40-57.	
Peter Drucker	Innovation is the work of knowing rather than doing.	Political Science; Philosophy	Drucker, P. (2014). *Innovation and entrepreneurship*. Routledge.	
Eric Von Hippel	User innovation is the idea that more users and consumers are the innovators of new products instead of suppliers.	Economics	Von Hippel, E. A. (2005). Democratizing innovation.	
Andrew Van De Ven	Innovation is a journey. It is the development and implementation of new ideas by people, who over time engage in transactions with others within an institutional order; focuses on four basic factors (new ideas, people, transactions, and institutional context).	Organizational Theory	Van de Ven, A. H. (1986). Central problems in the management of innovation. *Management Science*, *32*(5), 590-607	
Herbert Simon	Innovation is deviant organizational learning mechanisms and systems. Relating to knowledge transmission between individuals inside organizations.	Philosophy; Political Science; Economics	Simon, H. A. (1991). Bounded rationality and organizational learning. *Organization Science*, *2*(1), 125-134.	

Appendix D: Detailed Evaluative SDM Innovativeness Competencies Table

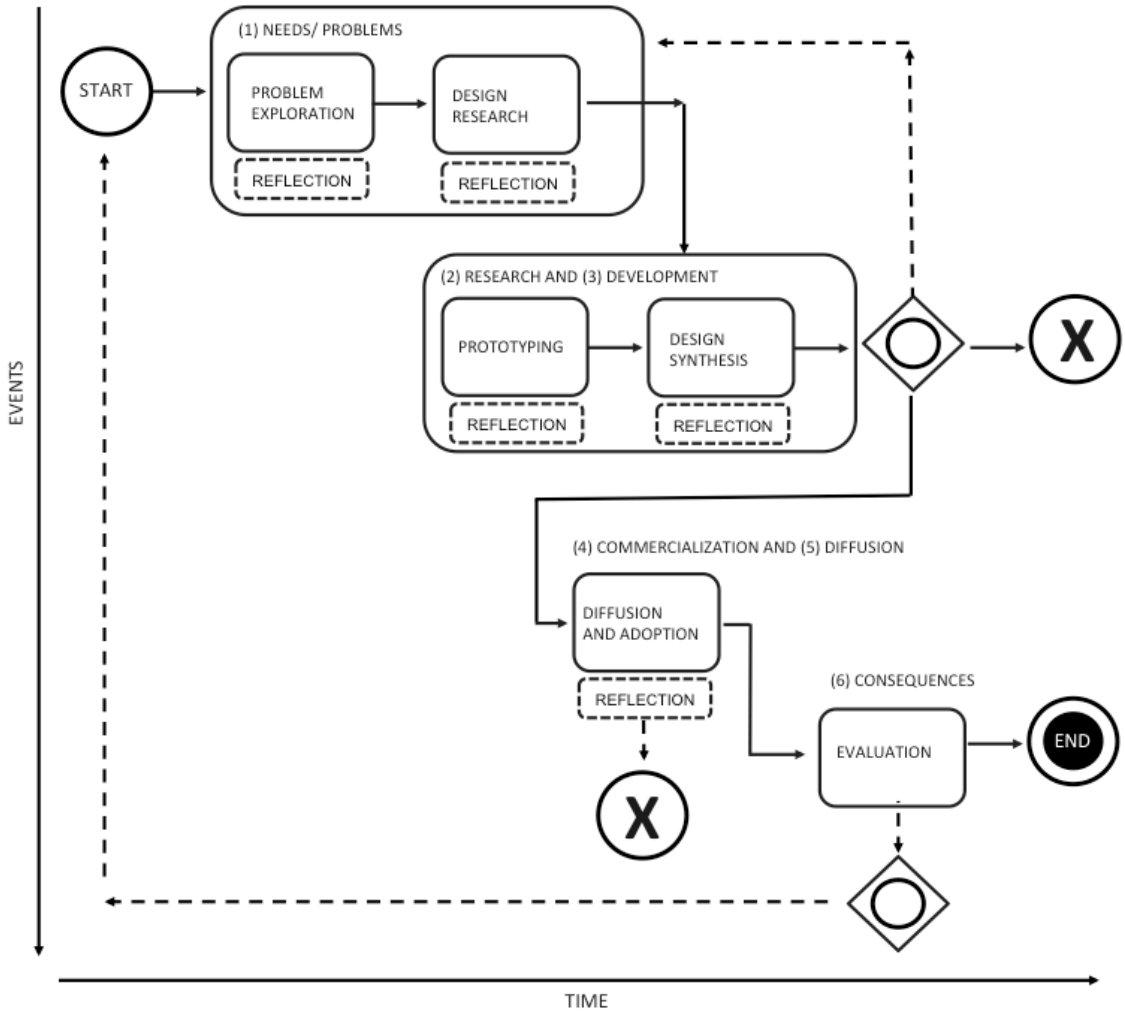
SDM competence facet	Evidence (Case Study A)	Evidence (Case Study B)
***Needs finding through Empathy*:** the ability to observe, understand and react to the concerns and needs of others; being aware of others' emotional responses, politics and actions.	*Empathy*: students wrote and presented individual SWOT technique; students engaged in Team SWOT technique; students observed physical settings on campus and created field notes and captured images on their mobile devices of the people, behaviour, place and space.	*Empathy*: subjects (Creative BC employees) completed a personal and Team SWOT activity; all subjects completed an organizational SWOT technique; subjects developed 'personas' as sketches and descriptions of creative industry artists, producers, entrepreneurs and consumers.
***Problem finding**:* the ability to productively ideate and define a workable task; developing an attitude for discovery.	*Problem finding:* students applied Bad Ideas theory to the original problem presented; engaged in an Assumption Dumption technique; client-project leaders proposed problems;	*Problem finding:* subjects created 'story briefs', scenarios and 'storyboards', postulating, identifying or proposing perceived needs and problems;
Creative thinking: the ability to think deliberately in ways to observe, find and discover problems.	*Creative thinking:* students created and submitted observations of their mini-ethnographic experience; students engaged in Six Thinking Hats technique to experience different thinking modes; students co-authored a problem statement in their design briefs and design solution assignment.	*Creative thinking:* subjects developed 'personas' as sketches and descriptions of creative industry artists, producers, entrepreneurs and consumers; subjects created visual 'story briefs' with paper, markers, pens and post-it notes.
***Critical thinking*:** the ability to think clearly and rationally, understanding the logical connection between ideas; to engage in reflective and independent thought.	*Critical thinking*: students engaged in visually communicating assumed problems and needs and used with the 5-Whys technique to probe deeper into the problem and reflect on their assumptions; they also engaged in an "Empathy Map" technique to ask questions about the user/consumer;	*Critical thinking*: subjects discussed and iterated concepts on large paper storyboards and/or written scenarios on whiteboards in teams and presented scenarios to larger work group for discussion.
***Communication*:** the ability to listen and speak effectively, present ideas appropriately, and write clearly and concisely.	*Communication*: students actively participated in team-based peer lectures (oral) and class presentations; students presented design brief drafts to peers, and design brief final to clients; students discussed, sketches and developed designed solution prototypes on whiteboards, paper and computers; students wrote, designed and posted personal reflective blogs.	*Communication*: subjects participated in oral and visual personal introduction techniques (e.g. their name as a symbol) and generated artifacts from techniques (storyboards, scenarios, etc.) using words and images.

SDM competence facet and skill	Evidence (Case Study A)	Evidence (Case Study B)
Reflective thinking**:** the ability to relate new knowledge to prior understanding; to think in abstract and conceptual terms; and, understand individual thinking strategies.	*Reflective thinking*: students wrote and submitted 'reflection blogs'; all students were invited to engage in peer critique with a third of each cohort leading the critique process, while the majority remained silent.	*Reflective thinking*: subjects responded to questions from facilitator on sharing their experience with the process and techniques and responded to pre-session questionnaire and post-session survey.
Qualitative Research (basic)**:** the ability to understand the philosophy of knowledge, think analytically, collect and manage data and synthesize information into reportable formats.	*Qualitative research*: students led basic document analysis, interviews and "light' ethnographic research to collect data for the problem statements, however most students were challenged with the quality of data sources; the majority struggled with identifying data sources and data collection and analysis. Most students synthesized information into meaningful reportable formats.	*Qualitative research*: subjects provided tacit knowledge about their industries, shared, debated or provided data points orally to validate problem and/or need;
Systems thinking**:** the ability to understand how concepts regarded as systems work and how they influence one another within a larger system.	*Systems thinking*: students explored abstract concepts of the problem presented by clients; explored how the problems were situated in systems was explored through Experience Map and Concept Mapping techniques; few students showed an understanding of the larger system and interrelationships between problem and system.	*Systems thinking*: subjects generated 'Fishbone technique' analyses of problems to identify causes and factors; generated 'Ecosystem maps' that identified creative industry members, stakeholders, competitors and Creative BC clients.
Visual Thinking: the ability to model and visualize concepts before all the information is available.	*Visual Thinking:* students engaged in creative warm-up techniques to draw their thinking styles; engaged in various visualization techniques (storyboarding, service journeys, persona sketches) to understand end-user for design solutions.	*Visual Thinking:* subjects engaged in creative warm-up to introduce themselves and work groups; engaged in storyboard development and scenario sketching of problem spaces.
Prototyping**:** the ability to iterate and build concepts, samples or models to test and replicated or learn from.	*Prototyping*: students generated ideas by sketching, describing, lego building, writing and /or drawing concepts and models.	*Prototyping*: subjects generated 'scenarios as stories' and storyboards to conceptualize new services, products and policies.
Designing: the ability to work at varying levels of abstraction; to recognize a broad range of potential in a given problem statement or project brief; to use form to communicate value.	*Designing:* students designed their problem statement and project briefs using digital and paper-based materials; designed their project plans and solutions (new service, new product or new process) using available materials.	*Designing:* subjects designed scenarios through storyboarding technique; and designed new service offerings through service journey mapping activity.

SDM competence facet and skill	Evidence (Case Study A)	Evidence (Case Study B)
Decision-making: the ability to choose between two or more alternatives or courses of action; and engage in an intuitive and/or reasoned process.	*Decision-making:* students analyzed problem spaces and solution alternatives, however many were observed as being uncertain about their decisions and process; the majority of students lack intuitive and/or a clear reasoned process.	*Decision-making:* subjects make decisions about problems and needs and between ideas, scenarios and strategies.
Collaboration: the ability to participate in group tasks; to help two or more people to work together and function well in project.	*Collaboration:* students formed into self-selected teams based on problem or topic of interest; team SWOT techniques were completed; group-based peer lectures or class warm-ups were planned and delivered.	*Collaboration:* subjects generated group-work based artifacts (i.e. team SWOTs and Fishbone diagrams) and engaged in discussion in teams, larger work groups and across sectors.
***Operations (project) planning and management*:** the ability to understand and navigate a project initiation through to completion; to communicate and manage phases and outcomes with project team members and functional leaders within the organization.	*Project planning and management*: students created and presented project plans in their design brief assignment, however half the teams were observed as being challenged to complete their team milestones on time; all students completed individual assignments on time; students completed and presented their final assignment on time.	*Project planning and management*: subjects generated 'service journey maps' as process journeys;
***Strategic thinking*:** the ability to think logically and creatively; to develop clear goals and objectives; design action plans; listen, observe and understand insights and convert them into strategic knowledge.	*Strategic thinking*: students communicated their personal thinking style in written and visually designed reflection blogs; they generated design briefs with both creativity and logic; generated prototypes, graphic notations and solution summaries.	*Strategic thinking*: subjects voted on proposed strategies and added comments and ideas on post-its; generated discussion on visible voting and ranking results.
***Market research*:** the ability to plan, design and implement market development strategies; apply knowledge of the principles and tools of research to solving problems related to consumer.	*Market research*: students proposed market analysis and outreach plans in their design briefs and identified audience or consumer channels in their final 'design solution' assignment.	*Market research*: subjects identified audience and client touchpoints, and described outreach plans through 'service journey maps' and 'scenario' techniques.
Business analyst: the ability to evaluate multiple options for a solution; listen to user or stakeholder needs; create clear and concise documentation; to conduct analysis and deconstruct the problem or solution.	*Business analyst:* students proposed evaluation measures (success metrics) to their design brief and design solution assignments; however the quality and thoughtfulness of the success criteria and was medium to poor across most cohorts.	*Business analyst:* subjects generated 'value proposition canvases' for each proposed scenarios; occupational subjects generated comments and ideas on post-it notes for 'risk/reward' analysis technique.

SDM competence facet and skill	Evidence (Case Study A)	Evidence (Case Study B)
Communications channel planning: the ability to find, reach and interact with intended innovation adopters.	*Communications channel planning:* students identified internal and external channels to reach intended audience for this proposed solutions; the business model canvas, service journey map techniques were used to identify relevant channels.	*Communications channel planning:* subjects identified internal and external channels to reach clients and stakeholders; service journey and ecosystem mapping techniques were used to identify clients and channels.
Innovation diffusion and delivery: the ability to develop and diffuse a new practice, product, process, or service.	*Innovation diffusion and delivery:* students generated new processes, new products, new services, new strategies and new policies for client projects.	*Innovation diffusion and delivery:* subjects co-authored a strategic framework and service innovation plan for Creative BC.
Business management: the ability to ensure and measure the economic viability of a new practice, product, process, or service.	*Business management:* students proposed economic viability of their innovation in their design brief and design solution assignment; however the quality of the projections was poor across most cohorts.	*Business management:* subjects generated performance measures for Creative BC; generated economic performance indicators for new strategies (innovation).

Appendix E: Business Process Model Notation of the SDM and Rogers' IDP



Appendix F: Sample Course Syllabus for COMM388

COMM 388

Strategic Design for Business Innovation: Studio Practice

COURSE SYLLABUS

COURSE GOALS

1. Introduce strategic design for business and innovation in a post-carbon economy.
2. Foster a culture of creativity, risk-taking, personal enrichment and teamwork.
3. Build problem-solving capacity and develop business-thinking processes.
4. Develop leadership and capacities for self-expression.

LEARNING OBJECTIVES Students will be able to…

- Articulate a role for design and thinking strategies in business, process, product and service innovation.
- Use strategic design, methods and tools effectively in a sustainable business context.
- Co-create, present and critique innovative ideas with local businesses.
- Integrate critical and creative thinking processes.
- Work effectively in teams in a studio practice environment.

SAUDER B.COMM PROGRAM GOALS

☒ Students will be skilled in creative and critical thinking.

☒ Students will be skilled in analytical decision-making.

☒ Students will be able to integrate knowledge from relevant disciplines when making decisions.

☒ Students will be effective communicators with the ability to prepare and deliver oral and written presentations using appropriate technologies.

☒ Students will be aware of ethical implications of business decisions and activities.

☒ Students will be prepared to apply sustainability management principles and practices to business.

ASSESSMENT SUMMARY

Assignments and Activities:	30%
Major Assignments:	60%
Participation:	10%

BRIEF COURSE DESCRIPTION

As the business environment becomes more unpredictable, organizations will demand leaders who are capable of navigating uncertainty and making the most of the opportunity. Leadership will increasingly mean being comfortable managing and motivating diverse teams of creative people. Truly innovative, disruptive technologies and processes will be needed to address local or global problems. The course will challenge teams of students to deliver real-world solutions that create social, cultural, economic, and environmental value using strategic design.

The course provides students with a strategic design process and techniques tool-kit. Design tools and processes, used for decades in industry and manufacturing, offer proven, alternative approaches for managing today's most challenging business problems. Part creative ideation, part critical analysis, and part innovative thinking for new ways of using existing information and systems, design processes and thinking strategies will become an essential tool for doing business better.

TEACHING & LEARNING FRAMEWORK: STUDIO PRACTICE

Sample studio session (subject to variation based on topics/activities): Monday/Wednesday 2:30-5:20pm

2:30	Check-in and Warm-up	Part 1: 10 min
2:50	Theory, Techniques and Practice (applied activity)	Part 1: 60 min
4:00	BREAK	*Break: 10 min*
4:10	Studio Work	Part 2: 70 min
5:20	Wrap-up	Part 2: 10 min

LEARNING AND ASSESSMENT ALIGNMENT

Learning Objectives	**Assessment Strategy**	**Assessment Details**
Students will be able to… 1. Articulate a role for design in business, process, product and service innovation. 2. Use design strategies, methods and tools effectively in a sustainable business context. 3. Co-create, present and critique innovative ideas for local businesses. 4. Integrate critical and creative thinking processes. 5. Work effectively in teams in a studio practice environment.	**Assignment 1**: Reflective Blog 1 (individual) **Due: ------** *(beginning of class)*	Reflective Blog posting: Reflect on personal thinking strategies, team work, and your leadership style.
	Assignment 2: Design Brief (Problem Exploration and Definition) (team) **Due: -------** *(beginning of class)*	• Individual & Team SWOTs • Design Brief Presentation • Critique of Design Brief
	Assignment 3: Design Solution (Problem Solving) (team) **Due: ------** *(beginning of class)*	• Design Solution (summary report) • Solution Presentation • Critique of Design Solution
	Assignment 4: Reflective Blog 2 (individual) Part a: reflections on your team work Part b: reflections on your leadership **Due: --------** *(beginning of class)*	Reflective Blog posting: Reflect on readings, d.studio experience, activities, thinking strategies, team work, and your leadership.
	Participation: Team Mini Lecture/ Warm-ups; Studio Engagement and	Contribute meaningful lectures and comments in class and on-line in

	In-Studio Activities (individual)	response to blogs; meet group responsibilities; engage in warm-up exercises.

ASSESSMENT

Assessment Activity	**Individual**	**Team**
Assignment 1: Reflective Blog 1	15%	
Assignment 2: Design Brief: Problem Exploration		30%
Assignment 3: Design Solution: Problem Solving		30%
Assignment 4: Reflective Blog 2	15%	
Participation: Studio Engagement (includes team engagement in warm-ups/mini-lectures)	10%	
TOTAL 100%	**40%**	**60%**

COURSE GRADE SCALE:

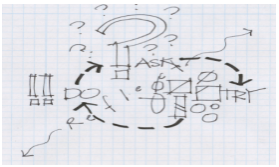
A+ 90% - 100%	B+ 76% - 79%	C+ 64% - 67%	D 50-54%
A 85% - 89%	B 72% - 75%	C 60% - 63%	F 0% - 49% (Fail)
A – 80% - 84%	B – 68% - 71%	C – 55% - 59%	

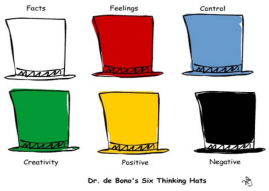
NOTE: In fairness to all students, grades are not negotiable.

COMM 388 SCHEDULE: FALL XXXX TERM X

Week by week class schedule at a high level (subject to amendment)

WEEK #	CLASS TOPICS	Warm-ups/ Mini-Lectures	THEORY INTO PRACTICE	ACTIVITIES	WHAT'S ASSIGNED & WHAT'S DUE
WEEK 1 **Sept 7**	**Intro + Orientation** **ASK. TRY. DO.**	**Warm-up**	**INTRODUCTION:** **Design and Business** **Studio Learning** **Strategic Design methods: ASK.TRY.DO**	**Class introductions** **Business in a Back-Pack** **Technique: So you think you can see?**	**Assign: mini-lectures** **Assign: Reflection 1** **Review Readings List** **Read:** *"10 Faces of Innovation"*
Week 2 **Sept 14**	**ASK: Finding Facts**	**Warm-up**	**FINDING FACTS:** **DESIGN BRIEF** **Innovation Intent** **Meet Class Sponsor**	**Technique: Problem/Opportunity Matrix** **Technique: Personal and Team SWOT**	**Assign: Project Teams** **Assign: Design Brief** **Read:** *"Question Everything" and VPD Canvas 1.1*

WEEK 3 **Sept 21**	**ASK: Finding Meaning**	**Warm-up** **Mini-Lecture 1: VPC Canvas 1.1**	**FINDING MEANING:** **Developing Insights** **Value Proposition and Business Model Canvas**	**Technique: Assumption Dumption** **Technique: Business Model Canvas**	**Assignment 1: DUE Reflection 1 due on Sept 21 in class** **Read:** *Value Proposition Design Canvas 1.2*
WEEK 4 **Sept 28**	**ASK: Finding Inspiration**	**Warm-up** **Mini-Lecture 2: VPC Canvas 1.2**	**FINDING FACTS and MEANING:** **Idea Generation: Why Bad ideas are Good Ideas**	**Technique: Eye Phone** **Technique: Empathy Map**	**Review: Assignment 2 Design Brief Draft review in studio** **Read:** *Value Proposition Design Canvas 1.3*
WEEK 5 **Oct 5**	**TRY:**	**Warm-up** **Mini-Lecture 3: VPC Canvas 1.3**	**FINDING INSPIRATION:** **Art of critique** **How to give and receive feedback**	**Technique: critique** **Activity: Design Brief Draft presentations (work in progress)**	**Practice: Draft Team Presentations** **Assignment 2: DUE Oct 12 in class + upload to Connect**
WEEK 6 **Oct 12**	**REFLECTION REVIEW RESTART**	**Team Presentations : Design Brief**	**PRACTICE:** **Teamwork** **Communication** **Critique** **iPEER**	**Presentation: Design Brief**  **Critique from sponsors, peers and guests.**	
WEEK 7 **Oct 19**	**ASK** **TRY** **DO**	**Warm-up** **Mini-Lecture 4: VPC Design 2.1**	**REFLECTION:** **Review Strategic Design Process** **Discuss: Strategic Thinking** **Problem Definition and Designing Solutions**	**Technique: Conceptual Blockbusting** **Studio work in teams** **iPEER Debrief Session**	**Assign: Design Solution** **Assignment 3: Design Solution** **Due: Nov. 23 in-class** **Read:** *Service Design 101*
WEEK 8 **Oct 26**	**ASK/TRY:** **Opportunities**	**Warm-up** **Mini-Lecture 5: VPC Canvas 2.6**	**IDEATE + PROTOTYPE** **Opportunity Definition** **Observations/Insights**	**Technique: EYE-PHONE** **Activity: Studio Work** **Technique: Service Journey**	**Practice: Research Methods (Fact Finding)** **Read:** *A Study of Prototypes, design activity and design outcomes*

WK 9 **Nov 2**	**TRY/DO:** **Prototyping**	**Warm-up** **Mini-Lecture 6: VPC Test 3.1** **Mini-Lecture 7: VPC Test 3.2**	**PROTOTYPE + TEST** **Framing Opportunities** **Six Thinking Hats**	**Studio work: Rapid Prototyping Technique**	**Practice: Critical Analysis** 
WK 10 **Nov 9**	**No Class**		**PROTOTYPE + TEST**	**STUDIO DROP IN**	**STUDIO DROP IN** **Read:** *Service Design 101*
WK 11 **Nov 16**	**DO:** **Refine**	**Warm up**	**DECIDE** **Theory: Decision-making** **Technique: Sift, Sort, Sieve**	**Activity: Design Solution Draft presentations** **(work in progress)**	**Assign: Reflection 2** **Develop: Design Solution**
WK 12 **Nov 23**	**ASK/TRY/ DO:** **Communicate** **Critique** **Revise**	**Warm up**		**DESIGN SOLUTIONS:** **FINAL PRESENTATIONS**	**Develop: Design Solution** **Assignment 3: DUE Nov. 23 in class + upload to CONNECT**
WK 13 **Nov 30**	**DO:**	**Warm up**	**Assignment 4: Critique and evaluations provided to each team** **iPEER**	**REFLECTION 2 BLOG**	**DUE: Reflection 2** **Assignment 4: DUE Nov 30 in class upload to CONNECT**

NOTE: Schedule subject to change. Refer to Assignment/Assignment Briefs on CONNECT for accurate timing and content.

COURSE MATERIALS & REQUIREMENTS:
All readings, cases and materials are available from the Connect course page.
Techniques are available from the d.studio website: http://dstudio.ubc.ca/toolkit/techniques/

Learning resources:
Subject Resources for Thinking Strategies: http://guides.library.ubc.ca/designthinking/strategies

REQUIRED TEXTBOOK

Osterwalder, Alexander and Pigneur, Yves. (2014) ***Value Proposition Design: How to Create Products and Services Customers Want.*** John Wiley & Sons, New Jersey.

Team Mini-Lecture 1: Week 3 -- **Canvas 1.1**	Team Mini-Lecture 5: Week 8 -- **Design 2.6**
Team Mini-Lecture 2: Week 4 -- **Canvas 1.2**	Team Mini-Lecture 6: Week 9 -- **Try 3.1**
Team Mini-Lecture 3: Week 5 -- **Canvas 1.3**	Team Mini-Lecture 7: Week 9 -- **Try 3.2**
Team Mini-Lecture 4: Week 7 -- **Design 2.1**	

REQUIRED READINGS

[Week 2] Kelley, Tom (2005). *The Ten Faces of Innovation: Ideo's Strategies for Beating the Devil's Advocate & Driving Creativity throughout Your Organization.* Introduction: Pp 1-15. Doubleday. http://www.tenfacesofinnovation.com/tenfaces/index.htm

[Week 3] Fulton-Suri, Jane (2007) *Question Everything* excerpt from "Thoughtless Acts: Observations on Intuitive Design". http://www.ideo.com/images/uploads/news/pdfs/QuestionEverything.pdf

[Week 4] Dix, et al. (2006) *Why bad ideas are a good idea*. http://www.alandix.com/academic/papers/HCIed2006-badideas/HCIED2006-badideas-CRC-v2.pdf

[Week 6] Martin, R. (2009). *The Design of Business: why design thinking is the next competitive advantage*. Chapter 1: The Knowledge Funnel: How Discovery Takes Shape. Pp. 1-31. Harvard Business Press.
http://www.youtube.com/watch?v=ZTgVYjp98Zk

[Week 6] Brown, Tim. (2008). *Design thinking*. Harvard Business Review. 86(6), pp. 84-92. https://hbr.org/2008/06/design-thinking

[Week 7] Service Design 101: http://www.cooper.com/journal/2014/07/service-design-101

[Week 8] Yang, Maria (2005) *A study of prototypes, design activity, and design outcome.* MIT. http://web.mit.edu/~mcyang/www/papers/2005-yang-DesignStudies.pdf

[Week 10] Yang, Maria (2005) *Decisions by Design*. Harvard Business Review – Case study. http://w.thoughtlessacts.com/images/uploads/news/pdfs/DecisionsbyDesign.pdf

ADDITIONAL READINGS and VIDEOS

Beckman, Sara L. and Michael Barry. (2007). *Innovation as a Learning process: Embedding Design Thinking*. California Management Review Vol 50. No.1.
http://static1.1.sqspcdn.com/static/f/425112/4863286/1259043624957/2_InnovationAsLearningProcess.pdf?token=2jw3tWUo1M0FWDIYWw8pbJm0uhk%3D

Boyer, Brian, Justin W. Cook & Marco Steinberg (2012). *In Studio:Recipes for Systemic Change.* Helsinki Design Lab powered by Sitra. http://helsinkidesignlab.org/instudio/

Fraser, Heather (2012) Design Works: How to Tackle your toughest Innovation Challenges Through Business Design. University of Toronto Press: Toronto.

Kaplan, Saul. *The Business Model Innovation Factory: how to stay relevant when the world is changing.* 2012. John Wiley & Sons.

Lehrer, Jonah. *Imagine: How Creativity Works.* (2012) Houghton, Mifflin, Harcourt, New York).

Liedtka, J., Ogilvie, T., and Brozenske, R. (2014) *The Designing for Growth Field Book:a Step-by-Step Project Guide* By Jeanne Columbia Business School Publishing

Lockwood, Thomas. *What Good Does Design Do For Business?* Article. FastCompany. http://www.fastcodesign.com/1665471/marketing-has-the-4ps-design-should-have-its-own-model

Martin, R. (2009) *Roger Martin on the Design of Business at Make/Think: AIGA Design Conference, Memphis, TN* (October 9, 2009). (28 min). http://www-2.rotman.utoronto.ca/facbios/file/DunneMartin.pdf

Manzi, Jim. (2014) Applied Predictive Technologies (APT).*Decisive Action: How business make decisions and how they could do it better.* The Economist. http://www.economistinsights.com/sites/default/files/Decisive%20Action%20-%20How%20businesses%20make%20decisions.pdf

Norman, Don. *Design Thinking: A useful myth.* (2010, Core77: http://www.core77.com/blog/columns/design_thinking_a_useful_myth_16790.asp

Osterwalder, Alexander and Pigneur, Yves. (2010) *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.* John Wiley & Sons, New Jersey.

Pink, Daniel. (2005) *A Whole New Mind: Why Right-Brainers Will Rule the World.* Chapter 4: Design, pp. 68-99. Riverhead Books. http://204.200.153.100/ebeling/AlignmentForumReviewOfPink.pdf

Schön, D. (1987) *The Reflective Practitioner: How Professionals Think in Action.* New York: Basic Books. Chapter 3: Design as Reflective Conversation with the Situation pp. 76-104 and Chapter 5: The Structure of Reflection-in-Action, pp. 128-167. http://sopper.dk/speciale/arkiv/book49.pdf

UK Design Council (2013) *Leading Business by Design Report* http://www.designcouncil.org.uk/sites/default/files/asset/document/dc_lbbd_report_08.11.13_FA_LORES.pdf

UK Design Council (2005) *A study of the design process - The Double Diamond*. http://www.designcouncil.org.uk/resources/report/11-lessons-managing-design-global-brands

Stickdorn, Marc & Jakob Schneider. *This is Service Design Thinking.* Wiley, 2011.

Verganti, Roberto (2009) Design Driven Innovation. Introduction: Design Driven Innovation. pp. 1-16. Harvard Business Press. http://www.designdriveninnovation.com/letter.html

Wired (2015).*"Take it From an Expert: Design is More Important Than Ever"* . http://www.wired.com/2015/03/take-expert-design-important-ever/

OTHER INFORMATION

Info also available on the d.studio website: http://dstudio.ubc.ca/

Studio participation

Studio participation grades will be based on the quality and quantity of in-studio participation and peer lectures. Discussions before or after studio do not count. Obviously, if you are not in studio you cannot participate. Participation includes engagement in in-studio exercises.

Studio Values, Norms and Expectations

The d.studio is, first and foremost, a class in which we explore new knowledge, processes and skills for business. We will do that every day. However, studio is also more than that. It is also a place, some colleagues, and a way of working, teaching and learning— at once a classroom, a project room, a home base, a presentation and review space, and a social learning centre.

General d.studio Etiquette: The purpose of the studio values, norms and expectations are to foster an atmosphere of mutual respect in the studio towards your fellow students and the instructor and teaching assistant.

1. Tardiness. Studio sessions are to be considered like business engagements. In the business world being late for meetings is unacceptable.
2. Computer etiquette. Use computers appropriately in studio.
3. Food in class. Beverages in class are fine. Eating food in class is fine as long as it is not disruptive or bothersome to others.
4. Entering and leaving the studio. Similar to tardiness, in business meetings coming and going is frowned upon. Naturally, there are legitimate reasons for stepping out of the studio so apply your professional judgment.

Breaches in etiquette will have a severe impact to your class participation score.

Detailed information about UBC Access and Diversity, Religious Accommodation and Statement on Respectful Environment, are NOT included in this sample.

Appendix G: Questionnaire Sample Used for Case Study B

Questionnaire: Personality Trait and Innovation Adoption Type Survey

The questionnaire consists of a personality trait test (Part A) and an innovation adoption type test (Part B) which should take about 15 minutes to complete. Answer as many questions as you can to get the most accurate score possible. Your answers are held in strictest confidence and are not shared with anyone. Upon completion of the survey, your individual results will be provided immediately. For your protection, the results are anonymous and will only be used in a limited research study on the factors for adoption of the design led innovation research project, so please try to give accurate answers.

Part A: Big Five Personality Trait Test

Please answer as many questions as you can to get the most accurate score possible. Your results will be provided at the end of the study. As you are rating yourself, please try to remain objective and truthful.
Directions: The following statements concern your perception about yourself in a variety of situations. Your task is to indicate the strength of your agreement with each statement by indicating the degree to which you:
Strongly Disagree = 1; Disagree = 2; are Neutral = 3; Agree = 4; Strongly Agree = 5

I see myself as someone who...
1. ...Is talkative
2. …Tends to find fault with others
3. ...Does a thorough job
4. ...Is depressed, blue
5. ...Is original, comes up with new ideas
6. ...Is reserved
7. ...Is helpful and unselfish with others
8. ...Can be somewhat careless
9. ...Is relaxed, handles stress well
10. ...Is curious about many different things
11. ...Is full of energy
12. ...Starts quarrels with others
13. ...Is a reliable worker
14. ...Can be tense
15. ...Is ingenious, a deep thinker
16. ...Generates a lot of enthusiasm
17. ...Has a forgiving nature
18. ...Tends to be disorganized
19. ...Worries a lot
20. ...Has an active imagination
21. ...Tends to be quiet
22. ...Is generally trusting
23. ...Tends to be lazy
24. ...Is emotionally stable, not easily upset
25. ...Is inventive
26. ...Has an assertive personality
27. ...Can be cold and aloof

28. ...Perseveres until the task is finished
29. ...Can be moody
30. ...Values artistic, aesthetic experiences
31. ...Is sometimes shy, inhibited
32. ...Is considerate and kind to almost everyone
33. ...Does things efficiently
34. ...Remains calm in tense situations
35. ...Prefers work that is routine
36. ...Is outgoing, sociable
37. ...Is sometimes rude to others
38. ...Makes plans and follows through with them
39. ...Gets nervous easily
40. ...Likes to reflect, play with ideas
41. ...Has few artistic interests
42. ...Likes to cooperate with others
43. ...Is easily distracted
44. ...Is sophisticated in art, music, or literature
45. ...Is politically liberal
46. ...Has high self-esteem

Scoring Scale: ("R" denotes reverse-scored items):
Extraversion > Introversion: 1, 6R, 11, 16, 21R, 26, 31R, 36
Agreeableness > Antagonism: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42
Conscientiousness > Lack of Direction: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R
Nervousness > Emotional stability: 4, 9R, 14, 19, 24R, 29, 34R, 39
Openness > Closedness to experience: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

Scoring Results:

a) Extraversion: If you scored high on this scale, it indicates you are outgoing and energetic. If you scored low, it indicates you are shy and withdrawn.
b) Agreeableness: If you scored high on this scale, it indicates you are friendly and compassionate. If you scored low, it indicates you are competitive and outspoken.
c) Conscientiousness: If you scored high on this scale, it indicates you are efficient and organized. If you scored low, it indicates you are easy-going and careless.
d) Nervousness: If you scored high on this scale, it indicates you are sensitive, reactive and easily bothered by stimuli in an environment. If you scored low, it indicates you are confident, secure and not easily provoked.
e) Openness: If you scored high on this scale, it indicates you are inventive and curious. If you scored low, it indicates you are cautious and conservative.

Adapted from: John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin, & O. P. John (Eds.), Handbook of personality: Theory and research (pp. 102-138). New York: Guilford Press.

Part B: Individual Innovativeness Test

An innovation is an idea, practice, or object that is perceived as new by an individual or an organization. People vary a great deal in their "innovativeness." Innovativeness has to do with how early in the process of adoption of new ideas, practices, products and services, you as an individual are likely to accept a change.

Directions: People respond to their environment in different ways. The statements below refer to some of the ways people can respond. Please indicate the degree to which each statement applies to you by marking whether you: Strongly Disagree = 1; Disagree = 2; are Neutral = 3; Agree = 4; Strongly Agree = 5

Please work quickly as there are no right or wrong answers, just record your first impression.

1. My peers often ask me for advice or information.
2. I enjoy trying new ideas.
3. I seek out new ways to do things.
4. I am generally cautious about accepting new ideas.
5. I frequently improvise methods for solving a problem when an answer is not apparent.
6. I am suspicious of new inventions and new ways of thinking.
7. I rarely trust new ideas until I can see whether the vast majority of people around me accept them.
8. I feel that I am an influential member of my peer group.
9. I consider myself to be creative and original in my thinking and behavior.
10. I am aware that I am usually one of the last people in my group to accept something new.
11. I am an inventive kind of person.
12. I enjoy taking part in the leadership responsibilities of the group I belong to.
13. I am reluctant about adopting new ways of doing things until I see them working for people around me.
14. I find it stimulating to be original in my thinking and behavior.
15. I tend to feel that the old way of living and doing things is the best way.
16. I am challenged by ambiguities and unsolved problems.
17. I must see other people using new innovations before I will consider them.
18. I am receptive to new ideas.
19. I am challenged by unanswered questions.
20. I often find myself skeptical of new ideas.

Please indicate your gender: [M /F]
Please indicate your age category: [18-24 | 25-30 | 31-40 | 41-49 | 50-60 | 60+]

Thank you for participating in this survey. Once you click on the “submit button” below, you will be presented with your individual results.

If you have any questions regarding this survey, please contact researcher.

Scoring:

Step 1: Add the scores for items 4, 6, 7, 10, 13, 15, 17, and 20.
Step 2: Add the scores for items 1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18, and 19.
Step 3: Complete the following formula: II = 42 + total score for Step 2 - total score for Step 1.
Scores above 80 are classified as Innovators.

Scores between 69 and 80 are classified as Early Adopters.
Scores between 57 and 68 are classified as Early Majority.
Scores between 46 and 56 are classified as Late Majority.
Scores below 46 are classified as Laggards/Traditionalists.

Scoring Results: You scored _____ !

a) If you scored 80 and above, you are classified as an **Innovator** type. Innovators are generally enlisted to identify or refine new products and services or improve existing products or services.
b) If you scored between 69 and 80, you are classified as an **Early Adopter** type. Early adopters are generally keen to be the first consumers (or users) and promoters of new products and services.
c) If you scored between 57 and 68, you are classified as an **Early Majority** type. Early majority types are consumers (or users) of new products and services, only after they have been used successfully by either innovators and early adopters that they know or trust.
d) If you scored between 46 and 56, you are classified as **Late Majority** type. Late Majority types generally consume a new product or service, only after seeing that the majority of the population has.
e) If you scored below 46, you are a **Traditionalist** type. Traditionalists are generally concerned with reliability and low cost, and will consume (or use) a new product or service only after traditional alternatives are no longer available.

In general, people who score above 68 and considered highly innovative, and people who score below 64 are considered low in innovativeness.

Adapted from: Hurt, H. T., Joseph, K., & Cook, C. D. (1977). *Scales for the measurement of innovativeness*. Human Communication Research, 4, 58-65.