EXAMINING ORGANIZATIONAL LEARNING CONDITIONS AND STUDENT OUTCOMES USING THE PROGRAMME OF INTERNATIONAL STUDENT ASSESSMENT (PISA): A CANADA AND SASKATCHEWAN SCHOOL CONTEXT

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ABSTRACT

The purpose was to investigate the relationship between Canadian and Saskatchewan PISA 2009 reading performance and organizational learning (OL) conditions as perceived by students and principals when selected student and school characteristics were taken into consideration. Gender, Aboriginal status, and socioeconomic status were the student characteristics that were considered. School size, urban versus rural school community, proportion of students self-identified as Aboriginal, and school average socioeconomic status were school characteristics taken into consideration.

A nationally represented sample of 978 schools and 23,207 15-year-old students across the ten Canadian provinces participated in the PISA 2009. Within this sample, 1,997 students and 99 schools were from Saskatchewan.

Principal components analyses were conducted to produce components for the calculation of two composite (OL) indices: a Student OL Index based on the Canada and OECD PISA student questionnaires and a School OL Index based on OECD PISA school questionnaire. Subsequently, two hierarchal linear modelling analyses were employed to examine the association of student-level OL index and school-level OL index with reading performance. Across Canadian and Saskatchewan schools, students' perspective of OL conditions was positively associated with reading performance in the presence of the selected student and school characteristics. Except for one school-level OL component (i.e., principal's perspective of school culture/environment) in the Canadian model, school-level OL conditions were not significantly associated to reading performance in the presence of student and school characteristics.

With the adjustment of student and contextual characteristics incorporated in the modelling, the average reading performance was comparable across Canadian and Saskatchewan schools, 528 and 523 respectively. Variance decomposition of final models indicated that 55% of the Canadian school-level variance in reading achievement and 68% of the Saskatchewan school-level variance were explained by the selected student and school characteristics along with student perspective of OL conditions.

The findings from this study supported the hypothesis that OL conditions are associated with student achievement. Additionally, it was noted that the effect of OL conditions was of similar magnitude to that of the socioeconomic status effect. Furthermore, the findings from this study further emphasized the importance of the student voice within the school OL framework.

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CHAPTER 1

INTRODUCTION

Provincial/territorial assessment programs must continue to respond to societal demands while ensuring assessment integrity if they are to positively inform educational decisions. The ongoing debates regarding the purposes and value of such assessment programs serve to highlight the need for ongoing examination of the large-scale educational assessment programs in Canada and the society in which these assessments operate. (Klinger, DeLuca, & Miller, 2008, p. 14)

Public education is a complex social system wherein the complexity is expanding in light of increasing globalization, cultural diversity, technological complexities, economic needs, and political demands. Mechanistic models with a more factory and efficiency approach are no longer adequate at providing explanations to how schools affect student outcomes (Anderson, Milford, & Ross, 2009). Organizational learning theories provide an alternate approach to framing schools as adaptive living systems and account for flexibility needed in complex systems (Mitchell & Sackney, 2011; Senge, 2006). From the organizational learning perspective, the need for continuous restructuring shifts accountability and assessment programs from a focus on the individual and learning deficits to a collective responsibility for academic outcomes and capacity building for sustainability into the future (Mitchell & Sackney, 2011). The shift from individual to collective responsibility contributes to an accountability system that belongs to principals, teachers, and students and is argued to contribute more positively to student outcomes (Valli, Croninger, & Walters, 2007).

Organizational Learning

The purpose of this study was to investigate the relationship of Canadian and Saskatchewan PISA 2009 reading performance and organizational learning conditions as perceived by students and principals when selected student and school characteristics were taken into consideration. Furthermore, there is a paucity of research that included the combination of large-scale assessment (such as the PISA) and an organizational learning perspective. This study was based on a view of organizational learning as a learning process involving a living system of a complex network of members within the organization. The focus was on those conditions which foster and promote that learning process and the outcomes intended by that process. More specifically, the study focused on members (principals, teachers, and students) of the school that together work toward student outcomes that ultimately prepare the students to be successful adult

members of society. The organizational learning domains of interest in this study are further detailed in the literature section.

Research within the field of organizational learning can be examined by focusing on the conditions that are in place to support the learning of members within the organization (Leithwood, Aitken, & Jantzi, 2006; Silins, Zarins, & Mulford, 2002). Organizational learning as defined by Argyris and Schön (1978) suggested a role for assessment within the process of aligning the organization to the internal and external needs of its environment:

> members of the organizations act as learning agents for the organization, responding to changes in the internal and external environments of the organization by detecting and correcting errors in organizational theory-in-use [theory of action constructed from observation of actual behavior] taking action and embedding the results of their inquiry in private images and shared maps of organization (p. 29).

Fiol and Lyles (1985) provided a holistic framework of four contextual factors (i.e., culture, strategy, structure, and environment) that have a "circular relationship with learning in that they create and reinforce learning and are created by learning" (p. 84). Other researchers argued for a holistic approach by linking organizational learning with program evaluation, a form of assessment (Preskill & Torres, 1999; Thornton, Shepperson, & Canavero, 2007). By linking school evaluation to organizational learning, Thornton et al. (2007) suggested that emphasis shifted from a strictly top-down managerial action often met with resistance to a more holistic approach encompassing more positive involvement from all members of the organization.

Since the 1966 U.S. landmark *Equality of Educational Opportunity* (Coleman et al.) study, research continues to provide evidence of school effects after controlling for socioeconomic status (Willms, 2004; Willms, 2010). Student engagement, a predictor of student achievement, is associated with organizational learning (Silins & Mulford, 2001; Silins & Mulford, 2002a; Silins & Mulford, 2002b; Silins & Mulford, 2004). In addition, positive student outcomes have been linked to school practices associated to organizational learning such as: collective efficacy (Goddard, Hoy, & Hoy, 2000), distributive leadership (Leithwood & Jantzi, 1998; Mulford & Silins, 2003; Mulford, Silins, & Leithwood, 2004), organizational capacity (Gray, 2001; Stoll, 2009), positive school climate (Heck, 2000; Hoy & Hannum, 1997; Marks, Seashore Louis, & Printy, 2000), capacity for organizational learning with teacher instruction and student achievement (Marks et al., 2000), professional community (Phillips, 2003), school autonomy (OECD, 2001), teacher collaboration (Goddard, Goddard, & Tschannen-Moran,

2007), and teacher empowerment (Sweetland & Hoy, 2000). Evidence mounts to support the hypothesis that schools with more capacity to promote organizational learning are also linked to more positive student outcomes.

Assessment of Student Outcomes

School administrators are faced with external factors related to globalization along with a multitude of internal and external pressures as they try to make decisions on behalf of the students that they represent. One assessment tool, conducted by the Organization for Economic Co-operation and Development (OECD), is the 2009 Programme for International Student Assessment (PISA), a large-scale assessment that has global as well as local policy-making and decision-making implications. The OECD administered the first instrument in 2000 with the plan to administer it every three years until 2015. About 470,000 fifteen year old students from 65 countries; about 23,000 students from Canada; and, about 1900 students from 90 Saskatchewan schools participated in the PISA 2009 (Knighton, Brochu, & Gluszynski, 2010). The instrument included an assessment of mathematics, reading, and science literacies as well as a student questionnaire and a principal questionnaire to capture contextual elements.

By viewing the PISA results from an organizational learning perspective, this study pointed to an important shift as to how large-scale assessment is perceived and used. In Saskatchewan, the PISA results were lower than the Canadian average. Consequently, the Ministry of Education strategic plans included student achievement as one of the primary focal points (Saskatchewan Ministry of Education, 2008). Next to Manitoba and the Territories, Saskatchewan has a high percentage of schools (47%) that have ten percent or more Aboriginal students (CMEC, 2007). By 2045, the Aboriginal population is projected to be one-third of the Saskatchewan population (Government of Saskatchewan, 2011). Typically, the PISA results in Canada are focused on and contrasted to the top international performers, Finland, and the top national performers, Alberta (Bussiere, Knighton, & Pennock, 2007). Research is lacking in examining the PISA contextual elements and exploring differences in school organization (Goldstein, 2004). This study aimed to shift the focus from rankings and competition to using the PISA data to examine the relationships of organizational learning factors and student outcomes within the schools of Saskatchewan and Canada overall.

<center>**Statement of the Problem**</center>

Ultimately, the education system undertakes the continual challenge to change and adapt in order to prepare the youth to be successful adults for tomorrow's society. This study entered into the debate of what effect schools have on student outcomes. Large-scale assessment has been key to informing policy decisions in this regard. Consequently, large-scale assessment continues to evolve and increase within the culture of education systems to meet multiple purposes including: instruments of public policy (Mazzeo, 2001); measurements of student achievement and/or school accountability of student outcomes (Crundwell, 2005; Earl, 1999); and, modes to monitor and certify student achievement (Klinger et al., 2008). There is a paucity of the use of large-scale assessment and evaluation results to inform education policy and decision making from an organizational learning perspective (Preskill & Torres, 1999).

While the Saskatchewan PISA student achievement results are publicly acknowledged along with some policy implications, much of the PISA database remains unexplored (Anderson et al., 2009). This study examined the PISA's contextual and performance data to inform current debates of the effects of school's organizational learning on student learning in Saskatchewan and Canada overall. The insights gained could be further investigated with other Canadian provinces as well as other countries that use PISA large-scale assessments to inform and monitor education. Rather than a focus on accountability from a top-down approach, this study attempted to shift the emphasis to an accountability where all members of the organization are responsible and to factors that help us learn as an organization.

<center>**Purpose**</center>

The purpose was to investigate the relationship of Canadian and Saskatchewan PISA 2009 reading performance and organizational learning conditions as perceived by students and principals when selected student and school characteristics were taken into consideration. The following questions guided this study:

Research Questions

The main research question was:

To what extent are a school's conditions that foster organizational learning, associated with student PISA reading literacy achievement in Saskatchewan and in Canada overall?

The research sub-questions were:

<center>4</center>

1. To what extent are student background variables (i.e. gender, Self-Identified Aboriginal, socioeconomic status, level of experience of school conditions that foster organizational learning that consists of a composite of collaborative culture, safe environment, visionary strategy, supportive structure, and distributive leadership factors as defined by factor analysis of 2009 PISA student questionnaire items) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

2. To what extent are school variables (school socio-economic index, school location, proportion of Aboriginal students, school size, level of fostering organizational learning that consists of a composite of collaborative culture, safe environment, visionary strategy, supportive structure, and distributive leadership factors as defined by factor analysis of 2009 PISA principal questionnaire items) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

Significance

There is a paucity of organizational learning research in conjunction with large-scale assessments; and, as such, there remains a gap of information that has the potential to inform education policy. Additionally, research in organizational learning within the educational context lacks in investigating the field from the students' perspective. This study provided insights into organizational patterns within education systems that are important to theoretical frameworks and policy making at international, national, and local jurisdictions. At the school level, support for assessment policies would be enhanced with increased understanding and credibility of the large-scale assessment policy and procedures that incorporate an organizational learning position. By viewing large-scale assessment from an organizational learning perspective, the emphasis shifts from a top-down approach that threatens members of the organization to an accountability view wherein all members learn and all members are responsible. This study holds potential to provide empirical evidence of models that incorporate organizational learning theory to facilitate educational research and inform policy makers.

Definition of Terms and Abbreviations

The terms and abbreviations below will have the meaning as assigned to them:

1. Principal: principal or designate that completed the School Questionnaire for PISA 2009.

2. Urban School: Urban school was defined as a school situated in a town or city with a population of 15,000 people or more.

3. Rural School: Rural school was defined as a school situated in a rural area, village, hamlet, or small town with a population of less than 15,000 people.

4. Self-identified Aboriginal: students that participated in PISA 2009 and that responded to 'yes, First Nations (North American Indian)', or, 'yes, Métis', or, 'yes, Inuk (Inuit)' to the question "Are you an Aboriginal person, that is, First Nations (North American Indian), Métis or Inuk (Inuit)? (Note: First Nations (North American Indian) included Status and Non-Status Indians)" on the Canadian PISA 2009 student questionnaire,

5. PISA 2009 Student Questionnaire (OECD): the student questionnaire consisting of non-cognitive and contextual questions asked of all participating students in all countries that participated in PISA 2009.

6. PISA 2009 Student Questionnaire (Canadian): additional student questionnaire of non-cognitive and contextual questions asked of Canadian students that participated in PISA 2009. The intent of this questionnaire was to continue with the Canadian Youth in Transition (YITS) longitudinal study that links with the PISA survey.

7. Economic, Social, and Cultural Status (ESCS): a PISA socio-economic status index that has been derived by the OECD, from student responses to questions relating to parent educational and occupational categories as well as student responses to items relating to home possessions.

8. Organizational learning – For the purposes of this study, organizational learning refers to the iterative processes in which students, teachers, and administrators of a school relate, communicate, experiment, interact, create, behave, understand, and construct understanding as they work together towards student learning in the school.

9. Conditions that foster organizational learning: For purposes of this study, the research framework focuses on five conditions developed from the research literature review: culture, strategy, structure, environment, and leadership. Each condition is further defined and operationalized by items within the PISA 2009 student and school questionnaires.

10. Systems thinking: a way of thinking that places emphasis on the whole and the patterns and relationships of the parts as they contribute to the whole.

11. Mechanistic View: a factory and efficiency approach to schools.

12. Organismic View: approaching schools as living systems.

13. Learning Organization: an ontological view wherein an organization is a living system capable of learning as defined by Capra (2007):

Because of feedback in living networks, these systems are capable of self-regulation and self-organization. A community can learn from its mistakes, because the mistakes travel and come back along these feedback loops. Next time around we can act differently. This means that a community has its own intelligence, its own learning capability. In fact, a living community is always a learning community" (p. 13).

14. Professional Learning Community: a focus on the administrators, teachers, and professional staff within the education context and defined as "a group of people with many common work-related values and goals engaged in continuous efforts to increase their individual and collective abilities to foster student learning" (Leithwood et al., 2006, p. 26).

15. Reading literacy: defined in PISA 2009 as "an individual's capacity to: understand, use and reflect on and engage with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society" (OECD, 2009; p.14)...

16. Reading performance: a PISA score in the reading domains expressed as scaled scores with a mean of 500 points for all the OECD countries and a standard deviation of 100 (Knighton et al., 2010). Student proficiency scores are estimated based on item response scaling models and the use of imputation methodology referred to as plausible values.

17. School size: determined by the number of boys and girls in the school.

Parameters of the Study

Upon choosing to conduct a study on organizational learning within a quantitative research design, I acknowledged certain underlying assumptions, the result of delimitations in the decisions made, and limitations related to secondary analysis of a cross sectional study.

Assumptions

Certain aspects underlying the study are assumed, essential to the research, and often out of the control of the researcher. In this study, the following assumptions have influenced this study:

1. Schools are living systems that learn through networks of individuals, ranging from team or group learning to whole school learning.

2. The learning that exists in the schools influences the learning of staff members and students.

3. Organizational learning can occur as a result of stimuli or conditions.

4. The conditions associated to external and internal organizational learning processes can be objectified for direct or indirect observation by the researcher.

5. Participating principals responded honestly to survey questions.

6. Participating students read, responded honestly and to the best of their ability to literacy and survey questions.

7. Student and principal perceptions represented their experience within their school learning system.

Delimitations

Certain choices were made that narrow the scope and boundaries of the study. Research questions, sources, analyses, and syntheses of the data were delimited as follows:

1. The focus of organizational learning is on processes supported to by school conditions and not the organizational content or knowledge learned.

2. The conditions of organizational learning were examined from perceptions of students and principals. School organization does involve many other stakeholders of whom their viewpoints were not obtained – such as parents, teachers, school staff, community members, school division central office, and provincial Ministry of Education.

3. Data collection was delimited to the time period of primary data collection. In Canada, administration of the PISA occurred during regular school hours in April and May, 2009.

4. The examination of the conditions that foster organizational learning were delimited by a decision to conduct a secondary analysis of PISA 2009 and the operationalization from items within PISA 2009 questionnaires.

5. Student population targeted by PISA were 15 year olds of which there were 23,207 Canadian and 1,997 Saskatchewan 15 year old students.

6. The PISA 2009 measures student achievement at a given point in time, therefore, this study did not examine achievement growth.

Limitations

There were some limitations that need to be kept in mind when reading and interpreting the findings of this study. The following limitations applied to this research:

1. The information was limited by secondary analysis. The measuring of intended constructs were limited to items available within the PISA 2009 instruments. On the

other hand, secondary analysis does contribute certain benefits that are discussed in more detail in Chapter 3.

2. Generalizability of findings from the study may be limited to schools with similar characteristics to the schools of the Canadian sample.

3. Multilevel modeling and correlation analysis allows for examination of relationships among variables but in no way determines causality.

4. The research design is cross sectional and given that organizations and organizational learning are dynamic and temporal, the findings may be different in another time frame.

Researcher's Background

My interest in organizational learning developed as an extension to my interest in determining how to measure learning. As a teacher, I constantly felt challenged in the process of assessing student learning. I had a strong desire to inform the student to find ways to improve their learning as well as to inform my own approaches to better facilitate student learning. Often I felt I was learning more from the student than vice versa. The reciprocity of the learning process in the student – teacher relationship was intriguing and led me to pursue my Master's degree in educational psychology.

As career and research opportunities opened up within the area of large-scale assessment, I was drawn into the importance of research to provide insights into issues with policy implications. Now, my interest was extended to the interplay of multiple levels of learning, not only at the individual level but at group and organizational levels.

My educational psychology background provided me with a research positionality predominantly from a positivist or empiricist stance as well as established within me the hunger to investigate learning. The field of educational administration furthered my interest in learning to encompass the organizational level. I believe that as we observe learning at a school level, we will find ways to inform educators, administrators, policy makers, and governing bodies to nurture an environment that contributes to the life and health of all its members and the organization as well.

Organization of the Dissertation

The dissertation is organized into five chapters. The first chapter provides an introduction to the research, the purpose, along with some personal background of the researcher's interest in the study. Chapter two includes a review of related literature in which theories of organization, learning, and organizational learning are examined along with conditions that support

organizational learning or learning organizations. Finally, chapter two concludes with the research framework to guide the study. Chapter three describes the research design, methodology, and plan for data analysis. Chapter four provides the findings. Chapter five consists of a discussion on the findings along with implications of this study for policy, theory, and further research.

CHAPTER 2

LITERATURE REVIEW

Organizational learning is touted as a key concept for organizations in response to fast-paced, ever-increasing changes due to globalization and technology advancements. Due to the rich development of organizational learning from multiple perspectives, the focus of the literature review was an attempt to provide key contributions to the notion of organizational learning. Initially, an overview of how organizational learning was defined in the literature was examined, including the definition of 'learning organization', the counterpart. Furthermore, it was important to examine how organizational learning is defined within the field of education. Second, Organizational Theory and Learning Theory were examined to provide some context to their influence and contributions that underlie the marriage of the two terms. Third, levels of learning, an important and integral characteristic to the nature of organizational learning, was explored. Fourth, the integration of theories and Systems Theory followed in order to address the multi-disciplinary approach that has influenced this study. Finally, the literature review examined conditions and factors in organizations that foster, support, and promote an integrative approach to organizational learning that views schools as learning systems. The chapter concluded with the framework of organizational learning factors that guided this study.

Organizational Learning Defined

There is no succinct common definition of organizational learning. A search of "organizational learning" in the *Oxford Dictionary of English* (Stevenson, 2010) produced no results. As one continues to ponder the meaning of organizational learning, it is not surprising that after four decades theorists continue to struggle to determine a common definition and model. To add to the challenge, each construct rudimentary in the notion of 'organizational learning' is independently at risk of divergent and fragmented theoretical development. Organizations may be viewed from a number of paradigms, depending on the fundamental ontological and epistemological stance (Burrell & Morgan, 1979). Likewise, learning theories can be framed from different epistemological traditions (Säljö, 2009). Organizational learning can also encompass the area of organizational knowledge or knowledge management with a focus on the content learned and generated. While at times there is an overlap, this research

study is delimited to literature focused on organizational learning processes rather than organizational knowledge or knowledge management.

"Organizational learning" was first coined in 1963 when Richard M. Cyert, an economist, and James G. March, a political scientist, referred to it as the behavioral manifestation of adaptation at an aggregated level in their book titled *Theory of a Firm*. They focused on the firm, a large, complex organization, as a basic unit of analysis with capability of learning as follows:

> Organizations learn: to assume that organizations go through the same processes of learning as do individual human beings seems unnecessarily naïve, but organizations exhibit (as do other social organizations) adaptive behavior over time. Just as adaptations at the individual level depend upon phenomena of the human physiology, organizational adaptation uses individual members of the organization as instruments. However, we believe it is possible to deal with adaptation at the aggregate level of the organization, in the same sense and for the same reason that it is possible to deal with the concept of organizational decision making. (Cyert & March, 1963, p. 123)

One of the most cited definitions is by Argyris and Schön (1978), the authors of the first book to be titled *Organizational Learning* and taps into cognitive and behavioral aspects of learning. The authors described organizational learning to occur when

> members of the organizations act as learning agents for the organization, responding to changes in the internal and external environments of the organization by detecting and correcting errors in organizational theory-in-use [theory of action constructed from observation of actual behavior] taking action and embedding the results of their inquiry in private images and shared maps of organization. (p. 29)

Lipshitz, Popper, and Friedman (2002) identified a turning point in the study of organizational learning when Senge (1990) focused on the positive attributes and reframed it as a learning organization. Easterby-Smith and Lyles (2011) described Senge's (1990) book as a key watershed to the field that was both "foundational work and a popularizer because it rapidly became a key source for academics as well as an inspiration for practitioners (p. 12). Senge (1990/2006) used organizational learning in reference to a learning organization that he defined where "people continuously expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" (p. 3).

Within these three definitions, it is noted that the definition of organizational learning spanned notions of 1) evidence of aggregated adapted behavior overtime to 2) a shared cognitive

process that involves reflecting on action to 3) a description of an ideal and living organization where members are continually and collectively learning. Other notable understandings of organizational learning that extend notions within these three milestone definitions include a) Cangelosi and Dill (1965) who authored the first paper entitled *'Organizational Learning'* and demarcated the advent of empirical and theoretical pursuit of the notion with the importance of integrating three levels into the model: individual learning, subsystem or group learning, and total system learning; b) Huber (1991) who suggested that organizational learning occurred even if there was the potentiality for change after the processing of information; and, c) Weick and Westley (1996) who emphasized the interpretive nature and introduced the concept from a social psychological view as a coupling of two notions that represent an oxymoron: "to learn is to disorganize and increase variety. To organize is to forget and reduce variety" (p. 440).

As can be observed from the brief overview of highlights in the defining of organizational learning over the past 50 years, the conceptual development of the notion has not converged to a singular notion; rather, multiple disciplines have contributed with a plethora of divergent spins (Crossan, Lane, & White, 1999). Thus further discussion is important to capture the richness and depth that explores the multiple research paths that may be undertaken in the field of organizational learning.

Organizational Learning Versus Learning Organization

The notions of organizational learning, learning organization, and professional learning community have common ground and have been used interchangeably; however, there were important distinctions addressed within the literature. Organizational learning was described as an academically-oriented concept and more theory driven while learning organization is prescriptive and practice-oriented (Argyris, 1999). The "learning organization" term was first coined in the title of the book authored by Garratt (1986); however, it was attributed to have earlier roots in action learning, systems thinking, and scientific management (Garratt, 1999). Popularity of learning organization followed the Senge's (1990) publication. The term 'professional learning community' has overlapped with the notion of a 'learning organization' specific to the educational context. It was defined as "a group of people with many common work-related values and goals engaged in continuous efforts to increase their individual and collective abilities to foster student learning" (Leithwood et al., 2006, p. 26).

Organizational learning was described more as a process and activity while the learning organization was described as a utopian state or a visionary aspiration. The classic organizational learning definition by Argyris and Schön (1978) focused on the action of "detecting and correcting errors" (p. 29). In contrast, Senge's (1990/2006) definition of a learning organization focused on the people and their collective capacity that comprise the organization. Argyris (1999) referred to the organizational learning literature as two-pronged with proponents of learning organization focused on the prescription of enablers through which organizations may enhance their capability rather than the meaningfulness of organizational learning as a primary concern.

In the midst of two distinct paths to approaching *organizational learning* and *learning organization*, some researchers argued for the integration of the two. Tsang (1997) observed a dichotomy in the field of organizational learning approaches: 1) prescriptive or concerned with 'How should an organization learn?' that is practitioner-oriented and included the learning organization writings; and, 2) descriptive or concerned with 'How does the organization learn?' that is academic-oriented. He suggested an integration of the two approaches would contribute to theory that addresses gaps in linking theory with practice. Likewise, Ortenblad (2004) suggested that an integrated model including both concepts would increase the more practice-oriented term of 'learning organization' to become more academically accepted.

Dodgson (1993) delineated the two terms in the use of them in the following statement: "Firms that purposely construct structures and strategies so as to enhance and maximize organizational learning have been designated 'learning organizations'" (p. 377). Leithwood, Jantzi, and Steinbach (1995) undertook an organizational learning perspective that was guided by both concepts. They suggested a learning organization is characterized by the fostering of conditions to develop the organizational learning processes. They focused on Fiol and Lyles' (1985), definition for organizational learning: "the process of improving actions through better knowledge and understanding" (p.203) along with Leithwood and Aitken's (1995) definition for learning organization:

> a group of people pursuing common purposes (individual purposes as well) with a collective commitment to regularly weighing the value of those purposes, modifying them when that makes sense, and continuously developing more effective and efficient ways of accomplishing those purposes. (p. 63)

In addition to integrating the two concepts, Dodgson and Leithwood et al. were among the researchers that were instrumental in promoting the organizational learning within the educational context. The application of organizational learning and learning organizations within the educational setting was furthered explored and summarized in the next section.

Schools as Learning Organizations

While learning is notoriously associated with school and educational institutions, organizational learning within the field of education became of interest since the early 1990s with the onset of Senge's (1990) popularization of the learning organization. Silins and Mulford (2002a; 2002b) ascribed the development of schools as learning organizations as necessary in response to the need for continuous educational system restructuring 'in face of complex global changes'. Wößmann, Lüdemann, Schütz, and West (2007) argued that the structure of the school system is an important factor in having a significant effect on student achievement. Organizational learning and 'professional learning communities', a notion developed from conceptual understandings of the school as a learning organization (Mitchell & Sackney, 2011), have been found to be important factors integral to school-wide capacity for promoting student learning (Marks et al., 2000; Sackney, Walker, & Hajnal, 1998; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006). Stoll (2009) advocated for a quality of capacity that is systemic, holistic, and multifaceted that promotes learning at all levels of the school; and, she defined capacity as "the power to engage in and sustain learning of people at all levels of the educational system for the collective purpose of enhancing student learning" (p. 470). Mitchell and Sackney (2011) stressed for an understanding of schools as living systems and developed a model with three mutually influencing and interdependent levels of capacity building: personal, interpersonal, and organizational.

Conceptualizing schools as learning communities and focusing on building the capacity of the learning community introduced a major shift in thinking and implicates transformation of school structure, strategy, management, and school culture. Mitchell and Sackney (2011) described this shift in thinking in the following:

> The notion of the school as a learning community represents a fundamental shift in the ideology that shapes the understanding of schools and professional practice. The traditional view of schools is grounded in a mechanistic worldview and associated with a positivistic epistemology, rationalist methodology and a managed system. From this perspective control and power reside at the top of the school organization and roles,

responsibilities, spheres of decision making are clearly delineated. Wholes are composed of parts that can be removed and replaced… (p. 142)

More importantly, schools with emphasis on learning communities have been associated with more successful student outcomes (Vescio, Ross, & Adams, 2008). In their LOLSO (Leadership for Organizational Learning and Student Outcomes) Project, Silins et.al. (2002) found that secondary schools could be characterized as learning organizations when they measured to a higher extent on a nested model with four dimensions of organizational learning characteristics and processes: 1) collaboration in a climate of openness and trust; 2) shared and monitored vision and goals; 3), encourage experimenting and risk taking; and, 4) the provision of professional development opportunities. Mitchell and Sackney (1998) determined comparable factors associated with organizational learning in the school context. They found an affective climate that included affirmation (valued as professionals) and invitation (valued their participation) provided a safe environment for the two cognitive processes, reflection and professional conversations, to flourish.

The literature of 'learning communities' and 'professional learning communities' in the educational field focused on the teacher and/or administrator learning community (Stoll & Louis, 2007; Mitchell & Sackney, 2011). The Stoll et al. (2006) literature review on professional learning communities indicated that much of the literature considered teachers and school leaders but excluded support staff such schools with special needs or preschool programs. They contended that the affective aspects were more community oriented (such as supportive relationships and shared norms and values) whereas the cognitive aspects were more professional-oriented (such as acquisition of knowledge and skills, professional autonomy, and approaches to clients). Mitchell and Sackney (2011) acknowledged the focus on the learning community defined as teachers and administrators but supported and argued for expansion of the learning community to include the students and even further to include the parents, community services and agencies associated with the school. In the LOLSO model (see Figure 1), Mulford (2005) conceptualized organizational learning in terms of the principal leadership and teacher leadership that incorporated a teacher voice. While the model included a student 'voice', it is conceptualized outside of the organizational learning community in terms of student socioeconomic status as well as student outcomes (i.e., academic achievement and non-academic student retention.
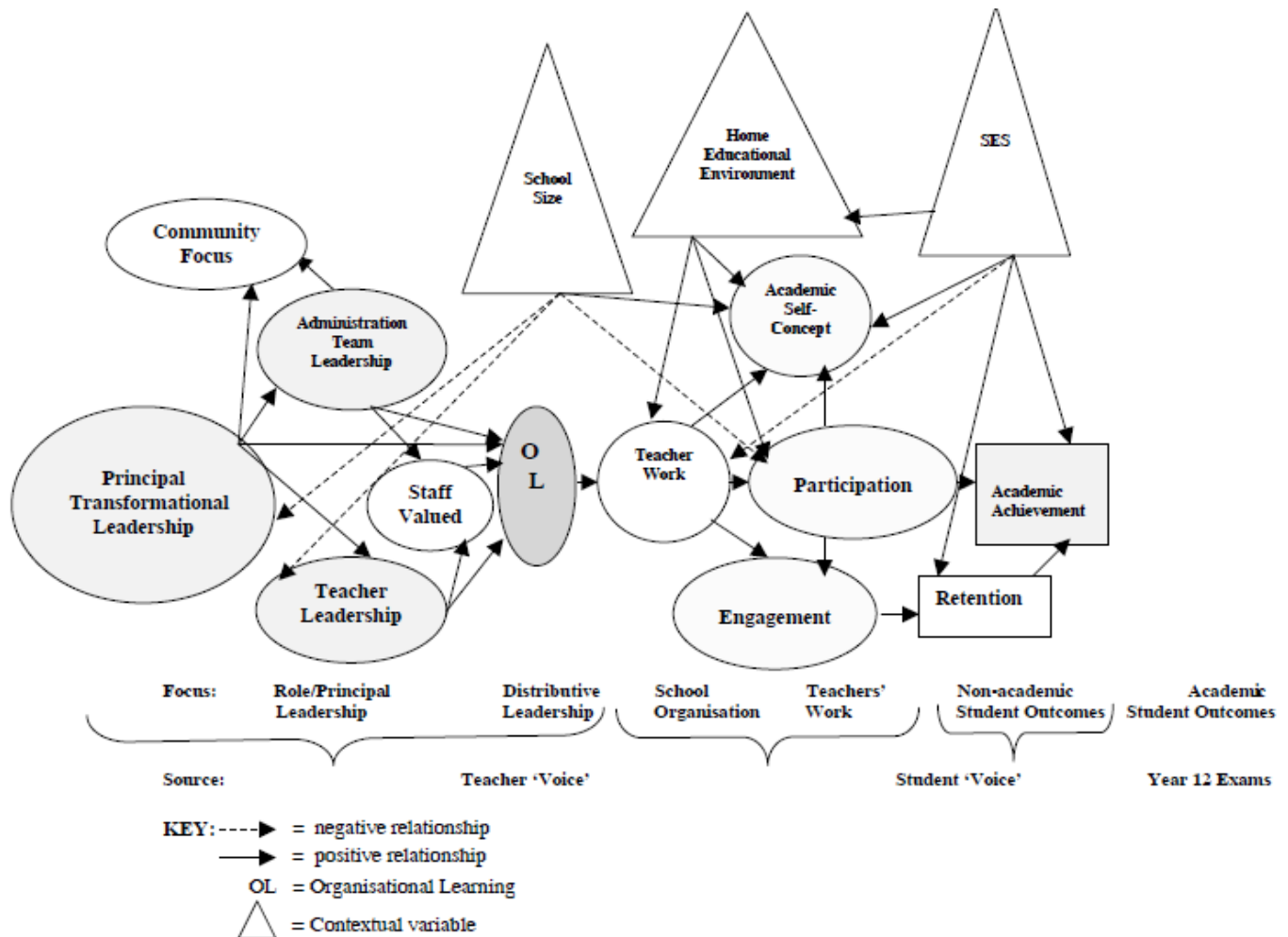
Figure 1. Leadership for organizational learning and improved student outcomes (LOLSO) model. From "Quality evidence about leadership for organizational and student learning in schools" by B. Mulford, 2005, *School Leadership & Management, 25.* p. 326. Copyright © 2005 Routledge. Taylor & Francis is pleased to offer reuses of its content for a thesis or dissertation free of charge contingent on resubmission of permission request if work is (commercially) published. Reprinted with permission.

  Mitchell and Sackney (2011) described the school as a learning community that necessitates development of capacity and organizational learning in three interdependent levels: personal, interpersonal, and organizational. Their model focused on the professional teacher and administrator community and consisted of an interplay of affective, behavioral and cognitive domains.

  At the personal level, they borrowed elements from Argyris and Schön (1978) to indicate theories-in-use can inform practice and action while espoused theories can inform knowledge and what is said. Additionally, reflection and inquiry were considered important processes to

evaluate the alignment and consistency between practice and knowledge. Building on Schwandt and Marquardt's (2000) and Parsons (1951) General Theory of Action, Mitchell and Sackney (1998) ascribed learning as the building of personal capacity when reflection and inquiry of practice and experience informs knowledge and vice versa. At the interpersonal level, characteristics of school climate and collaboration contribute to learning premised on trusting relationships and collective sense making. Mitchell and Sackney (1998) found evidence that a 'growth-promoting' affective climate that consists of invitation (i.e., involving member participation) and affirmation (i.e., valuing member contributions) will foster a cognitive climate that entails collective reflection and professional discourse. Mitchell and Sackney (2011) referred to the affective climate as the 'heart' of the community and the cognitive climate as the 'mind' of the community. Their perspective stressed the importance of collaboration to teamwork and the learning community. At the organizational level, Mitchell and Sackney (2011) strongly advocated for structures that support a living system or learning community and warned against models that manage in controlling, strict mechanistic ways. They spoke of structures that extended beyond the visible and to include "assumptions, values, belief systems, vision, purpose, relationships, culture and process" (p. 105). See Figure 2 for Mitchell and Sackney's (2011) model of key elements to building capacity for a learning community.

 The preceding two sections have provided an overview of the definition of organizational learning as well as a summary of how the literature defined organizational learning within the field of education. The following two sections have concentrated on the two theories that underlie the union of the two terms.
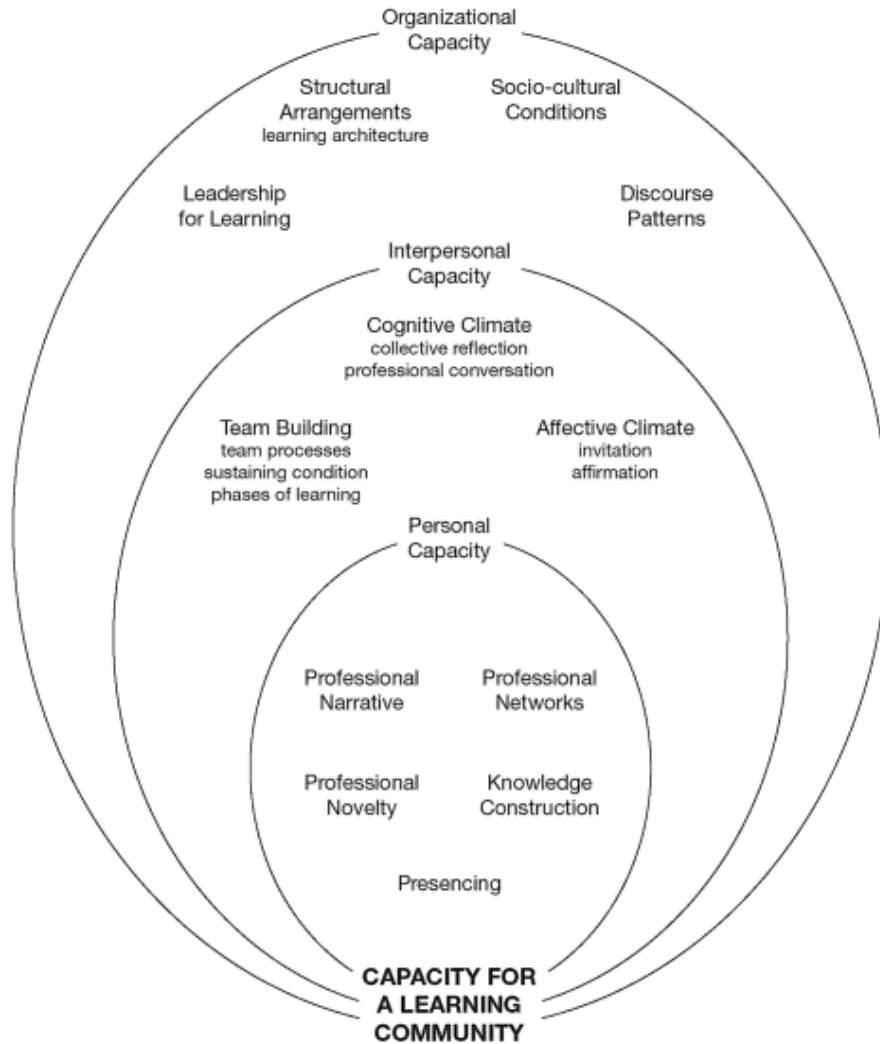
Figure 2. Key elements in building capacity for a learning community. From *Profound Improvement: Building Capacity for a Learning Community. Second Edition.* (p. 141), by C. Mitchell and L. Sackney, 2011, London, Great Britain: Routledge Taylor & Francis Group. Copyright © 2011 by Coral Mitchell and Larry Sackney. Reprinted with permission.

Organizational Theory

Organizational learning can be viewed from multiple perspectives as is the case of other underlying theories of organization. Theories of organization can be described by the underlying ontological (what is the nature of an organization's existence) and epistemological (how we know and understand an organization) assumptions. Therein, the multiple theories underlie the debate on the nature of organizations or, furthermore, the nature of how organizations learn. For this aspect of the literature review, Burrell and Morgan's (1979) fundamental classification of

paradigms was utilized to situate views of organizational learning within theories of organization.

A basic classification of organizational learning theories was determined by drawing upon the paradigmatic structure proposed by Burrell and Morgan (1979). Figure 3 illustrates an overview of primary characteristics of organizational learning theories within each paradigm. Essentially, Burrell and Morgan classified social theories or theories of organizations into four paradigms (i.e., functionalist, interpretive, radical structuralist, and radical humanist) based on two dimensions consisting of meta-theoretical assumptions: 1) a set of congruent assumptions dichotomously defined as objective or subjective that related to the scientific study of human nature with ontological, epistemological, and methodological underpinnings; and 2) a set of assumptions related to the nature of society dichotomously defined in terms of regulation or radical change. While the authors defined the paradigmatic structure within the two dichotomies, they provided some indication of a continuum within each dimension by describing extreme or borderline positions as well as variations within each quadrant.

	Subjective ← *Nature of Social Science* → Objective	
Radical Change ↑	critical of power with focus on change to social consciousness	critical of power with focus on radical change to social structures
	Radical Humanist	**Radical Structuralist**
	focus on OL processes involved in members' understandings and activities with emphasis on determining what limits human development facilitates emancipation by cultural change	focus on roles and the dialectical processes of OL facilitates emancipation of people in dominating social structures
Nature of Society ↓ **Regulation**	regulation focused on subjective constructions of social world	regulation focused on facts in social reality
	Interpretive	**Functionalist**
	social constructivism important to OL process learning situated in communities organizational members have free choice and autonomy	extreme behaviourist view with passive learning process for organizational members to borderline subjective that includes sharing of mental maps

Figure 3. Positioning organizational learning in Burrell and Morgan's (1979) four paradigms. Adapted by permission of the Publishers from 'Figure 3.1 Four paradigms for the analysis of social theory', *Sociological Paradigms and Organisational Analysis* by Gibson Burrell and Gareth Morgan, 1979 (Farnham: Ashgate,1985) p. 22. Copyright © 1985.

Examples of organizational learning were found in the literature from the four positions; however, the literature pointed to a dominant approach from a functionalist paradigm that holds

to a realist ontology and a positivist epistemology. The interpretive paradigm with a subjective ontology was gaining ground in predominance. Few studies take on the radical structuralist or radical humanist perspective (Ortenblad, 2004).

A common assumption to the functionalist view was that an organization exists independent of observation; however, there were variations within this view. Generally, organizational learning could be objectified (Spender, 1996) and organizational memory could be stored external to the individual members (Daft & Weick, 1984; Levitt & March, 1988). From the more extreme position, a behaviourist view focused on adaptation that results in behavior change (Cangelosi & Dill, 1965) or events from the environment such as reward and punishment feedback that shape behavior (Mausolff, 2004). The individual was perceived as more passive in the learning process and exemplified the deterministic aspect of this paradigm. The more borderline subjective position included the acknowledgment of the organizational members' implicit cognitive understandings and sharing mental maps (Argyris & Schön, 1978). Senge (1990/2006) took an approach that would fall into middle ground of the functionalist paradigm and considered to be normative and prescriptive. Following the tradition of systems theory and cybernetics, the approach assumes the social world is a concrete reality that can be observed and investigated through nomothetic methodological holism; however, there was an element of idealism. The learning organization is proposed as an idea that no one can actually attain but continually aspires to. Additionally, there was some suggestion of an intersubjective nominalist position required in the uncovering of assumptions within individual mental models and the team approach to developing a shared vision (Lane, 1994).

From the interpretive paradigm, reality was assumed to be subjective. In organizational learning, the reality was defined within relationships and participation in the organization. Organizational learning was situated within communities of practice (Lave & Wenger, 1991), and contextualized in the social practice (Brandi & Elkjaer, 2011). Organizational knowledge was not stored but supplanted by the more culturally framed active process of knowing (Blackler, 1995) and socially constructed through the medium of language. This view emphasized social learning such that the ontological issue of socialization and the epistemological issue of learning, what it means to be part of the world, become inseparable processes (Brandi & Elkjaer, 2011). Thus, the epistemological assumptions of learning in the organization and social practice or participation become entangled (Gherardi, 2011). Theorists

within the interpretivist paradigm viewed human nature as voluntaristic and allowed for free choice and autonomy by organizational members (Miller D. , 1996).

A common thread to the approaches within the functionalist and interpretivist paradigms was the underlying belief in the solidarity of society with a focus on a sociology of regulation. Theorists within the two paradigms were generally concerned with the need for regulation in society, order, and cohesion. Functionalists would be oriented towards the facts of the social reality whereas the interprevists would be focused on the subjective constructions of the social world. Burrell and Morgan (1979) contrasted these two positions focused on integration to the theorists concerned with the sociology of radical change that aims to find "explanations for the radical change, deep-seated structural conflict, modes of domination and structural contradiction which its theorists see as characterizing modern society" (p. 17).

Radical change constituted and was the common thread of theoretical interest in sociology of the two remaining paradigms within the Burrell and Morgan (1979) typology: radical humanist and radical structuralist. A primary interest for the two paradigms was power conditions in the organization and the emancipation of all members. The focus was in human development and cultural change from the humanist position versus interest in change to the roles and structure of the organization from the structuralist position. Few studies addressed the power issue in organizational learning such that they could be categorized within these two paradigms; however, the predominance of literature was critiqued for not overtly addressing the issue of power (Coopey, 1995; Huzzard, 2004). Ortenblad (2002) illustrated a radical perspective to organizational learning and distinguished the humanistic view as a focus on changes in social consciousness and cognition from the structuralist view as a focus on radical changes to the structural relationships. Dovey (1997) advocated that the radical humanist approach has the potential to facilitate the transformation of power and learning in the creation of a learning organization, particularly de-emphasizing hierarchical bureaucratic culture and individual competitiveness for a culture that flattens power structures. In general and in practice, the organizational management often shy away from the confrontational and critical methods implicit in these radical approaches.

Burrell and Morgan (1979) provided a framework for studying organizations and the respective theories. While their typology system was popular and provided a common ground for situating organizational studies, it was not complete nor without controversy. In particular,

theorists have challenged the notion of incommensurability amongst the four paradigms (Schultz & Hatch, 1996). In addition, different disciplines may debate with different emphasis as, for example, theorists within the discipline of organizational economics would favor market implications (Swedberg, 2003). Nonetheless, Burrell and Morgan's four paradigms provided a suitable base from which to capture the span of views within organizational learning. After all, the two continuums that premise their structure related to the two constructs in 'organizational learning': nature of society overlaps with organizations and nature of human knowledge overlaps with learning. In the following section, multiple perspectives to organizational learning are further diversified upon the examination of literature within learning theory.

Learning Theories

The concept of organizational learning has been embraced by researchers within a wide variety of disciplines (i.e., education, psychology, sociology, anthropology, business, management) leading to variations in theoretical perspectives of learning. The literature review focused on the predominant psychological, sociological, and anthropological learning theories influencing organizational learning theorists. Four main approaches have been examined and categorized as behaviorial, social, cognitive, or sociocultural.

Behavioral Learning

The long history of psychological individual learning theories were a precursor to organizational learning (Shrivastava, 1983). Initially organizational learning theories focused on adaptive behavior. Behavior learning that relates to more automatic and routine actions would be conceptually parallel to Pavlovian classical conditioning that "an organism learns about signals in environment (CSs)[1] that predict biologically significant events (UCSs) and allow organism to prepare for them (CRs)" (Mowrer & Klein, 2001, p. 3). Herbert A. Simon (1953) articulated this notion of learning within organizations as follows:

> we recognize that environmental forces mold organizations through the mediation of human minds. The process is a learning process in which growing insights and successive restructurings of the problem as it appears to the humans dealing with it reflect themselves in the structural elements of the organization itself. (p. 236)

Behavior that is shaped by Skinnerian operant conditioning involves more voluntary learning and the association of the behavior with some consequence. Leavitt and Bass (1964) discussed the

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[1] The author had ascribed acronyms as follows: CS as conditioned stimulus; UCS as unconditioned stimulus, and CR as conditioned response.

role of rewards and incentives as key to motivating desired organizational behavior as well as continue in maintaining the behaviour over time. Such approaches are still considered to be crucial to organizational learning and organizational change (Duhigg, 2012). For example, Verplanken and Wood (2006) suggested that public policy intervention could incorporate insights of crucial environmental factors that can cue behavioral change either to disrupt old habits or establish new ones. Also, Duhigg (2012) indicated the use of disrupting keystone habits as a lever for change, was how Paul O'Neill as CEO was instrumental in making Alcoa the safest company in the world along with record profit growth:

> O'Neill's safety plan, in effect, was modeled on the habit loop. He identified a simple cue: an employee injury. He instituted an automatic routine: Any time someone was injured, the unit president had to report it to O'Neill within twenty four hours and present a plan for making sure the injury never happened again. And there was a reward: The only people who got promoted were those who embraced the system. (p. 106)

Behavioral learning theorists tend to be aimed at more routine actions or actions associated with consequential changes in organizations. In the next section, research literature was investigated an extension to behavioral learning that addressed the social dimension to learning.

Social Learning

Within the social learning theory perspective, researchers introduced the social dimension to learning by finding that observation of others has a role in learning. At times the literature was confusing in defining social learning from the diverse approaches. Within this review, social learning theory was delineated as coming from the psychology tradition influenced by Bandura (1977) whereas the theories influenced by social theory and anthropology tradition are presented later in the sociocultural learning section.

The learning was explained as an iterative dynamic process of observer and the observed behavior of others which in turn influences subsequent behavior. Bandura (1977) summarized the rich interaction of multiple domains involved in humans' remarkable ability of observation that influenced the development of his theory as follows:

> The extraordinary capacity of humans to use symbols enables them to represent events, to analyze their conscious experience, to communicate with others at any distance in time and space, to plan, to create, to imagine, and to engage in foresightful action. Renewal of emphasis on symbolic functions expanded the range of techniques for analyzing thought and the mechanisms by which thought regulates action. The third distinctive feature of social learning theory is the central role it assigns to self-regulatory processes. People are

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not simply reactors to external influences. They select, organize, and transform the stimuli that impinge upon them. (p. vii)

Bandura (1977) concluded that "both people and their environments are reciprocal determinants of each other" (p. vii). Subsequently, Bandura (1986) directed his framework to a social cognitive theory wherein the cognitive learning was included to emphasize the *triadic reciprocality* of three dimensions intertwined in the process of learning. Self-regulation was emphasized as having a central role to the learning process in that members are "principal agents of their own change". By understanding the proactive and purposive use of information within the qualities of self-regulation, Bandura (2001) suggested organizations could be poised to face the rapid change of technological advancement.

Additionally, fundamental to social cognitive theory was the notion of self-efficacy defined as "people's beliefs in their capability to exercise some measure of control over their own functioning and over environmental events" (Bandura, 2001, p. 10). While self-efficacy was applied to individual level of learning, a group-level learning was acknowledged. Collective efficacy, an extension of self-efficacy and unique to the organizational level, was defined as "an emergent group-level property, not simply the sum of the efficacy beliefs of individual members…[and] is people acting conjointly on a shared belief, not an disembodied group mind that is doing the cognizing, aspiring, motivating, and regulating" (Bandura, 2001, p. 14).

In applying this theory to a group level, researchers attempted to explain organizational behaviours that effect social change. The focus is on the individual within the organization rather than an organization made of individuals. Nonetheless, a social learning perspective indicated that an organizational level of learning also emerged. In general, social learning theorists considered the social influences on the organizational activities. Furthermore, social cognitivists, as the name implies, were interested in how the organization develops or changes as a result of the interplay between social and cognitive processes. The following section examined literature with a primary focus on cognitive processes involved in learning.

Cognitive Learning

Within the organizational learning literature, two aspects of cognitive learning pertained to the more automatic and routine nature of learning as compared to the complexities of shared mental maps. These two aspects have been captured in advancements in cognitive learning theories that take a biological approach as two social network systems within the brain that

decipher signals: 1) an automatic, involuntary system that is based more on tacit information; and 2) a deliberate, conscious system that relies on explicit knowledge and the ability to mentalize (Frith & Frith, 2010). Mentalizing, also referred to as theory of mind, was described as an ability to attribute knowledge and beliefs which aids in communicating with another person (Frith & Frith, 2003). Learning that involve cognitive processes such as metacognition and reflection were considered vital to mentalizing as suggested by Frith and Frith (2012) in the following:

> Explicit mentalizing is a meta-cognitive process and enhances the ability to learn about the world through self-monitoring and reflection, and may be uniquely human. Meta-cognitive processes can also exert control over automatic behavior, for instance, when short-term gains oppose long-term aims or when selfish and prosocial interests collide. We suggest that they also underlie the ability to explicitly share experiences with other agents, as in reflective discussion and teaching. These are key in increasing the accuracy of the models of the world that we construct. (p.287)

From the cognitive learning perspective, learning involved changes of mental states such as changes in a cognitive map and/or mental representation. To further explore the concept of mental maps, Mowrer and Klein (2001) delineated subtle differences between formation of mental maps that are behavioral stimulus-driven (Hull, 1943) versus the cognitive reason-driven (Tolman, 1948) theoretical approach cognitively as follows:

> In a sense, Tolman says "head over that way" while Hull says "turn left, left, then right." Who is more accurate? It depends. When general environmental cues are not available to direct behavior, Hull is correct. However, when cues are available that indicate the location of a goal in a more general sense, Tolman is correct. To clarify, in a darkened cave you might find your way out by recalling specific turns in response to specific stimuli (turn left, left, then right). Under a different circumstance, one in which more general environmental cues are available, you might head in a general direction toward a goal (to get to the shopping mall, head toward the university and then head west). (pp. 12-13)

The notion of cognitive maps and other constructs from cognitive psychology and individual learning have been borrowed as metaphors or extended into unique entities within the field of organizational learning. Building on the metaphor of individual learning, processes within the organization are analogous to individual processes. Organizations develop cognitive strategies that involve and/or modify perceiving, encoding, retrieving, thinking, and problem-solving (Dodgson, 1993). Senge (1990/2006) emphasized the sharing of mental maps as one of the five disciplines important to a learning organization. Argyris (1999) stressed that inquiry and

individuals acting on behalf of the organization were key to organizational learning. He defined inquiry as "the intertwining of thought and action carried out by individual in interaction with one another on behalf of the organization to which they belong in ways that change the organization's theories of action and become embedded in organization artifacts such as maps, memories, and programs" (p. 9). Weick and Bougon (1986) approached organizations from an interpretive perspective and wrote: "Organizations exist largely in the mind, and their existence takes the form of cognitive maps. Thus, what ties an organization together is what ties thoughts together" (p. 102). Hedberg (1981/2006) recognized the strong support for individual learning within organizations but also suggested cognitive processes at organizational level unique to individual learning:

> Although organizational learning occurs through individuals, it would be a mistake to conclude that organizational learning is nothing but the cumulative result of their members' learning. Organizations do not have brains, but they have cognitive systems and memories. As individuals develop their personalities, personal habits, and beliefs over time, organizations develop world views and ideologies. Member come and go, and leadership changes, but organizations' memories preserve certain behaviors, mental maps, norms, and values over time. (p. 327)

Crossan, Lane, and White (1999) developed a '4I' model that consisted of four key organizational learning processes in their framework: intuiting, interpreting, integrating, and institutionalizing. They considered the process of interpreting when language and sharing of cognitive maps was crucial to the integrating phase and suggested that this process was where the organizational learning moved from an individual to a group process.

Essentially, cognitive approaches to organizational learning are focused on changes that occur in the mind and the means of sharing these interpretations with others. Sociological perspectives locate organizational learning in the relationships that occur in the social world and "as something people do together" (Gherardi, 2011, p. 43). The next section moves into the interplay of sociological and psychological dimensions of organizational learning

Sociocultural Learning

Within the sociocultural learning approaches, there is a marriage of influences from sociological, anthropological, and psychological perspectives. Sociocultural learning approaches have been classified as social learning theories (Brandi & Elkjaer, 2011); however, this study delineated a difference from other social learning theories such as Bandura's (1977) social learning. Other approaches within this category include "situated learning" (Lave & Wenger,

1991), 'practice-based learning' (Gherardi, 2011), 'actor-network theory' (Fenwick & Edwards, 2011; Fox, 2000), and cultural historical activity theory (Kerosuo, Kajamaa, & Engeström, 2006). The sociocultural learning perspectives have a cultural and/or contextual focus to their approach as well as a connection to elements of Vygotskian sociocultural theory (Haenen, Schrijnemakers, & Stufkens, 2003; Packer & Goicoechea, 2000). Vygotsky (1994) emphasized the role of environment as a source rather than a setting for learning and expressed a key principle to his theory as the following:

> the child's higher psychological functions, his higher attributes which are specific to humans, originally manifest themselves as forms of the child's collective behaviour, as a form of co-operation with other people, and it is only afterwards that they become the internal individual functions of the child himself. (p. 353)

Brandi and Elkjaer (2011) described this learning as "learners are social beings that construct their understanding and learn from participation within the specific socio-cultural settings of an organization" (p. 29). Generally, the primary mediating role of culture in learning is a unifying premise to approaches in this category.

The cultural approach of organizational learning shifted the examination to the action of the collective group. By focusing on organizations as cultures, Weick and Westley (1996) (1996) noted that "they focus less on cognition and what goes on in individual heads, and more on what goes on in the practices of groups" (p.442) with language, artifacts, and action routines as three cultural subsystems key to organizational learning. Also, Cook and Yanow (1993) defined culture "in application to organizations as a set of values, beliefs, and feelings, together with the artifacts of their expression and transmission (such as myths, symbols, metaphors, rituals), that are created, inherited, shared, and transmitted within one group of people and that, in part, distinguish that group from others" (p. 379). The cultural learning approach emphasized group learning, shared meanings carried through organizational artifacts, the collective activity, organizational knowledge made operational by several individuals acting 'in congregate', and a predominance of tacit transmission (Cook & Yanow, 1993). Schien (1993) advocated for understanding the role of dialogue for understanding cultures and subcultures in organizational learning in the context of rapid technological growth, especially when involving changes of cultural assumptions across subcultural boundaries.

The community or social setting is emphasized in the learning that "takes place when divergent interests, norms, values, and constructions of reality meet in an environment that is

conducive to learning" (Wals & van der Leij, 2007, p. 18). Wenger (2010) argued that the *community of practice* is the simplest social unit that characterizes processes found in a social learning system, such system characteristics as, "emergent structures, complex relationships, self-organization, dynamic boundaries, ongoing negotiations of identity, and cultural meaning" (pp.179-180).

The notion of communities of practice on participation in a shared activity is situated in a community of learning (Lave & Wenger, 1991). They named 'legitimate peripheral participation' as a key process of how newcomers of a community become members, and defined the concept as follows:

> Legitimate peripheral participation' provides a way to speak about the relation between newcomers and old-timers, and about activities, identities, artifacts, and communities of knowledge and practice. It concerns the process by which newcomers become part of a community of practice. A person's intentions to learn are engaged and the meaning of learning is configured through the process of becoming a full participant in a sociocultural practice. This social process includes, indeed it subsumes, the learning of knowledgeable skills. (p. 29)

Throughout the literature, there were a variety of approaches to articulating the social cultural relationship within organizational learning. Brown and Duguid (1991) emphasized the working-learning-innovating relationship that involved a collective interpretation, collaborative processes, a blend of individual learning with collective learning, and socially constructed vision. Nicolini and Meznar (1995) proposed that organizational learning is not limited to the cognitive processes within individual learning and must take into consideration learning at an aggregate level that is socially constructed. Gherardi, Nicolini and Odella (1998) stressed the relational aspects of learning in organizations and employed Bourdieu's notion of 'habitus', "a system of durable, transposable dispositions or principles which generate and organize practices and representations that can be objectively adapted to their outcomes without presupposing the conscious pursuit of ends or express mastery of the operations necessary to attain them" (p. 278). While language is central to this approach to learning, the tacit nature of learning includes customs and traditions that often go unspoken (Gherardi, Nicolini, & Odella, 1998; Weick & Westley, 1996).

The socio-cultural approach viewed organizational learning as a complex interplay of individual learning and collective learning as well as language and action. From the organizational learning perspective, the underlying emphasis was on the collective rather than the individual. Nonetheless, the next section is focused on how the different theories in the

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literature have grappled with the role of the different levels of learning which is inherent to all organizations.

Levels of Learning

In the literature of organizational learning, discussion of levels of learning are examined from organization levels and/or levels of processing. The perspective of organizational learning can impact how levels of organizational learning are approached (Crossan, Lane, White, & Djurfeldt, 1995). Levels of learning are often part of the debate as to whether an organization can learn or if it is only the individual members within the organization that can learn.

Organization Levels

Given the social context of the organization, organizational learning is multilevel; however, the view of the relationship of the levels in the context of organizational learning varied depending on the approach. This issue brought into the debate as to how, when, and what level the learning takes place (Crossan, Lane, White, & Djurfeldt, 1995). Three primary approaches to the individual level versus organizational level discussion included: 1) a focus on change at individual level will result in change at organizational level (Argyris & Schön, 1978); 2) a focus on the learning at the organizational level that will result in change at the individual level (Cook & Yanow, 1993); or, 3) learning at both individual and organizational levels (March J. G., 1991). Other approaches incorporated learning at three levels: individual, group, and organization (Crossan, Lane, & White, 1999; Mitchell & Sackney, 2011; Senge, 1990/2006).

In the initial stages of the development of organizational learning, Cyert and March (1963), who focused on the organizational decision-making process, suggested that organization level learning was an adaptation at the aggregate level of the organization dependent on the individual level. They viewed learning at the organizational level occurred when there was a change in organizational goals, a change in what aspects of the organization received attention, or a change in the way an organization searches for solutions to problems.

According to Argyris and Schön (1978), organizations learned through individuals acting on behalf of the organization; however, the organizational learning system facilitated the individual learning. Schön (1975) argued that creativity was a property at the individual level and members had to be creative if you wanted your organization to be creative. He added that capacity was a property at the organizational level and if you wanted your members to be creative, it was important to provide the organizational conditions to facilitate individual

creativity. He suggested that organizational learning occurs through experiences gained by the individual members. Espoused theories (mental maps that inform what they say) and theories-in-use (mental maps inferred from what they do) were purported to occur at the individual and the organization levels. Learning was described as the process of detecting and evaluating the degree of mismatch between intentions and outcome of action (Argyris, 2005). At the individual level, a member's mental map was a partial, changing image in relation to the whole organization. At the organizational level, organizational theories-in-use were shared descriptions of the organization which individuals jointly construct and use to guide their own inquiry (Argyris, 1999). The theories-in-use consisted of two components: governing values that inform intentions and behavioral strategies that are informed by actual behavior (Argyris, 1976). Inquiry, feedback, and reflection were considered important characteristics in the dynamic process of constructing theories-in-use through both the individual and collective mental maps (Argyris, 2005; Argyris & Schön, 1978). Following Argyris and Schön (1996), Collinson and Fedoruk-Cook (2007) concurred that individual level learning is central to organizational learning; however, they suggested that learning at the organizational level interacted and influenced the individual level. They acknowledged that boundaries between the two levels can be blurred and referred to Chatman, Bell, and Staw's (1986) micro-macro linkage. Chatman et al. (1986) stressed the importance of contextual factors (macro) in individual learning (micro) along with the reciprocity of this relationship in the following:

> There is conceptually an overlap between individual and organizational behavior that is seldom acknowledged. This is because when we look at individual behavior in organizations, we are actually seeing two entities: the individual himself, and the individual as a representative of his collectivity (which could be the work group or the organization). Thus, the individual not only acts on behalf of the organization in the usual agency sense, but he also acts, more subtly, 'as the organization' when he embodies the values, beliefs, and goals of the collectivity. As a result, individual behavior is more 'macro' than we usually recognize, and organization behavior is more 'micro' than is generally acknowledged. (p. 211)

Some researchers distinguished between the organizational level and its relationship to the individuals. Shrivastava (1983) recognized individual level as the basis to organizational learning but that organizational learning was more than just the sum of individual learning "organizational learning is an organizational process rather than an individual process. Although individuals are the agents through whom the learning takes place, the process of learning is

influenced by a much broader set of social, political, and structural variables. It involves sharing of knowledge, beliefs, or assumptions among individuals" (pp. 16-17), and went on to say the role of the individual learning is critical and organizational learning is the "conversion of individual knowledge and insights into a systematic organization knowledge base which informs decision-making" (p. 18) Hedberg (1981/2006) attributed the brain as the system for learning at the individual level and a cognitive system at the organization level that preserves mental maps, beliefs, norms, and assumptions of the organization. Hedberg advocated that organizational learning was different from the cumulative total of the individual members learning. Acknowledging Hedberg's model, Fiol and Lyles (1985) insisted that individual learning and organizational learning were distinct in that individual learning theory could not account for all aspects of learning at the organization level. Comparable to Fiol and Lyles (1985), Lipshitz, Friedman, and Popper (2007) took the position that there were two distinct levels of learning: individual learning as a cognitive process and organizational learning as a social process. They suggested that much of the literature on organizational learning assumes organizations learn like people and thereby incorporating anthropomorphism or attributing human quality to non-human entity. While some approaches focused on keeping these distinctions defined, in other approaches the distinctions become blurred.

Other researchers noted the dynamic process between the organizational level and the individual level. March (1991) conceptualized that the organization level consists of individuals with diverse sets of beliefs that develops an organization code to socialize members. The development of an organization code is a dynamic process between both levels:

> Individuals modify their beliefs continuously as a consequence of socialization into the organization and education into its code of beliefs. …At the same time, the organizational code adapts to the beliefs of those individuals whose beliefs correspond with reality on more dimensions than does the code. (p.85)

Schein's (1993) proposed a culture lens such that the organizational level involved learning of beliefs and assumptions shared by all members while the development of subcultures involved a group level learning with beliefs and assumptions that make them distinct. To quote Schein of the two levels:

> As organizations differentiate themselves in terms of programs, projects, functional groups, geographical units, hierarchical strata, or competency-based units (what Seely Brown and others have called "communities of practice"), we will find that each of these units inevitably creates common frames of reference, common languages, and ultimately

common assumptions-thus forming genuine subcultures that will have to be integrated if the organization is to work effectively. (p. 42)

Schein (1996) argued that a lack of alignment and understanding between subcultures can result in a hindrance to learning at the organization level.

The distinction of three levels in organizational learning is apparent from the onset of the development of organizational learning. One of the earliest empirical studies on examining distinctions between learning at levels in organizations was the work of Cangelosi and Dill (1965). They noted that learning occurred at three levels (individual, group, and organizational) stimulated by different kinds of stress and the interactions between the different levels as a result of adaptation. Discomfort stress (i.e., pressure related to time, energy, and ability constraints) and performance stress (i.e., experience, aspiration levels, and intraorganizational incentives) stimulates primarily individual level learning with impact on group levels of learning. While performance stress was viewed as an influence on the organizational level of learning, disjunctive stress (i.e., the degree of conflict and divergence from organizational expectations) were considered the major stimulus of learning at the total system level. Interactions were described to occur in that individuals and groups behavior contribute to disjunctive stress while organizational adaptation influences factors that contribute to discomfort stress and performance stress.

Within Mitchell and Sackney's (2011) conception of a learning community, teachers' professional learning in a school community consisted of three levels: individual, interpersonal, and organizational. The individual level learning was described as a search for knowledge both internally and externally that involves cognitive processes including reflection and inquiry. The interpersonal level learning was a consideration of cognitive and affective climates and cultures that support relationships and collaborative work. The cognitive climate required opportunities for collective reflection and dialogue. The desired affective climate was built on trust, respect, and caring with two aspects: 1) affirmation (i.e., valuing what each individual brings to the community) and 2) invitation (i.e., involving all members to participate). The organizational level learning was viewed as organizational structures, conditions, and strategies that support connections and valuing at all three levels of a learning community. The model was considered holistic in that any change at any level impacted the whole.

Crossan, Lane, and White (1999) provided a developmental framework of organizational learning occurring at three levels with distinct processes occurring at each level. Their 4I model consisted of intuiting process at the individual level, interpreting linking the individual to the group level, integrating linking the group level to the organizational level, and institutionalizing at the organizational level: "The three learning levels define the structure through which organizational learning takes place. The processes form the glue that binds the structure together." (p. 524).

Comparable to researchers with a view of three levels, Gherardi et al. (1998) suggested organizational learning as a social activity with three levels: individual, relational/interpersonal, and organizational. Learning at the individual level involved active participation that develops identity and membership of the organization based on the context of the activity. The view of learning was not about facts and knowledge of the organization but rather knowing how to be part of the organization. The group level was conceived in terms of a community of practice that entails common activity that is sustained and perpetuated in patterns of interpersonal relations. Learning at the organizational level was not so much about the organization but that the locale of the learning is a collective and the levels cannot be compartmentalized (Gherardi, 2001).

At times, four levels to organizational learning addressed learning that occurs from interaction beyond the organization. Argote and Greve (2007) classified research in organizational learning at four levels of organizational learning: individual, intraorganizational, organizational, and interorganizational. The authors defined interorganizational level as what organizations learn from other organizations. Intraorganzational learning focused on learning by groups, departments, teams, or units within the organization. Reagans, Argote, and Brooks (2005) noted that there was variation in learning rates between organizations and found evidence of learning at all levels that contributed to organizational learning.

There was a generous amount of literature with approaches to examining the group and/or teams and/or departmental learning that occurs within organization. Edmondson (2002) focused on group-level/organizational learning linkages and found evidence to support a variegated organization learning (i.e., non-uniform in both learning and learning goals) with implications for both group and organizational learning. Group level learning was examined in relation to group mind and transactive memory systems, defined as "a set of individual memory systems in combination with the communication that takes place between individuals" (Wegner,

1986, p. 186). Components included transactive encoding (i.e., includes group discussion and construction on the where, how, who, and what from information is stored) and transactive retrieval (i.e., involves determining location or locations of information as well as the integration of the information at the individual level). Liang, Moreland, and Argote (1995) found that groups with members that trained together had improved performance attributed to more developed transactive memory systems as compared to groups where members had trained alone. Team learning was fundamental to Senge (1990/2006) model of the learning organization. Team learning was defined as "transforming conversational and collective thinking skills, so that groups of people can reliably develop intelligence and ability greater than the sum of individual members' talents" (Senge, Ross, Smith, Roberts, & Kleiner, 1994, p. 6). The collective thinking skills were described as consisting of dialogue (i.e., collective pooling of meaning as well as recognition of interaction patterns that inhibit team learning), shared vision (i.e., a combination of a common aspiration along with each individual members' vision of the whole that provides coherence to activities of the organization), and; awareness of mental models (i.e., the assumptions, generalizations, and images that guide action). Edmondson (2002) found evidence that team learning linked to organizational learning and that team members' perceptions of power and interpersonal risk can impede quality of team reflection and in turn affect the organizational level of learning.

At the other extreme, Cook and Yanow (1993) proposed that organizational learning was not individual learning but rather collective or group learning. Using their well-known analogy of flute-making organizations, they elaborated as follows:

> It is true that each flutemaker knows how to perform his or her individual tasks; but the know-how required to make the flute as a whole resides with the organization, not with the individual flutemaker because only the workshop as a whole can make the flute. This is demonstrated in the fact that when flutemakers have left one of the workshops, the know-how needed to make the flute has not been lost to the organization, as evidenced in the sameness of play and feel of instruments produced by that workshop over the years….Further, such organizational know-how is not meaningfully transferable from one shop to the next; it is deeply embedded in the practices of each workshop. (p. 381)

From their perspective, organizational learning is focused on group level learning, shared meanings, the role of cultural artifacts, and group activity.

Regarding the levels of organizational learning, a common thread to the above explanations was that organizational learning is multilevel. However, the boundaries between

the levels were viewed as distinct, overlapping, or somewhat blurred. Research activity was evident as having involved an examination of all levels – that is, individual, group, or organizational levels or, at times, focused on a subgroup within the organization. There was a distinction between organization levels and levels of processing which is addressed in the next section.

Levels of Processing

In addition to learning that occurs at different levels of the organization, researchers have classified different types of learning. Fiol and Lyles (1985), from a strategic management position, distinguished organizational learning into two hierarchal levels as lower-level and higher-level. Lower-level learning was characterized as occurring with more behavioral outcomes that were repetitive, organizational routines, and oriented for the immediate needs of part of the organization. Likewise, Argyris and Schön (1978) described a lower-level learning as single-loop learning where learning (detecting and correcting errors) was within the given set of goals and values operating within the organization. Their higher-level learning was described as double-loop learning which occurred in the context of ambiguity and complexity and resulted in more cognitive outcomes as in new cognitive frameworks or interpretive schemes that impact the whole organization. At this level, norms, assumptions, and values central to the organization were examined and subject to change or modification. Schön (1975) borrowed the Bateson's notion of deutero-learning (that is, learning to learn) to articulate the importance for organizations to be aware of and incorporate both single-loop and double-loop levels of learning. Argyris (1999) stressed the importance of studying double-loop learning with the following warning: "to focus on single loop level may lead to the risk of becoming servants of status quo" (p. 70).

Informed by theories of limited rationality, March (1991) described the processes of organizational learning as a balance of exploitation and exploration. The two processes also mirror the above lower-level and higher-level processes in that exploitation is characterized as refinement, choice, implementation, and use of existing routines whereas exploration is referred to as experimentation, play, discovery, and innovation.

Like March (1991), Crossan et al. (1999) attributed institutionalizing as routine and embedded practices as exploitative versus the other three processes in their model that would foster exploration. They took into consideration the dynamic balance of the exploration and

exploitation by relating them to feed forward and feedback processes of their model in the following:

> Feed forward relates to exploration. It is the transference of learning from individuals and groups through the learning that becomes embedded – or institutionalized – in the form of systems, structures, strategies, and procedures. Feedback relates to exploitation and to the way in which institutionalized learning affects individuals and groups. (p. 524)

Additionally, Senge (1990/2006) distinguished two levels of learning within the learning organization as adaptive learning (i.e., survival learning) and generative learning (i.e., learning to enhance the capacity to create). Generative learning was described as requiring systems thinking and structural understanding of patterns of behavior. Senge viewed adaptive learning as important, essential, and basic to organizational life whereas generative learning was rare, powerful, and deepened the life of the organization. Dodgson (1993) used the metaphor of psychological explanations of higher level individual learning that moves beyond adaptive level and applied this understanding to organizational learning: "It is an organization which attempts to develop what psychologists see in individuals as higher level, constructive or generative mental functions, and is reflected in strategies and structures purposefully being developed to facilitate and coordinate learning in rapidly changing and conflictual circumstances" (p. 380).

Klimecki and Lassleben (1998) struggled with fitting into the above mentioned bipartitions of organizational learning processes (i.e., Argyris and Schön (1978) single- and double-loop learning or Senge (1990) adaptive versus generative learning). They found that organizational learning processes could be delineated between structural and strategic organizational learning. Structural organizational learning was described as more an organization-environment misfit with current problems, focusing more on form, assumptions for structural renewal, reactive, and pushed by problems. In comparison, strategic organizational learning was described as more an organization-environment misfit with anticipated plans, focusing more on course of action, assumptions for strategic renewal, proactive, and pulled by a vision.

In an attempt to understand organizational learning, debate and discussion within the field revolved around levels of organizational learning processes. Whether the levels of learning processes were hierarchically classified or delineated by a strategy versus structure relationship, the need to understand organizational learning in a multi-dimensional framework persisted. The

following section provides an examination of the literature that examined organizational learning from multiple perspectives.

Integration of Theories

Upon reviewing the organizational learning literature thus far, it is suffice to say that there was a plethora of views and perspectives. In brief, organization learning literature provided an interplay of different approaches to learning, different types of learning, different levels of learning, and multiple dimensions of learning. Easterby-Smith (1997) argued that organizational learning is a multidisciplinary field with diverse purposes, ontological and methodological perspectives such that a singular theory is unrealistic. Conversely, Elmholdt (2010) found evidence to support the need for organizational learning to include the interplay of both cognitive knowledge acquisition (Cyert & March, 1963; Huber, 1991; Senge, 1990/2006; Vera & Simon, 1993) and social participation processes (Brown & Duguid, 1991; Cook & Yanow, 1993; Lave & Wenger, 1991).

DeFillippi and Ornstein (2005) examined organizational learning from different views within the psychological orientation. They concluded that an emerging trend was leaning towards the integration of multiple perspectives and provided the following illustration:

> One of the most popularly acclaimed organizational learning models of the 1990s cuts across psychological perspectives and levels of analysis (citing Senge, 1990). Senge's 'disciplines' of mental models and personal mastery are based on individual learning models whereas his discipline of shared vision is a group level phenomenon that is based on cognitive assumptions. The discipline of team learning is clearly group focused and based on sociocultural assumptions while systems thinking can be applied at all levels of analysis as it shares assumptions across the psychological spectrum. (pp. 32-33) Not sure what this quote adds. Seems superfluous.

Mitchell (1995) reviewed the literature according to psychological, sociological, organizational, and integrative perspectives. Mitchell concluded that, while each field offers a unique aspect to investigating organizational learning, the integrative perspective offered a more satisfactory approach for determining factors associated with organizational learning. Mitchell emphasized that the integrated perspective encompasses a multilevel approach by combining "personal cognitions, organizational structures, and group norms; all of which contribute to a set of shared understandings about how information will be handled and how decisions will be made" (p. 26). Dodgson (1993), like Mitchell (1995), maintained that an integrative approach to organizational

learning captured the various levels more representative of the community nature of organizations.

With respects to the divide between the individual learning approach as knowledge acquisition and the sociocultural collective approach to learning as more about participation, Packer and Goicoechea (2000) reconciled the two perspectives as complementary and concluded as follows:

> What constructivists call learning is only part of a larger process of human change and transformation, the process called learning by socioculturalists. Whether one attaches the label 'learning' to the part or to the whole, acquiring knowledge and expertise always entails participation in relationship and community and transformation both of the person and of the social world. (p. 239)

An integrative approach provided a way of encompassing the multi-dimensional and multilevel conceptions of organizational learning. As daunting as this task may imply, systems thinking offered some helpful suggestions as explored in the following section.

Systems Thinking

Systems thinking was an approach that fit well into organizational learning and provided a way of dealing with the complexity and multiple levels inherent within the concept. Additionally, systems thinking introduced a shift in thinking from the Descartian or Galilean model of reducing an organization into parts to thinking of an organization as a whole. Aristotle (384 BC - 322 BC) is attributed with capturing the notion of the whole as being more than the sum of its parts in *Metaphysics:*

> To return to the difficulty which has been stated with respect both to definitions and to numbers, what is the cause of their unity? In the case of all things which have several parts and in which the totality is not, as it were, a mere heap, but the whole is something beside the parts. (Book VIII, Part 6)

Senge (1990/2006) popularized systems thinking within the organizational learning field when he incorporated it as the cornerstone discipline within his learning organization model. Hämäläinen & Saarinen (2007) summarized Senge's contribution as bringing "holism and the theme of interdependency to the forefront of organizational concerns and to the focus of relatedness-intense applied thinking" pp. 295-296).

System researchers recognized the organization as a unique entity beyond its elements. Von Bertalanffy (1972) emphasized that the notion of the 'whole being more than its parts' is

lacking in the Descartes mathematical model or Galilean method conception of organisms which resolutely attempts to reduce the whole into its parts. He argued for the return to Aristotle's notion and expounded as follows:

> We must strongly emphasize that order or organization of a whole or system, transcending its parts when these are considered in isolation, is nothing metaphysical, not an anthropomorphic superstition or a philosophical speculation; it is a fact of observation encountered whenever we look at a living organism, a social group, or even an atom. (p. 408)

Von Bertalanffy (1972) continued to say that "In order to understand an organized whole we must know both the parts and the relations between them" (p. 411).

The relationships between the elements of an organization are crucial to systems thinking. Bunge (2003) defined a system as "a complex object whose constituents are held together by strong bonds – logical, physical, biological, or social – and possessing global (emergent) properties that their parts lack" (p. 290). He stressed the importance of both parts and wholes in systems thinking and delineated systemism from holism and individualism in the following:

> Individualism is flawed because it underrates or even overlooks bonds; and holism is inadequate because it underrates individuals. By contrast, systemism makes room for both. ... Systemism takes into account social values (ignored by individualists) as well as individual values (held in contempt by holists). Hence, it is more likely than its rivals to inspire and defend policies that combine competition with cooperation, and enhance individual welfare and liberty while strengthening or reforming the requisite institutions. (p. 126)

Further to the definition of a system, systems can be differentiated and classified. Jackson (2000) classified the systems thinking as holistic thinking and indicated that, while Descartian approach has its success, systems thinking is able to address more complex problems that involve "richly interconnected sets of 'parts' and the relationships between the parts can be more important than the nature of the parts themselves" (p.1). According to Jackson (2000), systems can take on different meanings related to paradigms or metaphors. More generally, systems can be viewed as hard systems (i.e., functionalist, concrete and objective) versus soft systems (i.e., interpretive, mental constructs and subjective view of observer. The learning organization model developed by Senge (1990/2006) employs a mixture of functionalist and interpretive views of systems. Jackson (2000) described Senge's fifth discipline as a "conflated systems thinking" that more accurately embodies a functionalist, simplified version of Forrester system dynamics that

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uses archetypes of system feedback loops rather than elaborate computational methods and computer programs. On the other hand, the remaining four disciplines of Senge's learning organization model (i.e., personal mastery, mental models, shared vision, and team learning) represented an interpretivist view of systems. Jackson (2000) differentiated the use of paradigms versus metaphors in systems and suggested that different paradigms of systems are incommensurable whereas metaphorical understandings of systems can stand alone or be used with other metaphors.

Another approach to classifying systems focused on world views. Pepper (1942) used root metaphors to capture rudiments of systems of world views and to facilitate their understanding or world hypotheses such as: formism (i.e., similarity as its root metaphor to indicate the common characteristics that relate forms such as blades of grass or sheets of paper), mechanism (i.e., machine as its root metaphor to symbolize a system that consists of discrete parts related to each other), contextualism (i.e., 'an act in context' as its root metaphor that addresses the connections to the action), and organicism (i.e., living, growing organism as its root metaphor that incorporates notions of development and network of interconnections). In his literature review of key metaphors used to view systems, Jackson (2000) summarized five such metaphors as follows: 1) brains (i.e., scanning, learning, questioning of information from environment to detect and correct system action); 2) cultures (i.e., structures, a focus on the component parts as human beings with different perceptions of reality as well as shared values and beliefs); 3) political (i.e., focus on how members are governed, diversity of group and individual interests, and power struggles); 4) psychic prisons (i.e., considerations of how organization is a reflection of the unconscious aspects influencing action or behavior); and, 5) flux and transformation (i.e., logics of change shaping social life involving autopoiesis or self-regulation of systems and logics of complexity and chaos).

Each root metaphor view of systems implicates the adoption of certain epistemological and methodological perspectives. Jackson (2000) indicated that 'root-metaphors' of mechanism, organicism, and formism fall within the functionalism perspective. He described the functional view of systems as follows:

> Systems appear as objective aspects of a reality independent of us as observers. Using the methods of the natural sciences, they are examined in order to discover the laws that govern the relationships between their parts or sub-systems. If knowledge about the behavior of a system can be gained in this way, the knowledge can be used by experts to

improve the technical efficiency or efficacy of the system and/or its long-term ability to adapt and survive. The tenor of the functionalist approach is modernist. There is an optimism that progress in science will enable better prediction of natural and social events, and greater control over disorder and inefficiency. (p. 107)

Jackson (2000) stressed that epistemological stance of systems within functionalism can diverge between a positivist position in that "empirical observation of a system will reveal the law-like relations between parts governing its behavior" to a structuralist position in that "it is necessary to describe structures and mechanisms operating at a deeper level because it is these that casually generate the observable phenomena" (p. 107).

A major contribution of systems thinking within the field of organizational learning was the shift to examine relationships between parts and the whole. The use of root metaphors provided a way to understanding the complexities of the systems and relationships within organizations along with the corresponding epistemological and methodological implications. Specific to the field of organizational learning was the use and debate surrounding machine and organism metaphors.

Systems Thinking: Machine Versus Organism

The machine and organism metaphors has commonly been employed within a systems approach to organizations (Morgan, 2006; Jackson, 2000). The former metaphor emphasized a closed system with a view of organizations as lifeless whereas the latter metaphor emphasized an open and living system. Jackson (2000) indicated the machine 'root-metaphor' within a systems approach to organizations was most influenced by the following three strands within organization theory: 1) administrative management theory [which he accredits to Fayol (1949)]; 2) scientific management [which he accredits to Taylor (1947)]; and, 3) Weber's bureaucracy theory [(1964; 1969)]. He characterized the machine model wherein the organization is viewed as a hierarchically-structured instrument that is controlled by an authority and strict rules to work efficiently towards a specific purpose. In contrast, the organicism root-metaphor exemplifies a view of organizations as open systems (i.e., the constant need for action in response to changes in the environment) with the primary aim of survival of the organization as a whole (Jackson, 2000).

Miller (1978) included organizations as the eighth level in his general living systems hierarchy of eight levels from the cell to a supranational level. Within this theory, organizations are classified as living systems: "self-organizing systems are able to maintain a nonrandom and,

therefore, improbable state because they are open systems that exchange inputs and outputs of matter and energy with their environment" (Miller & Miller, 1995, p. 21). Tracy (1996) expanded Miller's theory and argued for social systems as living systems on the basis of organizational capacity to replicate with similarities to biological systems. While biological templates are based on genes, social systems employ meme-based templates for governance and replication (Tracy, 1996). Richard Dawkins (1976) is attributed to coining the concept of the 'meme' as a living structure; and defined it as follows:

> The new soup is the soup of human culture. We need a name for the new replicator, a noun that conveys the idea of a unit of cultural transmission, or a unit of imitation, 'Mimeme' comes from a suitable Greek root, but I want a monosyllable that sounds a bit like 'gene'. I hope my classicist friends will forgive me if I abbreviate mimeme to *meme*. If it is any consolation, it could alternatively be thought of as being related to 'memory', or to the French word *même*. It should be pronounced to rhyme with 'cream'.

> Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or building arches. Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation. (p. 192)

Systems thinking, in particular, when viewing organizations as living systems, involved a shift in how the organization and its members are viewed. Jackson (2000) highlighted Tracy's (1994) insistence of viewing organizations as 'life-forms' and how the managers' role takes on the nurturing characteristics of a father or a physician:

> They must also attend to the health of the organization, protecting it from predators and invaders, keeping it well fed with resources, leading it into favorable environments, modifying its behavior, diagnosing its illnesses, and prescribing appropriate treatments. Managers and founders must understand that the organization has a life of its own, that it has a right to survive and develop its potential, and that it may well outlive them. Their role, if they choose to accept it, is to make good decisions for the organization based on *its* values, purposes and goals (Tracy, 1994, p. 4).

Building on Miller's (1978) living systems principle that motivated behavior is exhibited at all eight levels of living systems, Tracy (2006) underlined the importance of motivation. He developed a model of complex motivation for management of organizations that integrated human elements such as needs, values, purposes, goals, drives, desires, choice, communication, feedback, learning, power, and influence. He concluded: "If we are able to understand our motives and the higher level systems we have built, we may be able to improve upon the model,

harness some of the chaos, and become better able to direct the behavior of life on earth" (Tracy, 2006, p. 407).

Other theorists advocated for a living systems approach to viewing social systems and organizations as well as attributing learning as a necessary characteristic to the organization's survival. Capra (2007) emphasized that the capability of learning within organization or community systems was an indication of it as a living system:

> Because of feedback in living networks, these systems are capable of self-regulation and self-organization. A community can learn from its mistakes, because the mistakes travel and come back along these feedback loops. Next time around we can act differently. This means that a community has its own intelligence, its own learning capability. In fact, a living community is always a learning community" (p. 13).

Additionally, Schwandt and Marquardt (2000) noted the importance of the process of organizational learning manifested in patterns of actions and attributes of the organization as a living system. They added that organizational learning was important to the sustainability of an organization's survival and defined the learning system as: "a system of actions, actors, symbols, and processes that enables an organization to transform information into valued knowledge which in turn increases its long-run adaptive capacity. (p. 61). The metaphor of an organism as well as the view of organizations as learning systems was predominant in the field of organizational learning.

Conditions That Foster Organization Learning

In the literature, factors have been identified that promote or foster or influence the organizational learning process. Research within the field of organizational learning focused more on how can we support organizational learning given that the literature has provided some understanding of what it is (Collinson & Fedoruk Cook, 2007; Silins & Mulford, 2004; Silins et al., 2002). From a normative or prescriptive approach to organizational learning, the extent to which these factors are present can be reasoned to the extent to which an organization is a learning organization. Kiedrowski (2006) claimed that the literature lacked empirical research on learning organizations but was rich in normative books that provided steps on how to implement a learning organization. There is a growing body of evidence that supported the link between the measure of an organization's learning capability and organizational performance (Goh, Elliott, & Quon, 2012). Fiol and Lyles (1985) provided a holistic framework of four contextual factors that deal with culture, strategies, structures, and environment that integrates a

reflexive, iterative learning process or a "circular relationship with learning in that they create and reinforce learning and are created by learning" (p. 84). This framework was used to develop the research framework of this study.

Culture

According to Fiol and Lyles (1985), the culture factor was represented by norms, values, and beliefs that underlie and influence cognitive and behavioral development in an organization. The organization's culture was described as manifested by the symbols, stories and established patterns of behavior that point to overriding ideologies and underlying assumptions (Bolman & Deal, 2008; Martin, Feldman, Hatch, & Sitkin, 1983; Schien, 2004). Bolman and Deal (2008) summarized the symbolic forms of culture in the following:

> Myths, values, and vision bring cohesiveness, clarity, and direction in the presence of confusion and mystery. Heroes and heroines are role models for people to admire and emulate. Stories carry values and serve as powerful modes of communication and instruction. Rituals and ceremonies provide scripts for celebrating success and facing calamity.(p. 278)

Certain characteristics have been associated to influence organizational learning or promote learning organizations. On the other hand, there were characteristics considered to be impediments of organizational learning. For example, norms were exemplified to promote isolation as in the "cellular structure of schools has been linked with a norm of non-interference among teachers" (Feiman-Nemser & Floden, 1984, p. 40). On the contrary, teacher collaboration was featured a condition that would support organizational learning. Leithwood et al. (2006) mentioned a study that involved five schools in British Columbia where efforts to develop consensus about school goals had strong positive effects on staff motivation and commitment. The reliance on oral or non-written communication was considered to minimize organizational learning and place emphasis on tacit level of practices. They referred to Levitt and March's (1988) "redundancy of experience problem" that produced the tendency of overlearning and habit to deter experimentation and more effective responses. This impediment was overcome with opportunities for daily recording and reflection of activities along with time for sharing and learning of others. Double-loop learning and a restructuring of norms and belief systems was a requirement for organizational change whereas defense routines (i.e., practice, policy, or action) were rendered aspects of the organization to be 'undiscussible' or kept in the dark (Argyris & Schön, 1978).

Characteristics of the culture was associated with organizational performance outcomes (Hartnell, Ou, & Kinicki, 2011). Managers used performance assessment differently in different types of culture. Henri (2006) noted that managers in a predominantly flexible culture used performance assessment more for attention-focusing and strategic decision making whereas managers in a predominantly control culture used performance assessment more for monitoring. In consideration of school improvement, McMahon (2006) argued for a culture characterized as a professional learning community with features that include "shared beliefs, concern for individual and minority views, and meaningful relationships. A professional learning culture (i.e., consisting of collective peer learning, collective leadership, collective reflective practice, shared vision, and collective decision making) was found to be associated with teacher efficacy (Kennedy & Smith, 2013). Mitchell and Sackney (2011) stressed the development of a collaborative culture in developing interpersonal capacity and teamwork. Collaborative culture entailed the development of shared norms and values with collective interest as opposed to mere collaboration with an orientation towards more individualistic interest. Such an understanding of a cultural emphasis of collaboration that impacts teacher learning was empirically deduced in the Meirink, Imants, Meijer and Verloop (2010) study. They argued for a collaboration that includes dimensions of interdependence, development of concrete artefacts, and autonomy.

Fullan and Hargreaves (1991) classified teacher cultures based on different forms of collegiality: individualism (i.e., lacks collegiality, state of professional isolation); balkanized (i.e., association to group, independent, often in competition); comfortable collaboration (i.e., bounded and restricted; limited to short-term, trick sharing, material sharing, advice-giving); contrived collegiality (i.e., formalized, bureaucratic procedures to joint teacher planning and consulting), and collaborative culture (i.e., climate of trust and relationships, joint sharing, interdependence, value for each individual voice, professional dialogue and reflection). Leithwood et al. (2006) extended the Bryk and Hermanson (1993) description of school organizations from two ideal types (rational bureaucracy and community) to three ideal types to include a third (professional learning community). Leithwood et al. (2006) described the culture of each type with the following characteristics: 1) school as bureaucracy would have a balkanized culture with norms of competition and individual achievement; 2) school as community would have a collegial culture with norms of caring and goodwill; and, 3) school as

Professional Learning Community would have a collaborative culture with norms of continuous problem solving.

Strategy

According to Fiol and Lyles (1985), strategy that allowed for flexibility was a second condition that promotes organizational learning. The authors reported that the "strategic posture also creates a momentum to organizational learning" (p. 805). They suggested that strategy provides a context and boundary to guide perception and interpretation of the environment. An organization's survival is related to how well they align to the environment and their flexibility of continual restructuring (Fiol & Lyles, 1985; Schön, 1975). Fiol and Lyles (1985) connected alignment with an organization's capacity "to learn, unlearn, or relearn based on its past behaviors" p. 804.

Daft and Weick (1984) proposed that interpretation modes are associated with organizational differences in strategy often dictated by the top of the organizational hierarchy: an organization characterized as having a 'conditioned' interpretation mode views the environment as analyzable and takes a passive and accepting approach to information from the environment versus an organization characterized as having an 'enacting' interpretation mode views the environment as unanalyzable and takes an active and creative approach to dealing with the external environment. By integrating the Miles, Snow, Meyer, and Coleman Jr. (1978) strategic typology, the former 'conditioned' view was related to a *defender* strategy (i.e., concerned with maintaining tradition and protecting what it has) while the latter 'enacting' view was related to a *prospector* strategy (i.e., concerned with taking initiative in a view of a changing environment with many opportunities) (Daft & Weick, 1984).

Mintzberg, Ahlstrand, and Lampel (1998) discussed the five *Ps* of how strategy is defined: *plan* (i.e., direction, vision, mission, goals, guide), *pattern* (i.e., consistency in actual behavior over time which is either deliberate strategy that is fully realized and intended; unrealized strategy that is not realized but intended; or emergent strategy that is realized yet not expressed as intended); *position* (location or purpose), *perspective* (looking inside the heads of the strategists and looking up to the grand vision), and *ploy* (how to face a threat or competition). The authors added that deliberate strategy focuses on control and emergent strategy focuses on experimentation. They discussed the distance between formulation and implementation from different approaches to strategy or how detached the thinking is from the actions. In other

words, they suggested that the effective strategy change more often originates informally at the heart of the action rather than from a formal strategic plan:

> Strategies could be traced back to a variety of little actions and decisions made by all sorts of different people (sometimes accidentally or serendipitously, with no thought of their strategic consequences). Taken together over time, these small changes often produced major shifts in direction. In other words, informed individuals anywhere in an organization can contribute to the strategy process A strategist can be a mad scientist working in a far-flung research laboratory who comes up with a better product. A group of salespeople who decide to flog one product and not others can redirect a company's market positions. Who better to influence strategy than the foot soldier on the firing line, closest to the action. (p. 177-178)

For the development of learning communities, Mitchell and Sackney (2011) described strategies that give voice to all members of the community, involving all stakeholders in the development of school vision and missions and indicated that teachers "report stronger support for school activities when students and parents have had input into the decisions" (p.82). Aramburu, Sáenz, and Rivera (2006) concurred that strategic processes that involve participation from all levels of the organization support high capacity learning: "open, participatory and decentralized processes, in which the strategy is not defined in a closed way by top management, but rather is shaped throughout the implementation process from contributions made from different organizational levels" (p. 437).

In consideration of the learning process, Mitchell and Sackney (2011) referred to the importance of the existence of strategic readiness. Strategic readiness referred to a continuous learning plan, or the "perpetual state of preparedness for change in general; amid highly turbulent conditions, the organization needs to be equipped to deal with anything and must be ready to reevaluate old assumptions and adjust its plans for the future" (Redding & Catalenello, 1994, p. 47). Reflection, flexibility, and communication were integrated into the implementation process for ongoing adjustments and alignment to goals and missions of the organization. Mitchell and Sackney stressed that strategic readiness "shines the spotlight on the cyclical, non-linear nature of school development and educational renewal." (p. 84).

Leithwood et al. (2006) highlighted the importance of human motivation when setting directions. They indicated that external initiatives are at higher risk of being ignored and impeding organizational learning when they do not align to school strategy. When external initiatives were viewed as meaningful to school strategy, organizational learning was supported

and followed by positive responses from the members. An extension to the notion of strategic readiness, they proposed a future oriented monitoring system as a means of systematically assessing organizational learning such that courses of action is informed by strategic directions.

Structure

According to Fiol and Lyles (1985), an organizational structure that 'allows both innovativeness and new insights' was a third condition that promotes organizational learning. They referred to Duncan (1974) who pointed out that different decision making structures reflect the degree of flexibility that is required: "A centralized, mechanistic structure tends to reinforce past behaviors, whereas an organic, more decentralized structure tends to allow shifts of beliefs and actions" (p. 805). They cited Galbraith (1973) that a decentralized structure reduces the cognitive workload of members which promotes assimilation of new patterns and associations. They went on to report that Meyer (1982, p. 533) suggested that "formalized and complex structures retard learning but that learning is enhanced by structures that diffuse decision influence". They concluded that organizations designed for learning and reflection tend to be less mechanistic. Similarly, Leithwood et al. (2006) indicated that centralized hierarchal structures support the reinforcement of past behaviours to ensure consistent performance and routine; however, this type of structure reduces organizational learning and is at higher risk of the redundancy problem. They argued that a decentralized structure is more amenable to organizational learning and encourages reflective action taking by distributing the demand for thinking about new information.

Characteristics of a decentralized structure included a more lateral, low degree of hierarchal authority, high degree of member participation in strategic and policy decision making whereas the converse, more vertical and hierarchal line of authority would be characteristic of a centralized structure (Andrews, Boyne, Law, & Walker, 2009; Bolman & Deal, 2008). Using Miles and Snow's (1978) typology, Andrews et al. (2009) found strategy-structure association and concluded that "centralized decision making works best in conjunction with defending, and decentralized decision making works best in organizations that emphasize prospecting" (p.57).

From a living systems and organic approach to organizations, the focus was to design structures that support connections, diversity, and relationships (Mitchell & Sackney, 2011). Mitchell and Sackney (2009, January) extended upon Senge's (1990/2006) distinction between visible structures and tacit structures and classified them as 'surface structures' and 'deep

structures' accordingly. Akin to a reinforcing relationship between strategy and structure, Mitchell and Sackney (2011) elaborated on the nature of the reciprocating relationship between the two types of structure as follows: "Specifically, people create visible structures that align with their deep beliefs about what kind of structure is possible and preferable, and the created visible structures shape and constrain subsequent actions" (p. 88). They stressed the importance of deep structures that support constant engagement in critical inquiry with emergent outcomes that facilitates confrontation of blind adherence to norms and groupthink. Mitchell and Sackney (2011) emphasized the need for relationships and connections as key structural elements to the processes of collaboration and confrontation within organizational learning and illustrated with the following quotation:

> Relationships are the pathways to the intelligence of the system. Through relationships, information is created and transformed, the organization's identity expands to include more stakeholders, and the enterprise becomes wiser. The more access people have to one another, the more possibilities there are. Without connections, nothing happens. (Wheatell, 2007, pp. 40, as cited in Mitchell & Sackney, 2011)

Structural arrangement with the inclusion of continual restructuring of schools was a complex and perplexing issue (Mitchell & Sackney, 2011). Bolman and Deal (2008) suggested that structure is the best reflection of an organization's alignment of inner workings with external situations. They added that restructuring requires "both fine-grained microscopic assessment of typical problems and an overall, topographical sense of structural options" (p. 97). Mitchell and Sackney (2011) proposed some structural arrangements that have promoted professional learning with the caveat that they only touch on the options since transformation in a living system is a process of 'self making', a notion borrowed from Capra (2002). Their suggestions included the following: strong investment in professional development, structures that support a collaborative culture and not just contrived collegiality, provision of time for teamwork, creation of learning teams, encouragement of networking, use of data supported by rich interpretation, horizontal lines of authority that are focused on facilitation rather than control, communication focused on professional discourse, learning-centred, openness, and trust. McMahon (2006) also emphasized the need for the provision of time as a structure to support the development of professional learning communities.

Environment

A fourth condition for organizational learning was determined by how organizations handle complexity and dynamics of either the internal or external environment. Too much or too little of either stability or change can be detrimental to learning (Fiol & Lyles, 1985). Along with Fiol and Lyles, (1985), a number of researchers of organizational learning argued for the need for a balance between stability and change and/or turbulence. Learners and their environment had an iterative adaptive-manipulative relationship where "learning requires both change and stability between learners and their environments" (Hedberg, 1981/2006, p. 5/236). Adaptive behavior was when an organization maps its environment and adjusts its behaviors to accommodate its environment while manipulative behavior is when an organization believed it can change environmental elements and impresses itself into its environment (Hedberg, Nystrom, & Starbuck, 1976). Sackney et al. (1998) found that indicators of organizational learning included 'balancing too much and too little change' and 'aligning internal activities of the school with external district goals'. March (1991) asserted for maintaining a balance between exploration (in terms of flexibility, experimentation, and risk-taking) and exploitation (in terms of routines and refinement of existing practices). Exploration was described as important to organizational learning and that too much emphasis on exploitation can lead to "suboptimal stable equilibria" and "make adaptive processes potentially self-destructive" (pp. 71 and 73). Santos-Vijande, López-Sánchez, and Trespalacios (2012) , from a business perspective, noted that successful organizations focus on both external and internal environments and that flexibility (i.e., firm's ability to keep pace with market evolution and respond rapidly to unpredictable and unexpected market conditions) was key to attainment of balance between the two environments. DiBella, Nevis, and Gould (1996) examined how conditions support the acquisition, dissemination, and utilization of knowledge in organizational learning. They suggested a learning organization was able to balance both adaptive and innovative manners of acquiring knowledge. They contrasted a bureaucratic style of disseminating knowledge as formal and typically using written procedures compared to a community of practice style that involved more informal and collaborative means of dissemination. Ellis and Shpielberg (2003) found that quality of decisions decreased and uncertainty increased for organizations that had mechanisms for information gathering but lacked mechanisms in how to use the information.

The authors suggested that "information becomes meaningful as a consequence of the evaluative schemas that are used to process and assess it" (p. 1245).

Akin to Fiol and Lyles (1985), Leithwood et al. (2006) indicated that the conditions for organizational learning within the environment depended on the balance of the stability and complexity of internal and external forces. They defined turbulence as 'complexity and instability' and suggested that schools can modulate the amount of internal turbulence by developing methods such as: 'implementation timelines that stage the introduction of change' or systematic development of a mission and/or a set of goals for which there is a high level of consensus among staffs" (p. 34). Leithwood et al. (2006) suggested that goal clarification can effectively handle the complexity experienced by the staff by reducing the cognitive load into meaningful and manageable components. Building on notions from Bandura's (1986) theory of self and collective efficacy, they proposed that goal consensus is a powerful influence on teacher commitment and more collaborative forms of decision making. Shared goals gives reason for shared decision making to contribute to a collective sense of responsibility to school success (Rosenholtz, 1989, as cited in Leithwood et al., 2006).

In the context of organizational learning, various researchers identified the need for an internal environment that focused on the safety of its members (Edmondson A. , 1999; Goh et al., 2012; Higgins, Ishimaru, Holcombe, & Fowler, 2012; Maden, 2012; Mitchell & Sackney, 1998; Mitchell & Sackney, 2011). Garvin, Edmondson, and Gino (2008) included psychological safety as one of the four important characteristics of a learning environment along with appreciation of differences, openness to new ideas, and time for reflection. Edmondson (1999) emphasized that 'team psychological safety' is more than the shared belief of interpersonal trust of risk taking but rather included a "team climate characterized by interpersonal trust and mutual respect in which people are comfortable being themselves" (p. 354). She stressed that a psychologically safe environment is particularly important for organizations with high performance standards and illustrated her point as follows:

> It's about recognizing that high performance *requires* the openness, flexibility, and interdependence that can develop only in a psychologically safe environment, especially when the situation is changing or complex. Psychological safety makes it possible to give tough feedback and have difficult conversations – which demand trust and respect – without the need to tiptoe around the truth. (p. 65)

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In this regard, Mitchell and Sackney (2011) addressed the 'sustainable conditions' in terms of an environment that supported relationships and the safety of the members. They suggested that members need to feed safe in order to foster communication processes important to relationships in the following manner:

> [W]e want to point out the importance of creating group dynamics, communication networks, and interaction patterns where people are safe from attack, are welcome, where the status quo can be challenged safely, and where even the strangest ideas get a hearing. These are the conditions that are sustainable for the long term and that can sustain the interest, engagement, and learning efforts of all those who are part of the learning community. (p. 132)

The environment was conceptualized as having implications for keeping a balance between group and organizational levels of learning. As suggested by Argote (1999), it is difficult to achieve learning at both levels as "transferring knowledge across groups requires some degree of standardization which can conflict with the emphasis on group autonomy" (p. 194). When uniform outcomes are required or when there is a high degree of interdependence in tasks, then organizational level learning is preferred to group level learning. When needs differ at local level or task structure associated to local units, then group level learning, autonomy, and flexibility are preferred.

Leadership

Leadership was not a contextual factor addressed in Fiol and Lyles (1985) as they were focused on management; however, Sackney and Mitchell's (2011) model emphasized the purpose for a leadership that supports learning for all members. Their notion of 'leadership for learning' encompassed role-specific leadership as well as an organization-wide leadership and included formal and informal forms of leadership; however, their notion of leadership also included leadership that emerged naturally from active engagement in the community life of the organization:

> In an educational community, leadership is all about making teaching and learning happen. It provides a sense of direction, energy, coherence, and coordination to the actions and activities going on in the school, and it supplies the power to accomplish the work. None of this, of course, is new. However, it is perhaps new that, in a learning community, leadership grows out of the members' sense of autonomy and personal commitment to the work of the school. Learning communities are designed so that educators reflect on the effects of their practices, experiment with new practices, and share practices with one another. ….Leadership is not only dispersed throughout the

educational team but emerges naturally as people set directions and initiate activities. (p. 106)

While the literature was rich in descriptions of leadership that support learning organizations or professional learning communities, empirical research examining the forms of leadership that interact with organizational learning was sparse (Sackney, 2007). In addition, Hallinger (2011) wrote "shared leadership, collaborative leadership, and distributed leadership have become mantras in the profession over the past decade. Unfortunately, much of the discussion is prescriptive, based on values rather than data" (p. 138). Some of the empirical research in the field of education has been interested in characteristics of leadership that are associated with organizational learning. Hardoin (2009) focused on role-specific, principal leadership, and found it was a key factor in terms of three dimensions that support professional learning communities: sharing leadership, inspiring vision, and supporting a collaborative culture. Sackney (2007) found evidence to support sustainable leadership as "crucial in providing a sense of vision and purpose, moral integrity, coherence, and a culture necessary for improved teaching and learning to occur. Kurland, Peretz, and Hertz-Lazarowitz (2010) found transformational leadership predicted school organizational vision and organizational learning.

Organizational Learning Linked To Student Outcomes

There was a paucity of educational research on organizational learning and specifically, that the link between organizational learning and student outcomes is in need of greater attention. Silins, Mulford, and Zarins (1999) found organizational learning was a significant mediator of principal and leadership team effects on teachers work and on student outcomes (i.e., student participation and student engagement) and concluded that organizational learning appears to contribute to the understanding of successful school change. Mulford (2005) endorsed the need for evidence within educational research that links leadership, organizational learning, and student learning.

Within the research, there were few attempts to develop school evaluation models to include organizational learning factors along with monitoring student outcomes. Leithwood et al. (2006) considered organizational learning factors and student outcomes in their context-input-process-output model for data-driven school improvement. They described three aspects for the inclusion of student performance outcomes within monitoring systems: philosophical to demarcate fundamental beliefs and values underlying the choices that were generally related to

curriculum and accountability; pragmatic to acknowledge constraints such as time or cost that limit choices with data that is already collected on a regular basis; and, technical to focus on choices that are satisfactorily operationalized and measureable. In that vein, while large-scale assessments have become a popular tool for measurement of student outcomes at regional, national, and global levels, it followed that there could be a potential for large-scale assessment as a way to contribute to monitoring organizational learning as well as student learning.

Large-Scale Assessment, Student Outcomes, and Organizational Learning

The large-scale assessments link to accountability is a modern phenomenon that has been increasingly employed as a tool in the educational setting nationally and throughout the world (Carnoy & Loeb, 2002; Klinger et al., 2008; Mazzeo, 2001). Performance-based accountability models were intended to foster student learning and success (Ben Jaafar & Earl, 2008). A large-scale assessment program was seen as having the potential to be a multilevel measure and able to provide information about student academic achievement, classroom teaching practices, and school effectiveness as a whole (Crundwell, 2005). Carnoy and Loeb (2002) discussed the notion of 'capacity building' and various purposes to the assessment program:

> Testing can be used in several ways. It can be an indicator to tell administrators and teachers whether they are reaching the organization's goals and to provide information on which elements of the curriculum are reaching students and which are not. It can be used as a measure of success or failure in an incentive system. It can be used as a gauge to increase standards, to assess curricula, or to provide technical assistance. It can be used as a mechanism to allocate additional resources in order to improve outcomes for groups having difficulty reaching the standard. (p. 307)

While student outcomes contribute to an indicator of how well the system is doing, assessment has been seen as multipurpose and with a way to provide information to many other levels of organizational learning.

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Research Framework

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Organizational learning has been described as a complex construct informed by multiple disciplines as well as by an array of organization and learning theories. Therefore, similar to Mitchell's (1995) approach to researching organizational learning, this study took an integrative approach to examining organizational learning. Following Miller's (1978) general living systems theory, organizations were classified as living systems. Synonymous to Schwandt and Marquardt (2000), a systemic approach was taken to examine the complexity of the

organizational learning in schools by developing a model and examining patterns of actions and attributes rather than causal relationships.

This research was positioned primarily from a functionalist view of organizational learning governed by a realist ontology and a positivist epistemology. In other words, organizational learning can be examined objectively with a need for regulation and modification upon the contextual factors. However, there was a role for the interpretive view and how individuals perceive and cognitively construct information affecting their experience and effect of those factors. Borrowing from Blackner (1995) and his notion of pragmatic aspects to knowing, research included a need for how collective action is driven by people's conceptions:

> Knowing as pragmatic: Central to activity theory is the idea that collective action is driven by the conceptions people have of the object of their activities. Further research is needed into the influence that 'informated' and 'communication-intensive' environments have on the approaches people take to their work. It seems likely that, as activity systems become interrelated and complex, traditional approaches to organizing are likely to be ineffective. Research is needed into the possibilities for developing communal narratives within expanded activity systems. (p. 1041).

For purposes of this research, organizational learning was defined as the learning processes that occurs within the organization which includes all levels (i.e., individual, group, and team, collective) whereby members are continuously pursuing and evaluating an intended common goal. The research is situated at the cross sections of learning organization and organizational learning. Aspects of a learning organization were found to provide insights into enablers, conditions, or supports for organizational learning (Song, Jeung, & Cho, 2011). On the other hand, this research attempts to understand the nature of the organizational learning that is being supported. According to Leithwood et al. (1995): "The learning organization is one promising vision for future schools and organizational learning is a promising perspective on the processes for getting there" (p. 230). There is a mounting source of literature advocating for schools as learning organizations but systematic research scarce (Silins et al., 2002)

While the research into professional learning communities does inform aspects of organizational learning, the research was focused more on the administrator and/or teacher perspective and the student perspective of organizational learning is lacking. Collinson and Fedoruk Cook (2007) indicated that organizational learning is important for the students as well since they will be entering work environments that too are being structured for organizational

learning. This research acknowledged the multilevels of organizational learning and intended to look at both principal and student perspectives.

This research attempted to look at school-wide perspective from student and principal perceptions in order to examine the extent that schools foster learning environments characteristic of holistic and/or ecological views (Capra, 2002; Mitchell & Sackney, 2011). McMahon (2006) questioned whether a learning community concept was appropriate in different cultural contexts. Schools in Canada vary in size, location, demographics, and percentage of Aboriginal students. This study investigated school characteristics and the extent that organizational learning as perceived by principals and students link to student outcomes.

The research framework comprised of five contextual factors that encompass the behavioural, cognitive, social, and cultural aspects influencing organizational learning as identified by Fiol and Lyles (1985) and Mitchell and Sackney's (2011): 1) culture, 2) strategy, 3) structure, 4) environment, and 5) leadership. It was assumed that the five factors, together (holistically), would show a greater extent of support for organizational learning and, in turn, be more successful at closing the gap between intended and actual achievement of the common goal. For purposes of this research, the common goal is successful student achievement.

As shown in Figure 4, the research framework illustrates the school viewed as a living system that aims to be a learning organization. The view of schools as living systems with a capability to learn introduced a major shift in how schools are perceived and implicates school leadership, school structure, school strategy, school culture and environment. The five factors (i.e., independent variables as defined by the PISA 2009 questionnaires) that influence the organizational learning of the school consisted of 1) culture that is characterized as collaborative and high extent of shared beliefs and vision among members; 2) strategy that is characterized as a posture is flexible with continuous learning plan of monitoring, interpreting and restructuring; 3) structure that is characterized as supporting and emphasizing relationships, relationship building, and teamwork amongst all members; 4) environment characterized as providing a healthy balance of stability and change as well as a safe and trusting environment for members to share honestly and to take risks in experimentation; and, 5) leadership characterized as an emphasis on learning for all members as well as leadership that inclusive of all members of the whole organization. The framework consisted of a school as a living system with the capability of a learning community that includes students, teachers, and the principal/s and their

relationships. The framework considered school characteristics that can vary between schools such as school size, school location, and percentage of Aboriginal population. Finally, the framework emphasized the primary goal of all members within the school: successful student achievement outcomes.
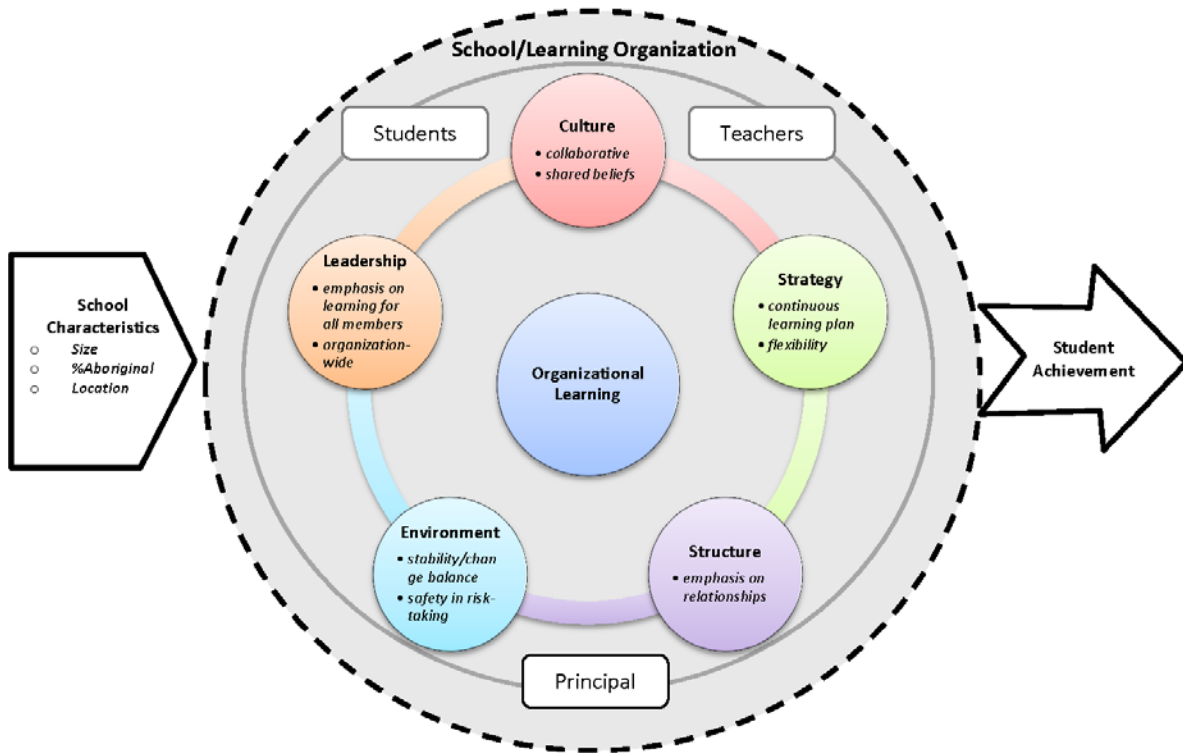
Figure 4. Research framework of five contextual factors influencing organizational learning

CHAPTER 3

METHODOLOGY

This study entailed a quantitative approach to examine links between conditions that influence organizational learning and student achievement, and is described in this chapter. While organizational learning can be approached from any one of Burrell and Morgan's (1979) four paradigms (Ortenblad, 2002), the methods of this study were oriented within a functionalist paradigm. It was appropriate from this paradigm to examine organizational learning with an objective, realist ontological perspective as well as with a positivist, epistemological stance. As such, the research methodology included a secondary analysis of the PISA 2009 dataset. This chapter provided details on the research design, PISA 2009 dataset, population focus of this study, PISA 2009 sampling method, operationalization of research framework as found within PISA dataset and the data analysis that was conducted for this research. Finally, ethical considerations necessary for this study were discussed,

Research Questions

The main research question was:

To what extent are a school's conditions that foster organizational learning, associated with student PISA reading literacy achievement in Saskatchewan and in Canada overall?

The research sub-questions are:

1. To what extent are student background variables (i.e. gender, Self-Identified Aboriginal, socioeconomic status, level of experience of school conditions that foster organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and distributive leadership as defined by PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

2. To what extent are school variables (school socio-economic index, school location, proportion of Aboriginal students, school size, level of fostering organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and distributive leadership as defined by PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

Design

A quantitative methodology approach was taken to measure conditions that influence organizational learning of a school and their links to student achievement. The methodology included a secondary analysis of the PISA dataset. The analysis focused on student-level and school-level characteristics and outcomes using hierarchical analysis as the PISA dataset provides cross-sectional achievement estimates for individual students nested in schools as well as contextual information on a wealth of areas as perceived by the students and principals. For example, student questionnaires solicited information on areas such as attitudes to learning, home environment, study habits, how time is spent on homework. School administrators responded to items such as school climate, school policies, teacher practices, and student behaviors.

Large-scale datasets, such as the PISA, are becoming more feasible and conducive to being examined for secondary analysis. Furthermore, the PISA was a valuable, underutilized dataset that can facilitate educational research. The dataset supported multilevel modeling analysis along with meeting many of the gold standards of educational research, 'such as rigorous sampling design, well-developed objective measures of student achievement, and collection of data related to student and school traits' (Anderson et al., 2009, p. 269). From an administrative point of view, secondary analysis was time and cost efficient as data collection is already complete. The PISA survey involved hundreds of thousands of individuals from over 50 countries; such cost and time would be prohibitive for an individual research project.

While there are many advantages to secondary analysis of the PISA dataset, limitations were important considerations as well. While secondary analysis of the PISA dataset was highly time and cost efficient in the data collection phase, the data analysis phase required some extra time to consider the technical complexity resulting from the sampling strategy that was undertaken (Rutkowski, Gonzalez, Joncas, & vonDavier, 2010). Limitations to primary data collection design continue to apply to secondary analysis. Since the PISA survey design was cross-sectional, it was generally not appropriate to make causal inferences (Rutkowski et al., 2010). Additionally, secondary analysis was restricted to variables considered in the primary data collection. Nonetheless, while there were pitfalls to consider in secondary analysis, there was merit and potential for secondary analysis of large-scale datasets to contribute to education research (Rogers, Anderson, Klinger, & Dawber, 2006). Rutkowski et al. (2010) indicated that

there has been a steady increase of studies and continued growth in the number of countries using such large-scale surveys.

PISA 2009 Data Set

The Organization for Economic Co-operation and Development (OECD) is an international organization of government representatives from 34 member countries, based in Paris. OECD serves as a forum to cooperate in areas of common interest, including educational research and policy development (OECD, 2013a). The organization recognized the need for education systems to shift from providing students with basic skills informed by demands for mass industrialization to providing students with learning how to learn in order to promote 'lifelong learning' (OECD, 2011). A major educational component of the OECD work and mandate includes the Programme for International Student Assessment (PISA) (OECD, 2013b). In 2000, the OECD administered the first PISA to establish the triennial standardized international indicators on education systems with microdata on student assessment (Peschar, 2006). By 2006, the PISA participants totaled 400,000 students from 57 countries that represented 90% of the world economy and averaging 4500 to 10,000 students from each participating country (OECD, 2007). By 2013, over 70 countries participated in the PISA, 34 OECD member countries and 43 partner countries (OECD, 2013c).

The OECD intergovernmental organization founded the PISA in 1997 with a strategic plan to unfold the PISA until 2015 and beyond (OECD, 2013d). By 2000, the OECD administered the first PISA to establish standardized international indicators on education systems with microdata on student assessment (Peschar, 2006; OECD, 2013c). The large-scale international PISA assessment is administered to 15-year-old students every three years to measure reading, mathematical, and scientific literacy. PISA focuses on students' capacity to apply their knowledge and skills relevant to real-life challenges and issues, rather than mastering a specific school curriculum.

The collaborative administrative undertaking for the 2009 PISA involved participation of over 200 representatives from member countries and observer countries with shared education policy interests. The OECD Secretariat monitored and oversaw the project, the PISA Governing Board established the framework, the PISA Consortium had taken on the responsibility of the expert instrument development, and the National Project Officers implemented and ensured consistent protocol administration at the national level.

A consortium of international organizations, headed by the Australian Council for Educational Research (ACER), carried out the assessment under the auspices of the OECD and the PISA Governing Board. Other organizations involved in the consortium include Westat Inc. (USA), National Institute for Education Research (NIER, Japan), Educational Testing Service (ETS, USA), and Netherlands National Institute for Educational Measurement (CITO) (OECD, 2009). In Canada, the PISA was carried out by the Human Resources and Social Development Canada (HRSDC), Council of Ministers of Education Canada (CMEC), Statistics Canada, and the provincial Ministries/Departments of Education (Government of Canada, 2009).

The PISA 2009 was selected over other years because it represented the most current sampling and data collection procedures. PISA 2009 survey consisted of four components: 1) two hours of direct students' skill assessment through reading, mathematics and science tests; 2) a 30-minute self-completed contextual questionnaire administered to students to collect background information to help understand the factors contributing to student achievement; 3) a 10-minute section on Information Technology administered to students; and, 4) a 30-minute self-completed school questionnaire administered to school principals to collect information about characteristics of schools (Government of Canada, 2011).

Population

The targeted population for the 2009 PISA was 15 year old students enrolled in education systems within the OECD member and participating countries. The rationale for choosing this population was in consideration that these students would be in their final year of compulsory education; and, in most cases, these students would be entering the labor market or starting to consider their career paths. The age-related focus takes the emphasis off varying grade structure within education systems and differing entry-age or grade-repetition rules.

The aim of the PISA is to be as inclusive and representative of the target population as possible; however, some restrictions are inevitable. PISA 2009 exclusions were monitored along with strict exclusionary guidelines at school level that included students who were emotionally and mentally unable to follow general instructions required to respond to the test (OECD, 2012). Canada PISA 2009 exclusionary rate of 5.46% was considered to be negligible following non-response bias analysis (OECD, 2012).

Sampling

Sampling procedures for the Canada PISA 2009 sample included a two-stage stratified method. The first stage included sampling of individual schools at the provincial level systematically with probabilities proportional to size based on estimates of eligible students. Subsequently, the second stage sampling of students at the school level was with equal probability selection unless there were fewer than 35 students enrolled (in which case all were selected). As a result, sampling weights for students and schools are a consideration in the data analysis.

In Canada PISA 2009, about 23,000 students from 1000 schools participated to allow for estimates for both official language groups and for each province (Government of Canada, 2011; Knighton et al., 2010). The three territories and Aboriginal schools were excluded from the sampling. Student response rates, weighted and based on 15-year-old enrolment numbers in each school, were above 80% for all provinces with the exception of 71.0% in Quebec for an overall Canada student level response rate of 79.5% (Knighton et al., 2010). Since the response rate for Canada PISA 2009 was below the 80% PISA standard, a bias analysis was undertaken and deemed that there was no notable non-response bias. The PISA 2009 sampling procedure was detailed in *PISA 2009 Technical Report* (OECD, 2012) and sampling procedures specific to Canada are detailed in *Measuring Up: Canadian Results of the OECD PISA Study: 2009 First Results* (Knighton et al., 2010).

Canada Population

Canada was the focus of this research as the researcher has interest in mining large-scale assessment with local policy implications. In addition, part of the aim of this research is to determine how the conditions for organizational learning framework compares in schools with varying school characteristics, such as school size, school location, average socio-economic status, and percentage of Aboriginal students. Since the Canadian education system is primarily a provincial jurisdiction, the Saskatchewan province was compared as well.

Dependent Variable: Student Achievement

The PISA is unique to typical large-scale assessments that aim to assess student achievement. While the PISA aims are to assess to the degree students have acquired knowledge and skills at the end of their compulsory education, the instrument is designed to focus on "the knowledge, skills, competencies and other attributes embodied in individuals that are relevant to

personal, social and economic well-being" (OECD, 2006). As such, the PISA 2009 aim was

purposely not to focus on a curriculum or a body of knowledge; rather, the aim is to focus on

underlying objectives of education systems to prepare lifelong learners and to prepare them with

basic and essential attributes enabling them to participate in adult life of society. In general, the

PISA aims are to answer the following three questions (OECD, 1999):

> How well are young adults prepared to meet the challenges of the future?
> Are they able to analyse, reason and communicate their ideas effectively?
> Do they have the capacity to continue learning throughout life? (p.7)

Within the PISA assessment framework, the design team operationalized core issues,

judgments, and decision making skills that face young adults concerned about their world and

their society within three core domains of reading, mathematical, and science. Every three years,

the three domains are assessed whereas the emphasis is rotated. In 2000 and 2009, reading

literacy was emphasized followed by mathematical problem solving literacy in 2003 and 2012

and, scientific literacy in 2006 and 2015. The curriculum is not considered the common

denominator in all the member countries; rather, the essentials and literacy are the focus.

The PISA versions have maintained the assessment framework throughout the cycles;

although, slight revisions have occurred with new developments and improvements. The reading

literacy definition have been well established by previous surveys such as the International Adult

Literacy Survey (IALS), but was taken further in PISA with an introduction to higher learning.

The Task Force for the International Reading Association endorsed the reading literacy

definition and supported the emphasis on reading for learning and not learning to read (Topping,

Valtin, Roller, Brozo, & Dionisio, 2003). The reading assessment framework has remained

parallel from 2000 to 2006 and updated in 2009 to include the reading of electronic texts;

mathematical literacy was revised in 2003 and remained the same to 2009; scientific literacy was

elaborated and revised in 2006 to include attitudinal characteristics of learning and remained

unchanged in 2009. The 2006 definition of scientific literacy was essentially the same as the

previous PISA definitions in that attitudinal component was reported separately to maintain

comparability of the cognitive aspect over time. More detailed information on the

conceptualization of the literacy domains can be found in the PISA documents (OECD, 2006;

OECD, 1999; OECD, 2004; OECD, 2009): The PISA 2009 brief definitions of the cognitive

domains are as follows:

- Reading literacy: An individual's capacity to: understand, use and reflect on and engage with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society (OECD, 2009; p.14).

- Mathematical literacy: An individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen (OECD, 2009; p.14).

- Scientific literacy: An individual's scientific knowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena, and to draw evidence based conclusions about science-related issues, understanding of the characteristic features of science as a form of human knowledge and enquiry, awareness of how science and technology shape our material, intellectual, and cultural environments, and willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen. (OECD, 2009, p. 14).

Standardized achievement in the three domains were assessed for each student that takes the paper and pencil tests for a duration of two hours. Test items were a mixture of multiple choice and constructed response. In the PISA 2009 design, a total of 450 item minutes were administered, 270 for the reading domain and 90 for each in the mathematics and science domains. The items are distributed into thirteen – 30 minute clusters followed by a distribution of four clusters into thirteen booklets. The proficiency component to the PISA employed an incomplete design in that each student completed a sub-set of the item pool within a two-hour booklet that consisted of four clusters. For more detail on PISA 2009 methodology and sampling, see *PISA 2009 Technical Report* (OECD, 2012).

PISA scores for achievement in all three domains are expressed as scaled scores with a mean of 500 points for all the OECD countries and a standard deviation of 100 (Knighton et al., 2010). Each student completes a sampling of items; therefore, student proficiency scores are estimated based on item response scaling models and the use of imputation methodology referred to as plausible values (i.e., randomly drawn imputed estimates of likely score that are conditional on observed item responses) (OECD, 2012).

Independent Variables: Contextual Variables

The independent variables in this research included student-level and school-level contextual factors that have been derived from student and school questionnaires and selected on the basis of the research conceptual framework. During the PISA assessment, each student

completed a 30-minute background questionnaire that provided information about themselves and their homes. The questionnaire included some Likert-type items (i.e., *strongly agree, agree, disagree, strongly disagree*) that pertain to attitude towards the major domain being assessed. In Canada, administration of an additional student questionnaire occurred to obtain information specific to Canada and was intended for the eventuality of the continuation of a linked PISA/ YITS: Youth in Transition longitudinal research project (Statistics Canada, 2011; Statistics Canada, personal communication, 2013).

Since PISA 2000, school principals completed a 20-minute questionnaire with items that pertain to contextual characteristics about their schools; such as: material, physical, and human resources, school curriculum, monitoring and evaluation practices, school climate and relevant equity factors.

Organizational Learning

Indices of organizational learning were derived at the student level and at the school level using exploratory factor analyses of items that aligned with the conditions for organizational learning research framework, For the student-level perceptions of their experience of organizational learning conditions, a total of 56 student-level items from the student questionnaire were included in the analysis. Prior to the student-level factor analysis, items from the student questionnaires were examined for evidence of face validity and conducted by the researcher for alignment to the research framework. An example of a student item that represented each domain of the research framework and included in the factor analysis is as follows: i) a culture item was "belief that school is a waste of time"; ii) an environment item was "reading class lesson is noisy and disorderly"; iii) a strategy item was "teacher asks questions that challenge students to get a better understanding of a text"; iv) a structure item was "teacher gives extra help when I need it"; and, v) a leadership item was "participate in student council or student government". See Appendices A and B for a full list of items examined.

Principal perceptions of organizational learning conditions were analyzed from 51 items from the school questionnaire. Again, prior to the school-level factor analysis, items from the school questionnaire were examined for evidence of face validity and conducted by the researcher for alignment to the research framework. An example of a principal item that represented each domain of the research framework and included in the factor analysis is as follows: i) a culture item was "extent the learning of students is hindered by student

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absenteeism"; ii) an environment item was "extent the learning of students is hindered by students intimidating or bullying other students"; iii) a strategy item was "how often students are assessed by standardized tests"; iv) a structure item was "school's capacity to provide instruction is hindered by a lack of English teachers"; and, v) a leadership item was "teacher groups exert direct influence on decision making". See Appendix C for a full list of items examined.

Economic, Social, and Cultural Status (ESCS)

The ESCS variable was a PISA socio-economic status index that was derived by the OECD. Since the 1960 Coleman report, socio-economic status was and continues to be a significant indicator of educational outcomes. ESCS was a PISA index that is derived from parent educational and occupational categories as well as student responses to items relating to home possessions that are used as a proxy of socio-economic status. The index was standardized to the OECD average given a mean of zero and then weighted by each country. This study considered the student level relationship of each student's socioeconomic background to his/her individual PISA reading performance. At the school level, this study considered the aggregated average socio-economic background of 15 year old students in the school and the relationship to the their PISA reading performance in the school. Additionally, at the provincial level, this study considered the aggregated average socio-economic background of 15 year old students in the province and the relationship to the their PISA reading performance.

Aboriginal Self-Identification

At the student and school levels, the variable of Aboriginal self-identification was added to the model to examine whether the factor sufficiently accounts for differences in reading performance. Participating Canadian students were asked to respond to the following item: "Are you an Aboriginal person, that is, First Nations (North American Indian), Metis, or Inuk (Inuit)?". This question was part of the Canadian student questionnaire conducted along with the OECD PISA 2009 student questionnaire completed by students in all participating countries. At the school level, the proportion of self-identified Aboriginal students in the school was examined as a school characteristic (i.e.; 25% or more of the students self-identified as Aboriginal). This study considered the relationship of the school's percentage of 15-year old students as self-identified Aboriginal with the PISA reading performance.

Gender

At the student level, gender was a student characteristic examined for differences in reading performance.

School Characteristics

At the school level, characteristics such as school size and school location were considered in order to examine whether the contextual variables sufficiently account for differences in reading performance. School size is a PISA 2009 variable was defined as the total student enrolment of the school and is based on the information provided by the school principal. School location was defined as urban or rural location based on information provided by the school principal to the following question and options:

"Which of the following definitions best describes the community in which your school is located? *i) A village, hamlet or rural area (fewer than 3 000; people); ii)A small town (3 000 to about 15 000 people); iii) A town (15 000 to about 100 000 people); iv) A city (100 000 to about 1 000 000 people); and, v) A large city (with over 1 000 000 people)"*. Urban schools included positive responses to iii, iv and v while rural schools included positive responses to i and ii.

The school size variable was categorized by percentiles for the HLM analysis in order to aid interpretation of each unit of increase by percentile versus than by one student. Additionally, the average school size related to the 50th percentile in Canada. The school size enrolments related to the following percentiles: (1 to 60 = 10) (61 to 138 = 20) (139 to 222 = 30) (223 to 300 = 40) (301 to 378 = 50) (379 to 518 = 60) (519 to 714 = 70) (715 to 905 = 80) (906+ = 90).

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Data Analysis

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Using IBM:SPSS software, descriptive and bivariate techniques were employed to examine the demographics and relationships between the organizational learning, sub-factor conditions of organizational learning, and reading performance. Assumptions of normality were assessed between the independent variables as well as with the outcomes measure to assure considerations of any analysis violations. Means and standard deviations were calculated for each factor by overall group and by subgroups at the Canada and Saskatchewan levels.

Normalized Weighting

To compensate for IBM:SPSS statistical software consideration of the sum of weights as sample size in computing variance, data files were weighted at the student level and the school level with "normalized final weights". Normalized final weights are computed based on the sampling

final weight in the PISA dataset and ensures the sum of weights is equal to the number of observations (OECD, 2009b, p. 37). Equation 1 was the formula used for the student normalized weighting as follows:

$$nW\_FSTUWT = W\_fstuwt / 360286) * 23207 \text{ where} \qquad \text{(Equation 1)}$$
nW_FSTUWT is normalized weight for student,
W_fstuwt is the final student weight provided within the OECD PISA 2009
      dataset,
360286 is the population number of students; and,
23207 is the sample number of students.

Equation 2 was the formula used for the school normalized weighting as follows:

$$nFSCHWT = W\_FSCHWT / 3788) * 971 \text{ where} \qquad \text{(Equation 2)}$$
$nFSCHWT$ is normalized weight for school,
W_FSCHWT is the final school weight provided within the OECD PISA 2009
      dataset,
3788 is the population number of schools and,
971 is the sample number of schools.

Exploratory Factor Analysis

Factor analysis is a procedure that is conducted to reduce a large number of items into a smaller, interpretable set of factors as well as to produce factor scores that are calculated from the sum of weighted loadings of the underlying items (Tabachnick & Fidell, 2013). Exploratory factor analyses was conducted at student level and at school level, to determine the best combination of items (i.e., factor structure) that capture organizational learning conditions identified in the research framework, using SPSS version 21 (IBM Corp., 2012). Based on the finalized factor structures at the student and school levels, an Organizational Learning score for each student and each principal was determined from the sum of the factor scores (i.e., the factor scores that were computed using the regression method within the SPSS software).

As suggested by Tabachnick and Fidell, (2013), the following procedure was used to conduct the exploratory factor analysis. Initially, a principal components extraction with varimax rotation was used to examine the factor structure and estimate the number of factors. A principal components extraction determines the least number of factors that accounts for a maximum amount of the total variance of the items while the varimax rotation considers that all factors are independent. Next, the adequacy of sample data for the factor analysis is examined by two statistical tests: 1) Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) should

be above .50 as it indicated whether an adequate proportion of the variance is explained by the factors (Kaiser, 1970; Kaiser, 1974), and; 2) Bartlett's Test of Sphericity should be significant (i.e., $p < .05$) as it tests the hypothesis that the correlation matrix is an identity matrix and unsuitable to detect a structure (Bartlett, 1954). However, Tabachnick and Fidell caution that the Bartlett's Test of Sphericity is a weak indicator for very large samples. If the overall data set is deemed appropriate, communality estimates of extraction for each item (i.e., the variance accounted for by the factor, or squared multiple correlation of the variable denoted as h^2) were examined to indicate if any items are too low and should be considered for elimination from analysis as the item is not contributing to any explanation to the variance. An item with a factor loading of less than .32, or less than 10% to overall variance, was used as a cut-off decision rule (Tabachnick & Fidell, 2013). This step was followed by a decision on the number of factors to retain. This task was guided by the use of at least two rules which are most often the following: 1) Kaiser's (1960) eigenvalue-greater-than-one rule as otherwise the factor accounts for less variance than a single item, and; 2) Cattell's (1966) scree test that involves a visual examination of eigenvalue graph to determine the point at which the last significant drop before the graph levels off.

A second procedure conducted had involved principal components extraction for specifying the number of factors in both varimax and direct oblimin rotations. Direct oblimin is an oblique rotation that allows for factors to be correlated. An examination of results and correlation matrix of factors were examined in consideration that if correlation of factors is low, then the varimax factor structure is warranted. The factor structure that best meets the criteria of simple structure (Thurstone, 1947) and is interpretable by the research framework, guided the structure that was retained and used to produce factor scores. Other considerations that guided the determination of the final structure were: i) crossloading (i.e., items with strong loadings (.50 or greater) on more than one factor; and, ii) no fewer than three items per factor were considered in determining the final structure. Cronbach's alpha reliability coefficients was examined for each factor. The factor scores were combined by using the regression approach to calculate Organizational Learning Index scores.

Multilevel Modeling Analysis

A multilevel modeling or hierarchical linear modeling (HLM) was used to examine variables at the student and at school levels (Anderson et al., 2009; Lee, 2000; Raudenbush &

Bryk, 2002). HLM7, is a software that is able to decompose variance of factors at multiple levels (Raudenbush, Bryk, & Congdon, 2011). In addition, HLM is capable of handling achievement data that are expressed as plausible values as is the case for the five plausible values in the PISA dataset (Ma & Crocker, 2007). HLM analysis allowed for the inclusion of both sample weights and plausible values that are involved in the PISA dataset.

For the HLM analyses, the following considerations were followed in the data analyses. The analyses employed two HLM analyses: i) a two-level hierarchical linear model with students nested in schools in Canada overall and ii) a two-level hierarchical linear model with students nested in schools in Saskatchewan. The two procedures allowed for an examination of variance of schools within Canada and then for an examination of variance of schools within Saskatchewan.

The 2-level HLM procedure was essentially a duplication of two regression equations: a) Level-1 equation examined the extent to which student characteristics predict reading performance, b) Level-2 equation examined the extent to which school factors predict the slope between individual factors and student reading performance. The first 2-level HLM examined the extent to the variation between individual and school differences in student reading performance in Canada overall. The second 2-level HLM examined the extent the Saskatchewan jurisdiction explains the variation between individual and school differences in student reading performance. See Appendix D for the mathematical formulas. Table 1 provides an overview of HLM analyses at each model stage and the respective questions, hypotheses, and independent variables.

In stage 1, the fully unconditional models were constructed to determine a baseline or unconditional models. The fully unconditional model did not include any predictors at the two levels. The proportion of the total variance at all three levels was calculated for the outcome variable, PISA reading literacy. Variance partitioning was examined to see if there is a significant amount of variability in reading literacy for each of the two levels of the model. In order to proceed with analyses, student outcome scores should significantly vary within schools and between schools. Reliability and variance coefficients were examined to determine if there are significance in school difference.

In stage 2, student characteristics models were constructed to address the first research question:

To what extent are student background variables (i.e. gender, Self-Identified Aboriginal, socioeconomic status, level of experience of school conditions that foster organizational learning) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall? At this stage, the student characteristics models allowed the researcher to investigate if individual characteristics function comparably across schools. Gender, self-identified Aboriginal, ESCS, and student OL index were entered into the Level 1 equation. At the individual level, predictors were grand-mean centered to aid interpretation at Canadian level for the Canada modelling or at provincial level for the Saskatchewan model. Significant fixed effects (i.e., γ coefficients with a p-*value* **<** .05) were retained in the final models.

In stage 3, school contextual models were constructed to address the second research question:

To what extent are school variables (school socio-economic index, school location, proportion of Aboriginal students, school size, and level of fostering organizational learning) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall? At this stage, the school contextual models allowed the researcher to investigate if school characteristics function comparably across schools in Saskatchewan, and in Canada. Proportion of self-identified Aboriginal students in school, School average ESCS, School size, School Location, and school OL index were entered into the Level 2 equations.

Table 1
HLM Analyses Steps with Associated Questions, Hypotheses, and Variables at Individual (Level 1) and School (Level 2).

Step/Model	Questions	Hypotheses	Independent Variables
1. Fully unconditional	**Level 1.** How much of the variance between students' reading performance is attributable to individual characteristics?	**Level 1.** Based on prior school effectiveness research, it is predicted that individual characteristics will explain the majority of the variance in reading performance across students.	*No Independent Variables are included in the Unconditional Model*
	Level 2. How much of the variance between reading performances is attributable to school-level variables?	**Level 2.** Factors associated with the school-level will explain a significant portion of the variability in students' reading performance, albeit a smaller amount than variables at the individual level.	*No Independent Variables are included in the Unconditional Model*

2. Student Characteristics Model	**Level 1. Considering** effects of student background characteristics that vary among schools, will organizational learning as perceived by students vary between schools?	**Level 1(a). Given significant student** variables that vary by school, students that perceive schools with higher organizational learning conditions will perform better in reading performance.	*Gender* (1 = male, 0 =female) *Self-identified Aboriginal* (1 =Yes, 0 = No) *ESCS* (continuous) *Student Organizational Learning (StudentOL) Index* (continuous)
3. School Contextual Model	**Level 2.** Will the school characteristics significantly influence students' reading performance?	**Level 2**. Schools with a higher average ESCS will be significantly associated with higher reading performance however, controlling for average ESCS, reading performance is predicted to be higher for schools where principals have high level perception of OL. In consideration of significant student characteristics from model in stage 2.I	*Significant student characteristics from model stage 2.* *25%Proportion of self-identified Aboriginal students in school* (Yes=1; No=0) *ESCS* (school average: continuous) *Schoolsize percentile* (0 to 60=10) (61 to 138=20) (139 to 222=30) (223 to 300=40) (301 to 378=50) (379 to 518=60) (519 to 714=70) (715 to 905=80) (906+=90), *School Location* (five dummy variables for each locale and dummy variable for village and small town combined) *School Organizational Learning (SchoolOL) Index* (continuous)
4. Student and School Organizational Learning Components Model	**Level 2.** Will the student and school organizational learning components significantly influence students' reading performance?	**Level 2**. Schools with a higher average ESCS will be significantly associated with higher reading performance however, controlling for average ESCS, reading performance is predicted to be higher for schools where students have high level perception of the OL components and where schools have higher levels of School OL components. In consideration of significant student characteristics from model in stage 3.	*Significant student characteristics from model stage 3.* *Student Organizational Learning Components* – (consisted of 6 components) *School Organizational Learning Components* (consisted of 4 components)

Note. The dependent variable for all analyses was PISA reading literacy. These hierarchical models intended to build upon one another, with the exception of stage 4 which considered OL components rather than OL indices. At each step variables were added in one at a time. Variables with a significant coefficient of $p < .05$ were retained for subsequent modeling. Level 1 = Individual-level equation. Level 2 = School-level equation. Two analyses were conducted: 1) Canada overall and 2) Saskatchewan.

Ethical Approval Procedures

Pursuant to the requirements of the Behavioural Research Ethics Board (Beh-REB) at the University of Saskatchewan, ethical approval was requested and approved.

Additional ethical approval was required to conduct secondary analysis of PISA data set, Canadian questionnaire. Approval to conduct analysis at Research Data Centre (RDC) was requested and approved. Data confidentiality was assured and findings were reported such that no individual or school could be identified.

Summary

In this chapter the research methodology within the research framework was presented. A quantitative methodology approach was taken to measure conditions that influence organizational learning of a school and their links to student achievement. The research design included secondary analysis of the PISA dataset. In summary, an overview of the data analysis was presented that consisted of 1) exploratory factor analysis to determine factor structures of conditions that foster organizational learning, at both a student level and a school level and 2) HLM data analyses to address the research questions that overall examine the extent that a school's conditions that foster organizational learning was associated with student PISA reading literacy achievement in Saskatchewan and in Canada overall. Furthermore, details were presented of the ethical guidelines followed to ensure confidentiality and anonymity of human subjects involved in this study.

CHAPTER 4

RESULTS

This chapter consisted of two parts to address the two aspects of data analysis required to investigate the primary research question: To what extent are a school's conditions that foster organizational learning, associated with student PISA reading literacy achievement in Saskatchewan? and in Canada overall? The first part provides the results of the two factor analyses, a school-level analysis and a student-level analysis. These analyses were conducted to reduce a large number of variables to a smaller number of components within the organizational learning conditions research framework. Each factor analysis produced factor scores that were used to calculate two organizational learning indices. A school organizational learning index was used to capture level of conditions that foster organizational learning in the school while a student organizational learning index was used to capture the student level experience of school conditions that foster organizational learning. Following the factor analyses results, the second part of this chapter consists of the hierarchical linear modelling results. The hierarchical linear modelling was conducted to investigate the following research sub-questions:

1. To what extent are student background variables (i.e. gender, Self-Identified Aboriginal, socioeconomic status, level of experience of school conditions that foster organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and distributive leadership as defined by the PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

2. To what extent are school variables (school socio-economic index, school location, proportion of Aboriginal students, school size, level of conditions that foster organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and distributive leadership as defined by the PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

Data Screening, Missing Data, and Outliers

Data screening and cleaning were conducted for both the student and the school datasets prior to factor analysis. Six cases from the school data were eliminated from the analysis as they were missing data on all variables. Factor analysis was initially conducted excluding pairwise

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cases with missing values. Upon determining the final model structure, the mean was imputed for all cases with missing data in the determination of factor scores. Factor analysis was then redone with the omission of cases with factor scores containing outliers (i.e., three standard deviations above and below the mean). The full data set was restored upon determining that the factor structure did not change, suggesting no significant impact of outliers. Multilevel models were redone in HLM analysis using a variable that flagged cases with missing data and omitting those cases in analysis. Again, the full dataset was restored upon determining little change in models, suggesting no significant impact of missing data.

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Factor Analysis of Organizational Learning Factors and

Construction of Organizational Learning Indices

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Factor analysis was conducted to reduce a large number of items into a smaller, interpretable set of factors as well as to produce factor scores that are calculated from the sum of weighted loadings of the underlying items (Tabachnick & Fidell, 2013). Exploratory factor analyses was conducted at the student level and at the school level, to determine the best combination of items (i.e., factor structure) that capture organizational learning conditions identified in the research framework, using SPSS version 21 (IBM Corp., 2012).

School Principal Dataset Factor Analysis

Principal components analysis was used because the primary purpose was to identify and compute factor scores underlying the notion of organizational learning as defined within the PISA 2009 school questionnaire. Fifty-one variables in the PISA 2009 school questionnaire had characteristics that provided evidence of face validity to the research framework. The sample size requirement of 5 cases to 1 variable was met as the initial factor analysis of 971 schools to 51 variables is a 19 to 1 ratio.

Initially, the factorability of the 51 variables was examined with the determination of the presence of substantial correlations indicated between variables that suggested 14 components with eigenvalues above one. However, only four components contributed 5% or more to the explanation of the overall variance. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was .80, above the commonly recommended value of .50; and, Bartlett's Test of Sphericity was significant, $\chi^2(1275, N = 971) = 16768.74$, $p < .001$. The diagonals of the anti-image correlation matrix were also all above .50, supporting the inclusion of all variables in the factor analysis. Finally, the communalities were all above .32, further confirming that each

variable shared some common variance with other variables. Given these overall indicators, factor analysis was deemed to be suitable with all 51 items.

Four, five, six, and seven factor solutions were examined to determine optimal simple structure, using both varimax and oblimin rotations of the factor loading matrix and the principal components extraction method. The four factor solution, which explained 49.1% of the variance, was preferred because of its support to the research framework, the 'leveling off' of eigenvalues on the scree plot after four factors, the insufficient number of primary loadings and difficulty of interpreting more than four components. The eigenvalues of the final structure with four components and 29 variables showed that the first component explained 19.0% of the variance, the second factor explained 14.6% of the variance, a third factor explained 9.9% of the variance, and the fourth factor explained 5.6% if the variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy of the final analysis was .86, above the recommended value of .50 with a significant Bartlett's Test of Sphericity, $\chi^2(406, N = 971) = 10043.51, p < .001$. Figure 5 provides an illustration of the final scree plot with 29 variables from the PISA 2009 school questionnaire. The varimax and oblimin[2] rotations for the four factor structure were examined before deciding on a varimax rotation for the final solution as there were no significant correlations between the components.

After several steps, a total of 29 variables were retained as they contributed to a simple factor structure of four components, each consisting of a minimum of three variables, (see Table 2). The variables met the minimum criteria of having a primary factor loading of .32 or above, and no cross-loading of .32 or above. Component 1 was interpreted as 'School Culture/Environment' that related to cultural beliefs and expectations that impact the collaborative nature of organizational learning as well as environmental characteristics in the school that contribute to a safe and trusting environment for members to share honestly and to take risks in experimentation. Component 2 was interpreted as 'Strategy' that related to a cognitive component of organizational learning with a flexible posture aimed at continuous learning plan of monitoring, interpreting and restructuring. Component 3 was interpreted as 'Structure' that related to supports in place to build relationships and teamwork. Component 4

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[2] Theoretical and conceptual reasons would favour the choice of an oblique oblimin rotation that allows for correlation of the components to represent "reality". However, the more statistical choice of orthogonal varimax rotation with no correlation of components is deemed acceptable for ease of interpretability of a simple structure when there is evidence of low correlations in the oblique rotation (Tabachnick & Fidell, 2013).

was interpreted as 'Leadership' that related to support for diverse leadership and a responsibility of learning upon all members of the whole organization.
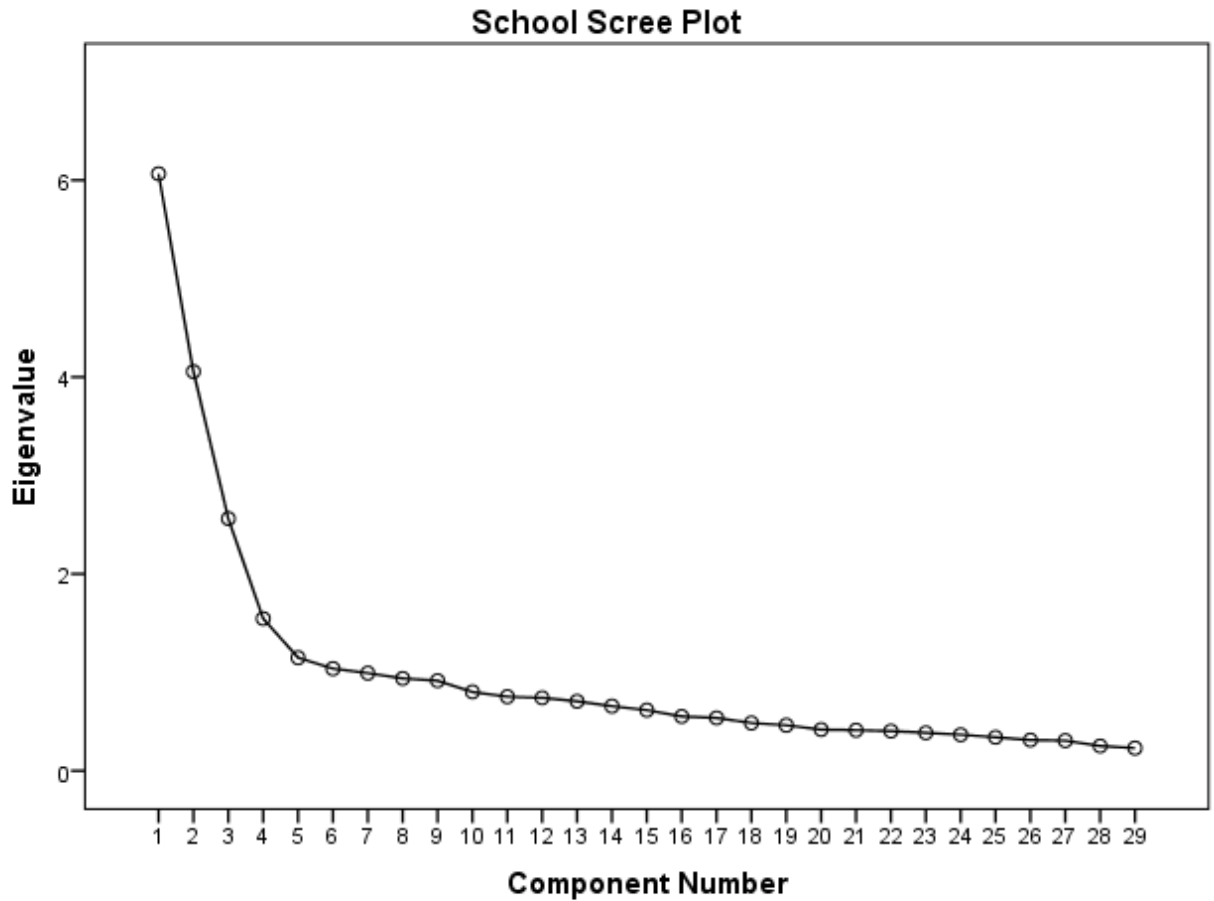
Figure 5. Scree plot of final school principal components analysis.

School Organizational Learning Index. Based on the factor analysis of the items from the school questionnaire, the school organizational learning composite index comprised of the summation of the four school component scores as follows in Equation 3:

> ***School Organizational Learning Index*** *= Component 1: School Culture +*
> *Component 2: Strategy + Component 3: Structure +* (Equation 3)
> *Component 4: Leadership*

Table 2

Rotated Factor Loadings and Communalities Based on 29 Items and Derived Variables from PISA 2009 School Questionnaire (N=971)[1,2]

Item	Component				Communality
	School Culture/ Environment	*Strategy*	*Structure*	*Leadership*	*h²*
Sc17Q08 Student learning hindered by students lacking respect - reverse coded	**.79**	.04	-.03	.00	**.62**
Sc17Q03 Student learning hindered by poor student teacher relations- reverse coded	**.75**	.02	.08	-.06	**.56**
Sc17Q04 Student learning hindered by disruption of classes by students - reverse coded	**.74**	.00	.20	.02	**.59**
Sc17Q05 Student learning hindered by teachers not meeting individual students' needs – reverse coded	**.73**	.05	.05	.11	**.56**
Sc17Q09 Student learning hindered by staff resisting change - reverse coded	**.73**	.06	.10	.06	**.55**
Sc17Q13 Student learning hindered by students not being encourage to achieve their full potential - reverse coded	**.69**	.16	.17	-.03	**.53**
Sc17Q11 Student learning hindered by teachers being too strict with students - reverse coded	**.68**	.07	.07	-.04	**.47**
Sc17Q12 Student learning hindered by students intimidating or bullying other students – reverse coded	**.66**	.04	-.11	.12	**.47**
Sc17Q06 Student learning hindered by teacher absenteeism - reverse coded	**.66**	-.05	.12	-.18	**.48**
Sc17Q01 Student learning hindered by teachers' low expectations of students - reverse coded	**.66**	.13	.23	-.14	**.52**
Sc17Q02 Student learning hindered by student absenteeism - reverse coded	**.53**	-.01	-.03	-.04	**.77**
Sc26Q09 Educational Goals - Classroom	.10	**.71**	-.06	.10	**.53**
Sc26Q02 Educational goals - Teachers	.05	**.68**	-.02	-.09	**.47**
Sc26Q11 Curriculum Responsibility	.09	**.64**	.12	-.13	**.44**
Sc26Q01 Professional development	-.04	**.63**	-.04	.03	**.40**
Sc26Q05 Give suggestions	-.05	**.62**	.01	.19	**.43**
Sc26Q08 Teachers Updating skills	-.05	**.62**	-.01	-.13	**.40**
Sc26Q07 Teacher's problems	.02	**.62**	-.01	-.12	**.40**
Sc26Q06 Monitor student's work	.16	**.59**	-.13	.12	**.40**
Sc26Q04 Student performance	-.06	**.57**	.10	.21	**.29**
Sc26Q03 Observe in classrooms	.15	**.53**	.09	.15	**.34**
Sc26Q13 Disruptive behaviour	.09	**.53**	.09	.07	**.30**
Sc11Q01 Shortage of Science Teachers - Reverse Coded	.02	-.03	**.87**	-.04	**.75**

Sc11Q02 Shortage of MathTeachers- Reverse Coded	.13	.06	**.86**	-.01	**.77**
Sc11Q03 Shortage of language Teachers - Reverse Coded	.10	.05	**.82**	.09	**.70**
Sc11Q04 Shortage of other Teachers - Reverse Coded	.21	.00	**.62**	-.03	**.43**
Sum of ScQ16d,e,h Assessments for School Use	-.10	.13	.05	**.77**	**.61**
Sc16Qf and ScQ23 Monitor Teachers	.11	.05	.19	**.74**	**.62**
Diverse Leadership: sum of z scores for Parent Leadership, Student Leadership, Teacher Leadership, and Principal Leadership	-.06	.02	-.17	**.37**	**.20**

1. Factor loading greater than .32 are in boldface.
2. Extraction method: Principal components with Varimax rotation

Psychometric properties of factor scores and School Organizational Learning Index.
The internal consistency was examined for each component as well as the composite index
determined by the summation of the component scores. The internal consistency ranged from a
low reliability coefficient, .37, for the 3-item Leadership Component to strong reliability
coefficients for the remaining components, .83 to .90, (see Table 3). The reliability coefficient
for the composite score consisting of all 29 items was strong, .84.

Table 3
Psychometric Properties: School Components and School Organizational Learning Index

Scale	N[1]	Items	Mean	SD	Cronbach's Alpha
Component 1: School Culture/Environment	959	11	0.05	7.70	.90
Component 2: Strategy	932	11	0.00	6.77	.84
Component 3: Structure	969	4	0.00	3.25	.83
Component 4: Leadership	971	3	0.00	1.95	.37
Composite: School Organizational Learning Index	919	29	0.09	12.39	.84

[1] Weighted by normalized Final School Weight and excluded cases by listwise deletion on all variables in the procedure

Student Dataset Factor Analysis

Principal components analysis was used because the primary purpose was to reduce the
number of items to identify and compute factor scores underlying the notion of organizational
learning as defined within the two PISA 2009 student questionnaires (OECD and Canada only).
Fifty-five variables from the PISA 2009 student questionnaires had characteristics that provided
evidence of face validity to the research framework. Sample size requirement of 5 cases to 1
variable was met as initial factor analysis of 23,207 students to 56 variables is a 414 to 1 ratio.

Initially, the factorability of the 56 variables was examined with the determination of the presence of substantial correlations indicated between variables that suggested 11 components with eigenvalues above one. However, only four components contributed 5% or more to the explanation of the overall variance. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was .92, above the commonly recommended value of .50, and Bartlett's Test of Sphericity was significant, $\chi^2(1540. N = 23,207) = 444254.77, p < .001$. The diagonals of the anti-image correlation matrix were also all over .50, supporting inclusion of all variables in the factor analysis. Finally, the communalities were all above .32, further confirming that each variable shared some common variance with other variables. Given these overall indicators, factor analysis was deemed to be suitable with all 56 variables.

Four, five, six, and seven factor solutions were examined to determine optimal simple structure, using both varimax and oblimin rotations of the factor loading matrix and the principal components extraction method. Finally, the five factor solution, which explained 55.4% of the variance, was preferred because of its support to the research framework, the 'leveling off' of eigenvalues on the scree plot after five factors, the insufficient number of primary loadings and difficulty of interpreting more than five components. The eigenvalues of the final structure with five components and 31 variables showed the explanation of the total variance was distributed between the five components as follows: the first component explained 13.9% of the variance, the second component explained 13.9% of the variance, a third component explained 10.7% of the variance, the fourth factor explained 10.4% of the variance, and the fifth component explained 6.6% of the variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy of the final analysis was .90, above the recommended value of .50 with a significant Bartlett's Test of Sphericity, $\chi^2(465, N = 23,207) = 272029.32, p < .001$. Figure 6 provides an illustration of the final scree plot with 31 variables. The varimax and oblimin rotations for the five factor structure were examined before deciding on a varimax rotation for the final solution as there were weak to no significant correlations between the components.

Student Scree Plot

Analysis weighted by nW_FSTUWT
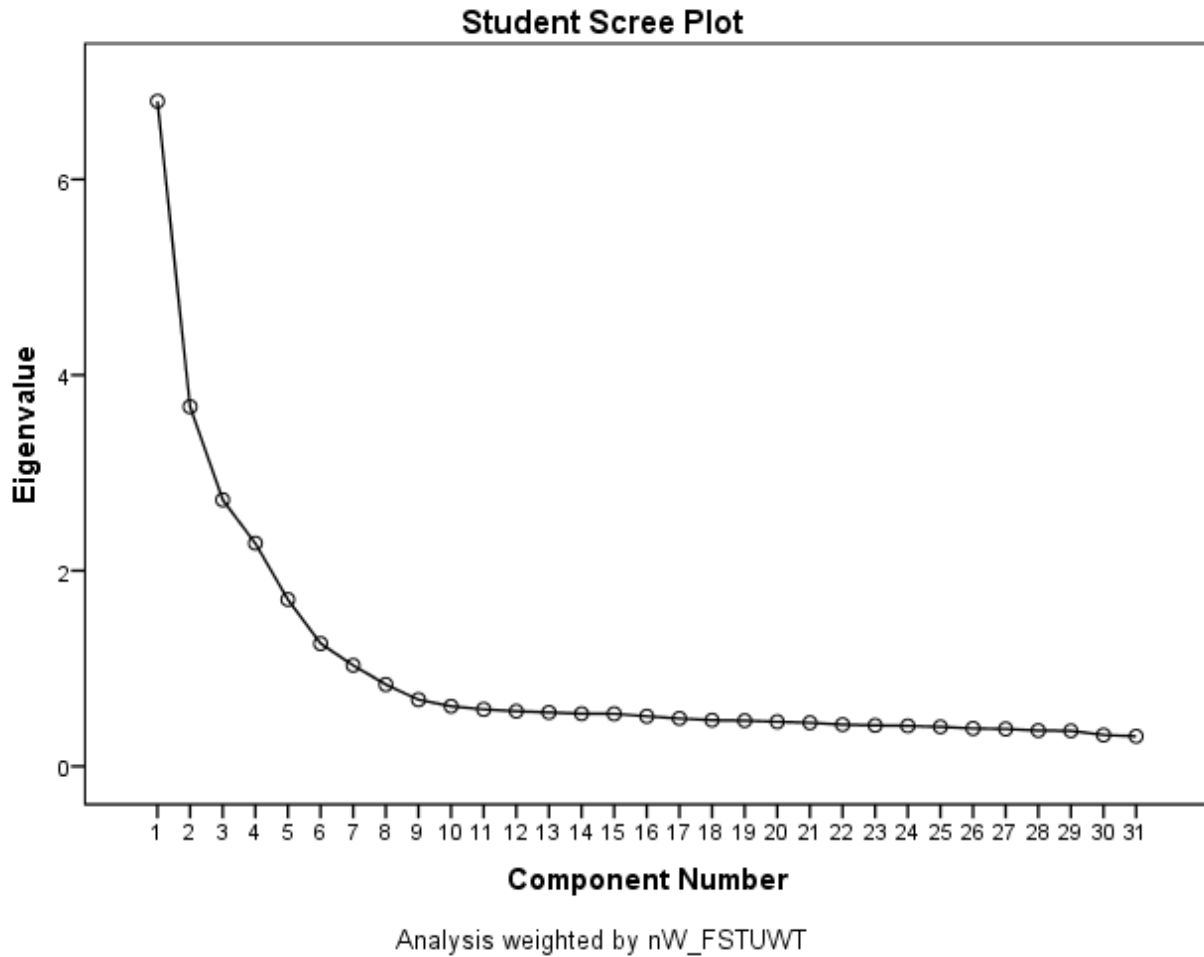
Figure 6. Scree plot of final student principal components analysis.

After several steps, a total of 31 variables were retained as they contributed to a simple factor structure of five components, each consisting of a minimum of three variables, (see Table 4). The variables met the minimum criteria of having a primary factor loading of .32 or above, and no cross-loading of .32 or above. Component 1 was interpreted as 'School Culture' that related to cultural beliefs and views of school as a community. Component 2 was interpreted as 'Strategy' that related to a cognitive component of organizational learning with a flexible posture aimed at a constructive and continuous learning plan of elaborating, interpreting and restructuring. Component 3 was interpreted as 'Environment' that related environmental characteristics in the school that contribute to a safe and trusting environment for members to share honestly and to take risks in experimentation. Component 4 was interpreted as 'Structure' that related to supports in place to build relationships and teamwork; particularly, teacher-student

relationships. Component 5 was interpreted as 'Friend Culture' that related to beliefs and expectations of a peer subculture within the school community.

Table 4

Rotated Factor Loadings and Communalities Based 31 Items and Derived Variables from the OECD and Canada Only PISA 2009 Student Questionnaires (N=23,207)[1,2]

Item	Component					Communality
	School Culture	*Strategy*	*Environment*	*Structure*	*Friend Culture*	*h²*
QA9_B: School is a place: Make friends easily	**.75**	.05	.00	.03	.04	**.57**
QA9_F Reverse Coded: School is a place: Feel lonely	**.73**	.01	.04	.06	-.01	**.54**
QA9_D Reverse Coded: School is a place: Feel awkward	**.72**	.03	.04	.08	-.02	**.53**
QA9_A Reverse Coded: School is a place: Feel like an outsider	**.72**	.01	.07	.08	-.02	**.53**
QA9_C: School is a place: Feel like I belong	**.69**	.10	.04	.09	.08	**.50**
QA9_E: School is a place: Other students like me	**.68**	.06	.00	.06	.06	**.47**
QA9_G: Sch is a place: Inter what have to say	**.66**	.07	.06	.10	.08	**.46**
QA9_H: Sch is a place: Have friends can talk to	**.57**	.09	-.03	.05	.24	**.40**
QA9_I: Sch is a place: Have friends can help me	**.56**	.13	-.01	.11	.31	**.43**
ST38Q08: Strategies - Motivating questions	.06	**.72**	.11	.11	.05	**.55**
ST38Q05: Strategies - Ask if understood	.07	**.70**	.08	.15	.03	**.53**
ST37Q05: Stimulate - Express opinion	.06	**.69**	.08	.07	.06	**.49**
ST38Q03: Strategies - Discuss work	.05	**.69**	.06	.07	.04	**.48**
ST37Q07: Stimulate - Build on knowledge	.07	**.68**	.05	.04	.03	**.47**
ST37Q06: Stimulate - Relate to lives	.05	**.65**	.01	-.03	-.01	**.43**
ST38Q07: Strategies - Student questions	.05	**.64**	.09	.20	.11	**.47**
ST38Q04: Strategies - Explain judgments	.04	**.63**	.07	.14	.09	**.44**
ST38Q02: Strategies - Check Concentrating	.06	**.62**	.13	.16	.01	**.44**
ST36Q03 Reverse Coded: Lessons - Wait for quiet	.04	.10	**.84**	.04	.02	**.72**
ST36Q02 Reverse Coded: Lessons - Noise and disorder	.04	.10	**.81**	.04	.02	**.68**
ST36Q04 Reverse Coded: Lessons - Cannot work well	.06	.12	**.79**	.08	.05	**.65**
ST36Q01 Reverse Coded: Lessons - Students don't listen	.02	.12	**.78**	.06	.03	**.63**
ST36Q05 Reverse Coded: Lessons - Long time to start	.02	.13	**.78**	.07	.05	**.63**
ST34Q05: Teachers - Treat me fairly	.10	.12	.07	**.80**	.07	**.68**
ST34Q02: Teachers - Interested in well-being	.12	.18	.06	**.79**	.06	**.68**
ST34Q03: Teachers - Really listen	.13	.18	.09	**.79**	.05	**.68**

ST34Q01: Teachers - Get along well	.11	.10	.06	**.76**	.11	***.62***
ST34Q04: Teachers - Extra help	.12	.19	.03	**.72**	.06	***.57***
QC3_A: Friends: plan to pursue educ after HS	.12	.08	.02	.07	**.80**	***.66***
QC3_E: Friends: think complete HS is important	.15	.06	.07	.11	**.79**	***.66***
QC3_G: Friends: it's OK to work hard at school	.12	.12	.07	.11	**.75**	***.61***

¹   Factor loading greater than .32 are in boldface.
²   Extraction method: Principal components with Varimax rotation

Student Organizational Learning Index. The student organizational learning composite index was based on the factor analysis of the items from the two PISA 2009 student questionnaires. In addition to the five component scores calculated from the factor analysis (see Table 4), a student leadership variable was included in the composite index. The student leadership variable was derived from the Canada only PISA 2009 student questionnaire and the summation of the number of items selected in item QE1: Volunteer Activities from 'a' to 'g' such that zero selections was scored 1, one selection was scored 2, two selections was scored 3, three selections was scored 4, and four or more selections was scored 5. The student leadership variable was standardized and given equal weighting to the five other components in the organizational learning composite index. The student organizational learning composite index comprised of the summation of the six subscores: the five student component scores and the student leadership score as follows in Equation 4:

> ***Student Organizational Learning Index*** *= Component 1: School Culture +*
> *Component 2: Strategy + Component 3: Environment +*   (Equation 4)
> *Component 4: Structure + Component 5: Friend Culture +*
> *Component 6: Student Leadership*

Psychometric properties of factor scores and Student Organizational Learning Index. The internal consistency was examined for each component as well as the student organizational learning composite index. The internal consistency coefficients were all strong with a range from .75, for the 3-item Friend Culture Component to reliability coefficients of .86 or .87 for the remaining components, (see Table 5). The reliability coefficient for the student organizational learning composite score consisting of all 32 items was strong, .88.

Table 5

Psychometric Properties: Student Components and Student Organizational Learning Index

Scale	N^1	Items	Mean	SD	Cronbach's Alpha
Component 1: School Culture	**21,925**	9	0.04	6.23	**.87**
Component 2: Strategy	**22,066**	9	0.03	6.18	**.86**
Component 3: Environment	**22,491**	5	0.00	4.07	**.87**
Component 4: Structure	**22,453**	5	0.02.	3.76	**.86**
Component 5: Friend Culture	**22,158**	3	0.01	2.44	**.75**
Composite: Student Organizational Learning Index[2]	**20,482**	32	0.38	14.65	**.88**

[1] Weighted by normalized Final Student Weight and excluded cases by listwise deletion on all variables in the procedure
[2] Index included item that made up the Student Leadership factor as well as items consisting of the five components.

Multilevel Modeling of Organizational Learning Indices and Organizational Learning Factors

Two multilevel modeling analyses were conducted to examine the association of organizational learning with student 2009 PISA reading performance 1) in Canada overall and 2) in Saskatchewan. Four factors were considered at the student level: i) student organizational learning index, ii) gender, iii) student socioeconomic background (ESCS index), and iv) self-identification as Aboriginal. Five factors were considered at the school level: i) school organizational learning index, ii) school mean student socioeconomic background (mean ESCS), iii) proportion of students that self-identified as Aboriginal students, iv) community locale, and iv) school size. The analyses employed a two-level hierarchical linear model with students nested within schools, using HLM7 software (Raudenbush et al., 2011). Three models were examined before determining the final model. The first model, Model I, is a 'fully unconditional model' as it did not include any student or school-level variables. Model II included the student level factors. Model III extends to include the school level factors. The final model, Model IV, included only the factors at both student level and school level that have an effect on reading performance as measured by PISA 2009.

Canada Overall: Modelling of School's Conditions that Foster Organizational Learning and Student PISA Reading Literacy Achievement

Table 6 displays the student level and school level descriptive results for Canada. In Canada, data were collected from a considerably larger sample than most countries that

participated in the PISA in order to provide more detailed information at the provincial level. A sample of 23,207 students was weighted by normalized weight to represent a population of 360,286 fifteen-year-old Canadian students in school. Of the 23,207 students in the sample, 107 (or 0.46%) cases were excluded in the multi-modelling as they did not have a school match.

Table 6

Canada Student-Level and School-Level Descriptives

		Normalized Weighted	
Student LEVEL-1	**N**	***Mean***	**SD**
Plausible Value1 READ	23207	524.0	90.56
Plausible Value2 READ	23207	524.4	90.16
Plausible Value3 READ	23207	524.3	90.04
Plausible Value4 READ	23207	524.3	90.56
Plausible Value5 READ	23207	524.2	90.44
Normalized Student Weight	23207	2.2	1.32
Student C1: School Culture	23207	0.0	0.99
Student C2: Strategy	23207	0.0	0.99
Student C3: Environment	23207	0.0	0.99
Student C4: Structure	23207	0.0	0.99
Student C5:Friend Culture	23207	0.0	0.99
Student C6: Leadership	23207	0.0	1.00
Student OL Index[1]	23207	0.04	0.98
MALE	23207	0.503	0.50
SDABORIG	23207	0.057	0.23
ESCS	23207	0.50	0.82
School LEVEL-2			
Normalized School Weight	971	4.0	4.63
Urban	971	0.52	0.50
School OL Index[2]	971	0.0	1.00
School C1: School Culture	971	0.0	1.00
School C2: Strategy	971	0.0	1.00
School C3: Structure	971	0.0	1.00
School C4: Leadership	971	0.0	1.00
XESCS (School Average ESCS)	971	0.37	0.57
Prop25AB	971	0.138	0.35
SCSZPTIL (School Size Percentile)	971	53.99	27.34

[1] Student OL Index refers to an index measuring student's perspective of conditions of organizational learning.
[2] School OL Index refers to an index measuring principal's perspective of conditions of organizational learning.

The weighted sample represented similar proportions across gender, 50.3% male and 49.7% female. Across the weighted sample, 5.7% of the students self-identified as Aboriginal.

The average student socio-economic index (ESCS) was 0.50 (*SD* = 0.82), based on ESCS with the inclusion of imputed mean for missing cases while the average school ESCS index (XESCS) was 0.37 (*SD* = 0.57). Slightly more than half of the schools, 52.4%, were situated in urban communities (a population greater than 15,000) whereas 47.6% were situated in rural communities. The average school size (SCSZPTIL) was around the 50th percentile (student

enrollment of 300 to 378, SD = 27.34 percentile) and 13.8% of the schools had 25% or more of the students self-identify as Aboriginal (Prop25AB).

Based on the normalized weighting and five Plausible Value READ scores, the average reading performance for the Canadian students was 524 points which is 24 points higher than average OECD score. Additionally, the average standard deviation of 90.4 indicated slightly less variability across Canada in comparison to the OECD variability of 100.

The results of the multilevel models for Canada are provided in Table 7. Model I, a "fully unconditional model", did not include any student or school-level variables. See Appendix D for the detailed equations. The average school reading performance mean in Canada was estimated at 509.3 (SE = 2.60) and statistically different from zero, $t(970) = 195.84$, $p < .001$. The proportion of variance in reading performance between schools or intraclass correlation coefficient (ICC) was .207 ($1755.96_{\text{between-school variance}}/8475.28_{\text{total variance}}$), indicating 20.7% of the variability in reading performance was between schools (79.3% of the variability was within school). Significant variation existed among schools in their average reading performance. Variability between school reading performance means was substantial with a standard deviation of 41.90 and 95% confidence that the school means fell in the range of 427.1 to 591.4 (rejecting the fully unconditional hypothesis that all schools have the same mean, H$_0$: τ_{00} $= 0$, $\chi^2(970, N = 971) = 7701.66$, $p < .001$). The information from the fully unconditional model indicated that it is appropriate to add student-level 1 variables and school-level 2 variables to try to explain student-level and school-level variance in the following models.

Model II, the student characteristics model, included four student-level variables to consider the effect of student characteristics on reading performance: gender (Male), self-identified as Aboriginal (SDAboriginal), a PISA socio-economic status index (ESCS), and student organizational learning index (StudentOL Index). For the Canadian HLM analysis, ESCS and StudentOL Index were 'centered' on the Canadian means.

On average, a Canadian female student who is non-Aboriginal with average Canadian ESCS, and average Canadian Student OL Index would have a reading performance score of 528.0 (SE = 2.39). The coefficient for "Male" was -28.3, which indicated that Canadian males with average student characteristics underperform in comparison to Canadian females in reading performance by an average of about 28 points. The coefficient for "SDAboriginal" was -24.9, which indicated that Canadian Aboriginal students with average student characteristics

underperform in comparison to Canadian non-Aboriginals in reading performance by an average of 25 points. The slope for "ESCS" is 18.1, which indicated that Canadian students perform on average 18 points higher in reading performance for each unit increase in ESCS index. The slope for "StudentOL Index" is 17.7, which indicated that Canadian students perform on average 18 points higher in reading performance for each unit increase in StudentOL index.

The proportion of variance explaining the between school variance by adding student level-1 predictors into Model II was determined by comparing it to the between school variance of the fully unconditional model. The inclusion of the student-level variables in Model II accounted for 11.8% of the student-level variation in reading performance and 41.8% of the variation among school means.

There was a statistically significant difference in remaining variance in school means, H_0: $\tau_{00} = 0$, $\chi^2(970, N = 971) = 5579.08$, $p < .001$. Therefore, it was appropriate to examine further to determine if between school variance might be explained after incorporating school-level variables.

Model III, the school-level model, included the significant set of level-1 variables along with the addition of the level-2 variables to allow us to predict variation in reading performance. The level-2 predictors selected for the analysis include SchoolOL Index (School Organizational Learning Index, a continuous variable, centered around Canadian grand mean of a standardized score of zero), PROP25AB (25% or more students Self-identified as Aboriginal, dichotomous dummy variable), SCSZPTIL (School Size Percentile with following classification according to school enrolment: (1 to 60=10) (61 to 138=20) (139 to 222=30) (223 to 300=40) (301 to 378=50) (379 to 518=60) (519 to 714=70) (715 to 905=80) (906+=90), centered around Canadian grand mean of 50th percentile), XESCS (school mean ESCS derived from student ESCS index that included missing imputed with provincial means and centered around Canadian grand mean of 0.37), and URBAN (Urban community size with 15,000+ population, dichotomous dummy variable).

Table 7

Multilevel Models: Canada

	Model I		Model II		Model III		Model IV	
	Fully unconditional		Student Level Variables		Final with OL Index		Final with OL Components	
Intercept	Effect	(SE)	Effect	(SE)	Effect	(SE)	Effect	(SE)
Intercept – Reading	509.3	2.60	528.0	2.39	530.6	2.02	529.4	2.01
Student-Level Variables								
Male			-28.3***	2.06	-28.4***	2.07	-25.7***	2.31
SDAboriginal			-24.9***	4.53	-23.5***	4.55	-20.3***	4.87
ESCS			18.1***	1.36	16.3***	1.39	17.5***	1.41
Student OL Index[1]			17.7***	1.08	17.7***	1.08		
Student C1: School Culture							n.s	
Student C2: Strategy							5.8***	0.91
Student C3: Environment							6.0***	1.10
Student C4: Structure							13.3***	1.00
Student C5: Friend Culture							10.7***	0.96
Student C6: Leadership							6.0***	1.06
School-Level Variables								
School Mean ESCS					23.9***	6.36	18.8**	6.15
School OL Index[2]					n.s.			
School Size (1 unit = 1 percentile)					0.25**	0.09	0.3***	0.09
PROP25AB					n.s		n.s.	
Urban					n.s.		n.s.	
School C1: School Culture							6.5**	2.24
School C2: Strategy							n.s.	
School C3: Structure							n.s.	
School C4: Leadership							n.s.	
Variation among Students and Schools								
Degrees of freedom (X^2 tests)[3]	970		970		968		967	
Student-Level (SD)	82.0		77.0		77.1		76.3	
School-Level (SD)	41.9		32.0		28.1		27.7	
Variance Explained								
Student-Level (%)			11.8%		11.5%		13.3%	
School-Level (%)		(ICC: 20.7%)	41.8%		55.1%		56.3%	

*significant at p < .05
**significant at p < .01
***significant at p < .001
n.s. = not significant and eliminated in final model
[1] Student OL Index refers to an index measuring student's perspective of conditions of organizational learning.
[2] School OL Index refers to an index measuring principal's perspective of conditions of organizational learning.
[3] Chi-square statistics are reported on degrees of freedom on school units that had sufficient data for computation. Fixed Effects and variance components are based on all 971 units.

The average reading performance was 530.6 for a Canadian female non-Aboriginal student with average ESCS and average Student OL Index as well as attended an average ESCS school in 50th percentile school size (enrollment around 375). A large and significant effect on reading performance was related to school mean ESCS. A student with average characteristics would perform 24 points higher if he or she attended a school with a mean ESCS one unit higher than a school ESCS mean of 0.37. School size had a small but significant effect related to reading performance in that a student with average characteristics would perform an additional 0.25 points per percentile or 10 points higher in a school in the 90th percentile (i.e., a school size

greater than 978 students). There was no significant effect that related reading performance to urban community location or School OL index.

The variables in Model III account for about 55.1% of school-level variance – an increase of 13.3% over that obtained with Model II.

Model IV, the last model presented in Table 7 consisted of an examination of the effect of the individual components of the organizational learning index with reading performance. Reading performance score was 529.4 ($SE = 2.01$) for the average Canadian female student who is non-Aboriginal with average Canadian ESCS, and average Canadian component scores as well as attending a school of average ESCS, average school size, and an average School Component 1: School Culture score.

Among the student organizational learning factors, Student C1: School Culture was excluded from the model as it was not statistically significant as a fixed effect. The remaining five student organizational learning components were positively related to reading performance. Student C2: Strategy, Student C3: Environment, Student C4: Structure, Student C5: Friend Culture, and Student C6: Student Leadership were significant (all at $p < .001$). A one unit increase in the component score was associated with the following increase in reading performance: 5.8, 6.0, 13.3, 10.7, and 6.0 respectively. Additionally, one of the school organizational learning components was found to have a positive and significant effect on reading performance in this model. An increase of one unit in School Component 1: School Culture was associated to a 6.5 point increase in reading performance ($p = .004$).

Model IV, consisting of the organizational learning components factors, explained approximately the same proportion of school-level variance (56.3%) as Model III (55.1%) which consisted of the Student Organizational Learning Index and no school organizational learning components. Model IV explained slightly more of the within school variance (about 2%) as compared to Model III, 13.3% versus 11.5 respectively.

Final Canada model equation. In conclusion, Model III provided the best explanation over Model II of variance in reading achievement across schools in Canada. The equation is presented in Equation 5:

Level-1

$$PVREAD_{ij} = \beta_{0j} + \beta_{1j}*(StudentOL_{ij} - \overline{StudentOL}..) + \beta_{2j}*(MALE_{ij}) + \qquad \text{(Equation 5)}$$
$$\beta_{3j}*(SDAboriginal_{ij}) + \beta_{4j}*(ESCS_{ij} - \overline{ESCS}..) + r_{ij}$$

Level-2

$$\beta_{0j} = 530.6 + 23.9*(XESCS_j - \overline{XESCS}.) + 0.25*(SCSZPTIL_j - \overline{SCSZPTIL}.) + u_{0j}$$
$$\beta_{1j} = 17.7$$
$$\beta_{2j} = -28.4$$
$$\beta_{3j} = -23.5$$
$$\beta_{4j} = 16.3$$

Saskatchewan: Modelling of School's Conditions that Foster Organizational Learning and Student PISA Reading Literacy Achievement

Table 8 displays the student level and school level descriptive results for Saskatchewan. For the PISA data collection, a larger sample was drawn from the provinces in order to obtain provincial level estimates as well as national level. A Saskatchewan sample of 1,997 students was normalized weighted to 761 and to represent 11,822 students.

The weighted sample represented similar proportions across gender, 52.8% male and 47.2% female. Across the weighted sample, 13.9% of the students self-identified as Aboriginal.

The average student socio-economic index was 0.43 ($SD = 0.78$), based on ESCS with the inclusion of imputed mean for missing cases while the average school ESCS index was 0.25 ($SD = 0.31$). A majority of the schools, 84.5%, were situated in rural communities (a population less than 15,000) whereas 15.5% were situated in urban communities. The average school size was just slightly over the 30th percentile (student enrollment of 138 to 222, $SD = 19.3$ percentile) and 12.4% of the schools had more than 25% of the students self-identify as Aboriginal.

Based on the normalized weighting, the average reading performance (PVREAD/plausible value READ score) for the Saskatchewan students was 504 which was 20 points below the average Canadian score of 524 points and 4 points higher than average OECD score. Additionally, the average standard deviation of 92.4 indicated slightly more than the Canadian variability of 90.4 and lower in comparison to the OECD variability of 100.

Table 8

Saskatchewan Student-Level and School-Level Descriptives

| | | Normalized Weighted | |
Student LEVEL-1	N	Mean	SD
Plausible Value1 READ	761	504.7	92.38
Plausible Value2 READ	761	503.9	92.06
Plausible Value3 READ	761	503.1	92.81
Plausible Value4 READ	761	505.3	91.93
Plausible Value5 READ	761	503.7	92.79
Normalized Student Weight	761	0.54	0.36
Student C1: School Culture	761	-0.02	1.06
Student C2: Strategy	761	-0.07	1.01
Student C3: Environment	761	-0.01	1.01
Student C4: Structure	761	-0.10	1.03
Student C5:Friend Culture	761	-0.22	1.00
Student C6: Leadership	761	0.00	0.99
Student OL Index[1]	761	-0.12	0.99
MALE	761	0.528	0.50
SDABORIG	761	0.139	0.35
ESCS	761	0.43	0.78
School LEVEL-2			
Normalized School Weight	97	3.07	2.13
Urban	97	0.155	0.36
School OL Index[2]	97	-0.14	0.69
School C1: School Culture	97	0.09	0.98
School C2: Strategy	97	-0.26	0.94
School C3: Structure	97	0.10	0.82
School C4: Leadership	97	-0.21	0.70
XESCS (School Average ESCS)	97	0.25	0.31
Prop25AB	97	0.124	0.33
SCSZPTIL (School Size Percentile)	97	36.24	19.30

[1] Student OL Index refers to an index measuring student's perspective of conditions of organizational learning.

[2] School OL Index refers to an index measuring principal's perspective of conditions of organizational learning.

Table 9 provides the results of the multilevel models for Saskatchewan. Model I, a "fully unconditional model", did not include any student or school-level variables. See Appendix D for the formula. The average school reading performance mean in Saskatchewan was estimated at 493.4 ($SE = 7.48$) and statistically different from zero, $t(98) = 66.00$, $p < .001$. The proportion of variance in reading performance between schools or the intraclass correlation coefficient (ICC) was .194 ($1681.73_{\text{between-school variance}}/8667.84_{\text{total variance}}$), indicating 19.4% of the variability in reading performance was between schools (80.6% of the variability was within school). Significant variation existed among schools in their average reading performance. Variability between school reading performance means was substantial with a standard deviation of 41.01 and 95% confidence that the Saskatchewan school means fell in the range of 413.0 to 573.8

(rejecting the fully unconditional hypothesis that all schools have the same mean, H_0: $\tau_{00} = 0$, $\chi^2(98) = 588.03$, $p < .001$). The information from the fully unconditional model indicated that it was appropriate to add student-level 1 variables and school-level 2 variables to try to explain student-level and school-level variance in the following models.

Model II, the student characteristics model, included four student-level variables to consider student characteristics: gender (Male), self-identified as Aboriginal (SDAboriginal), a PISA socio-economic status index (ESCS), and student organizational learning index (StudentOL Index). For the Saskatchewan HLM analysis, ESCS and StudentOL Index were 'centered' on the Saskatchewan means.

On average, a Saskatchewan female student who was non-Aboriginal with average Saskatchewan ESCS, and average Saskatchewan Student OL Index would have a reading performance score of 522.9 ($SE = 4.73$). The coefficient for "Male" was -34.0, which indicated that Saskatchewan males with average student characteristics underperform in comparison to Saskatchewan females in reading performance by an average of about 34 points. The coefficient for "SDAboriginal" was -45.0, which indicated that Saskatchewan Aboriginal students with average student characteristics underperform in comparison to Saskatchewan non-Aboriginals in reading performance by an average of 45 points. The slope for "ESCS" is 17.0, which indicated that Saskatchewan students perform on average 17 points higher in reading performance for each unit increase in ESCS index. The slope for "StudentOL Index" was 18.4, which indicated that Saskatchewan students perform on average 18 points higher in reading performance for each unit increase in StudentOL index.

The proportion of variance explaining the between school variance by adding student level-1 predictors into Model II can be determined by comparing it to the between school variance of the fully unconditional model. The inclusion of the student-level variables in Model II accounted for 13.7% of the student-level variation in reading performance and 47.9% of the variation among school means.

There was a statistically significant difference in remaining variance in school means, H_0: $\tau_{00} = 0$, $\chi^2(98, N = 99) = 420.58$, $p < .001$. Therefore, it was appropriate to examine further to determine if between school variance might be explained after incorporating school-level variables.

Model III, school contextual model, included the significant set of level-1 variables along with the addition of the level-2 variables to allow us to predict variation in reading performance. The level-2 predictors selected for the analysis include SchoolOL Index (School Organizational Learning Index, a continuous variable, centered around Saskatchewan grand mean of a standardized score of -0.12), PROP25AB (25% or more students Self-identified as Aboriginal, dichotomous dummy variable), SCSZPTIL (School Size Percentile with following classification: (1 to 60=10) (61 to 138=20) (139 to 222=30) (223 to 300=40) (301 to 378=50) (379 to 518=60) (519 to 714=70) (715 to 905=80) (906+=90), centered around Saskatchewan grand mean of 30th percentile), XESCS_M (school mean ESCS derived from student ESCS index that included missing imputed with provincial mean and centered around Saskatchewan grand mean of 0.25), and URBAN (Urban community size with 15,000+ population, dichotomous dummy variable).

The average reading performance was 530.7 ($SE = 3.86$) for a Saskatchewan female non-Aboriginal student with average ESCS and Student OL Index as well as attending an average ESCS school with more than 75% non-Aboriginal students.

A significant effect related reading performance and school proportion of 25% or more Aboriginal students. A student with average characteristics would underperform by 38 points if he or she attended a school with a more than 25% of the students self-identified as Aboriginal. Additionally, a large and significant effect related reading performance and school mean ESCS. A student with average characteristics would perform 43 points higher if he or she attended a school with a mean ESCS one unit higher than a school ESCS mean of 0.37. There were no significant effects across Saskatchewan schools that related reading performance to "School OL Index", "School Size Percentile", or "Urban" community location.

The variables in Model III accounted for 68.4% of school-level variance – an increase of 20.6% over that obtained with Model II.

Model IV, the last model in Table 9 consisted of an examination of the effect of the individual components of the organizational learning index with reading performance. Reading performance score was 529.8 ($SE = 4.23$) for the average Saskatchewan female student who was non-Aboriginal with average Saskatchewan ESCS, and average Saskatchewan component scores in Component4: Structure, Component5: Friend Culture, and Component 6: Leadership as well as in a school with more than 75% non-Aboriginal students and average school ESCS.

Table 9
Multilevel Models: Saskatchewan

	Model I		Model II		Model III		Model IV	
	Fully Unconditional		Student Level Variables		Final with OL Index		Final with OL Components	
Intercept	Effect	(SE)	Effect	(SE)	Effect	(SE)	Effect	(SE)
Intercept – Reading	493.4	7.48	522.9	4.73	530.7	3.86	529.8	4.23
Student-Level Variables								
Male			-34.0***	7.57	-33.7***	7.49	-31.9***	7.16
SDAboriginal			-45.0***	9.17	-38.4***	10.38	-38.5***	10.59
ESCS			17.0***	3.88	15.2***	4.00	14.5***	4.19
StudentOL Index[1]			18.4***	2.61	17.9***	2.59		
Student C1: School Culture							n.s	
Student C2: Strategy							n.s.	
Student C3: Environment							n.s.	
Student C4: Structure							13.9***	2.93
Student C5: Friend Culture							9.0**	3.08
Student F6: Leadership							9.1*	4.04
School-Level Variables								
School Mean ESCS					42.5**	14.00	48.0**.	14.78
School OL Index[2]					n.s.			
School Size (1unit=1percentile)					n.s.		n.s.	
25Proportion SDAboriginal					-38.0*	17.19	-35.5*	17.23
Urban					n.s.		n.s.	
School C1: School Culture							n.s.	
School C2: Strategy							n.s.	
School C3: Structure							n.s.	
School C4: Leadership							n.s.	
Variation among Students and Schools								
Degrees of freedom (X^2 tests)[3]	98		98		96		96	
Student-Level (SD)	83.6		77.6		77.6		76.8	
School-Level (SD)	41.0		29.6		23.0		23.5	
Variance Explained								
Student-Level (%)			13.7%		13.7%		15.5%	
School-Level (%)		(ICC: 19.4%)	47.9%		68.4%		67.0%	

*significant at p < .05
**significant at p < .01
***significant at p < .001
n.s. = not significant and eliminated in final model
n.s. in final = not significant but in final model as significant at school level.
[1] Student OL Index refers to an index measuring student's perspective of conditions of organizational learning.
[2] School OL Index refers to an index measuring principal's perspective of conditions of organizational learning.
[3] Chi-square statistics are reported on degrees of freedom on school units that had sufficient data for computation. Fixed Effects and variance components are based on all 99 units.

The level-2 organizational learning components, School OL Index, School Size, and Urban, were excluded from this model as they were determined to be not statistically significant. Among the level-1 organizational learning factors, Student C1: School Culture, Component2: Strategy, and Student C3: Environment were excluded in Model IV as they were not significant fixed effects. Three of the student organizational learning components were positively related to student reading performance. Student C4: Structure was highly significant ($p < .001$) while Student C5: Friend Culture and Student C6: Student Leadership were moderately significant ($p <$ .05 and $p < .01$, respectively). A one unit increase in Student C4: Structure score was associated

with an increase of 13.9 points in reading performance. A one unit increase in Student C5: Friend Culture score or Student C6: Student Leadership score were associated with an increase in reading performance of 9.0 and 9.1 points, respectively.

Model IV, consisting of the organizational learning components factors, had explained a slightly less proportion of school-level variance (67.0%) as compared to the Model III (68.4%). On the contrary, Model IV which consisted of organizational learning components had explained slightly more proportion of student-level variance (15.5%) as compared to Model III (13.7%) and Model II (13.7%) which both consisted of the student organizational learning aggregate (i.e., the organizational learning index).

Final Saskatchewan model equation. In conclusion, Model III provided the best explanation of variance of reading performance for Saskatchewan schools. The equation is presented in Equation 6:

Level-1
$$PVREAD_{ij} = \beta_{0j} + \beta_{1j}*(StudentOL_{ij} - \overline{StudentOL}_{..}) + \beta_{2j}*(MALE_{ij}) + \qquad \text{(Equation 6)}$$
$$\beta_{3j}*(SDAboriginal_{ij}) + \beta_{4j}*(ESCS_{ij} - \overline{ESCS}_{..}) + r_{ij}$$

Level-2
$$\beta_{0j} = 530.7 + 42.5*(XESCS_j - \overline{XESCS}_{.}) + -38.0*(PROP25AB_j) + u_{0j}$$
$$\beta_{1j} = 17.9$$
$$\beta_{2j} = -33.7$$
$$\beta_{3j} = -38.4$$
$$\beta_{4j} = 15.2_j$$

Summary

In this chapter the research findings presented were guided by the research methodology. In summary, data analyses involved two exploratory factor analyses and two HLM data analyses.

Initially, the results were presented for the first factor analysis that was conducted at a school level to determine factor structures of conditions that foster organizational learning as perceived by school principals in the 2009 PISA school questionnaire. The analysis contributed to the composition of the school organizational learning index that consisted of four components: 'School Culture/Environment', 'Strategy', 'Structure', and 'Leadership'. These results were followed by a second factor analysis that was conducted at a student level to determine factor structures of conditions that foster organizational learning as perceived by students within the 2009 OECD PISA student contextual questionnaire and the 2009 PISA Canada only student contextual questionnaire. The second factor analysis contributed to the composition of the student organizational learning composite index that comprised of the summation of the six

subscores: Component 1: 'School Culture', Component 2: 'Strategy', Component 3: 'Environment', Component 4: 'Structure', Component 5: 'Friend Culture', and 'Student Leadership' score.

Additionally, the results were presented for the two-level HLM data analyses conducted to address the research questions that overall examine the extent that a school's conditions that foster organizational learning was associated with student PISA reading literacy achievement in Canada and in Saskatchewan. Briefly, the findings provided support for the first research question in that Canadian and Saskatchewan 15-year-old students' reading performance was associated with their perspective of organizational learning conditions in their school in consideration of their gender, socioeconomic status, and Aboriginal status. In regards to the second research question, school-level organization learning from the principals' perspective had no significant effect on students' reading performance across Canada and Saskatchewan schools in the presence of the significant student variables and students' organizational learning index.

The following chapter provides an overview of the research study along with a discussion and implications of the findings presented in this chapter.

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

Perceptions of organizational learning conditions from students and principals within Saskatchewan and Canada were examined and investigated for links to reading performance. Secondary analysis was conducted of the 2009 Programme of International Student Assessment (PISA) along with the student and school contextual questionnaires that were administered by the Organization for Economic Co-operation and Development (OECD).

This final chapter begins with an overview of the purpose, methodology, and summary of the findings for each research question. Second, a discussion of the findings follows in relation to the research and literature in the field of organizational learning. Finally, the chapter addresses considerations of the research framework and findings along with policy, theoretical and future research implications.

Purpose of the Study

The purpose was to investigate the relationship of Canadian and Saskatchewan PISA 2009 reading performance and organizational learning conditions as perceived by students and principals when selected student and school characteristics were taken into consideration. Organizational learning theories provide an approach to framing schools as adaptive living systems and promote the flexibility needed to address the expanding complexity of the public education social system in light of increasing globalization, cultural diversity, technological complexities, economic needs, and political demands (Mitchell & Sackney, 2011; Senge, 2006). The following questions guided this study:

1. To what extent are student background variables (i.e. gender, Self-Identified Aboriginal, socioeconomic status, level of experience of school conditions that foster organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and distributive leadership as defined by PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

2. To what extent are school variables (school socio-economic index, school location, proportion of Aboriginal students, school size, level of fostering organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and

distributive leadership as defined by PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

Methodology

The research design included a secondary analysis from PISA 2009 to investigate the relationship between 15 year old student reading performance with contextual and student characteristics in Saskatchewan and in Canada. The dependent variable of study was reading performance, calculated by averaging five plausible reading scores as determined within the PISA 2009 assessment. The independent variables included student-level characteristics (socioeconomic status, gender, Aboriginal status, and student organizational learning index) and school-level characteristics (average student socioeconomic status, proportion of Aboriginal students, school community, school size, and principal school organizational learning index).

Student Organizational Learning index and School Organizational Learning index were determined from principal components factor analyses of items within the PISA 2009 student and school questionnaires. The study's research framework that approached a school as a living system with the capability of a learning community guided the item selection. Additionally, the theoretical framework followed Fiol and Lyles' (1985) definition of organizational learning as well as Mitchell and Sackney's (2011) model of elements that build capacity for a learning community. The research framework was focused on five contextual factors that encompass behavioural, cognitive, social, and cultural aspects of conditions that foster organizational learning: 1) culture that is characterized as collaborative and high extent of shared beliefs and vision among members; 2) strategy that is characterized as a posture is flexible with continuous learning plan of monitoring, interpreting and restructuring; 3) structure that is characterized as supporting and emphasizing relationships, relationship building, and teamwork amongst all members; 4) environment characterized as providing a healthy balance of stability and change as well as a safe and trusting environment for members to share honestly and to take risks in experimentation; and, 5) leadership characterized as an emphasis on learning for all members as well as leadership that is inclusive of all members of the whole organization.

Because of the naturally occurring clusters of students nested in school within the PISA 2009 dataset, multilevel models were used to capture relationships among the student level and the school level variables and reading performance in Saskatchewan, and in Canada overall. The analyses employed two HLM analyses: i) a two-level hierarchical linear model with students

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nested in schools in Canada overall and ii) a two-level hierarchical linear model with students nested in schools in Saskatchewan. The two procedures allowed for an examination of variance of schools within Canada and then for an examination of variance of schools within Saskatchewan. Each two-level HLM analysis proceeded through four stages: 1) fully unconditional model stage that established a baseline of variances within schools and between schools, 2) the student characteristics model that introduced the student-level independent variables as well as addressed the first research question, 3) the intercepts-and/or slopes-as-outcomes model that introduced the school-level independent variables as well as addressed the second research question; and, 4) organizational learning components model that introduced the student-level and school-level organizational learning components into the model rather than the organizational learning indices.

Discussion of Findings

This study focused on two research questions that examined the relationship between organizational learning conditions and reading performance in Canada overall and in Saskatchewan. The Canadian sample of 23,207 students was weighted by normalized weight to represent a population of 360,286 fifteen-year-old Canadian students in 3,787 schools from the ten provinces. The three territories and Aboriginal schools were excluded from the sampling. The Saskatchewan sample comprised of 1,997 students that was normalized weighted to 761 students and to represent 11,822 fifteen-year-old Saskatchewan students in 378 schools.

The weighted Saskatchewan sample differed in the majority of the student and school characteristics as compared to the weighted Canada sample. Proportion of male students was slightly higher in Saskatchewan than in Canada overall, 52.8% versus 50.3% respectively. Proportion of self-identified Aboriginal students was higher in Saskatchewan than in Canada overall, 13.9% versus 5.7% respectively. The average ESCS in Saskatchewan was 0.43 and slightly lower than the 0.50 average ESCS in Canada. The average school ESCS in Saskatchewan of 0.25 compared to 0.37 in Canada. The average school size in Saskatchewan was about the 30th percentile (138 to 222 students) versus about the 50th percentile (300 to 378) in Canada. In Saskatchewan, 25.5% of the schools are situated in urban communities or a population that is greater than 15,000 versus 52.0% of the schools in Canada in urban communities. The proportion of schools that had 25% or more of the students self-identify as Aboriginal students was similar in both Saskatchewan and Canada, 12.4% compared to 13.8%

respectively. These percentages seem somewhat higher than what would be anticipated and may have been inflated as a result of a combination of sample design weighting at student level and at school level.

Research Question 1: Student Organizational Learning Model

> To what extent are student background variables (i.e. gender, Self-Identified Aboriginal, socioeconomic status, level of experience of school conditions that foster organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and distributive leadership as defined by PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

The student level model was developed to address the first research question regarding the extent to which Canadian and Saskatchewan 15-year-old students' reading performance was associated with their perspective of organizational learning conditions in their school in consideration of their gender, socioeconomic status, and Aboriginal status. The first research question was investigated in two stages: 1) the fully unconditional model that excludes all levels of independent variables and 2) the school characteristics model that included all the student-level independent variables. See Table 7 for the detailed Canadian and Table 9 for the Saskatchewan results. See Appendix D for detailed equations.

Fully unconditional model. The investigation of the first research question proceeded upon the determination that the Canada and Saskatchewan fully unconditional models that exclude student-level and school-level variables provided evidence that the average reading performance among schools did vary significantly to warrant the addition of variables (Canada ICC = .207 and Saskatchewan ICC = .194). Therefore, the addition of student-level variables was an attempt to explain about 20% of the variance in reading performance between schools and 80% of the variance of reading performance within schools. Notably, the fully unconditional models for both Saskatchewan and Canada indicate a similar magnitude of school effect on student reading performance as well as a comparable heterogeneous mix of students within the schools. A 20% proportion of variance in reading performance attributed to Canadian schools was comparable to the 17% proportion of variance in mathematics achievement accounted for by Canadian schools found by Anderson et al. (2009) in their review of PISA 2003 studies.

The school reading performance mean in Canada was estimated at 509.3, *SE* = 2.6 and in Saskatchewan was estimated at 493.4, *SE* = 7.5. Considering standard error surrounding the estimate, there is a 95% chance that Canada's school reading performance mean is significantly

higher than Saskatchewan's school reading performance mean (*Mean difference* = 15.9; 95% CI [0.4, 31.4]).

      School characteristics model. Gender, self-identification as Aboriginal, and socioeconomic status are student-level characteristics that have been associated with differences in academic achievement (Coleman et al., 1966; Saskatchewan Ministry of Education, 2011; Willms, 2004; Willms, 2010). However, these characteristics have not been investigated along with student perceptions of school organizational learning conditions.

      A student organizational learning index comprised of six components determined from factor analysis of items from the Canadian and OECD PISA 2009 student questionnaires that were associated to the organizational learning conditions research framework. The six components were 1) "School Culture" that consisted of items relating to the student perception of school as a place to make and have friends, feel belonging, feel comfortable, feel liked, and feel valued; 2) "Strategy" that consisted of items relating to the student perception of instructional approaches that were motivating, related to their lives or previous knowledge, required discussion and expression of their opinion, and student engagement; 3) "Environment" that consisted of items relating to the student perception of the classroom climate that was conducive to working and listening; 4) "Structure" that consisted of items relating to the student perception of their relationship with teachers where they felt they were treated fairly, valued, received extra help, and got along well; 5) "Friend Culture" that consisted of items relating to the student perception that their friends valued school and respected a hard working ethic at school; and, 6) "Student Leadership" that consisted of an item that related to their level of volunteering in school activities as well as the community.

      Considering standard error surrounding the estimate, there is a 95% chance that the Canada and Saskatchewan school reading performance means were similar when taking into consideration the student-level independent variables, 528.0 (*SE* = 2.39) and 522.9.0 (*SE* = 4.73) respectively (*Mean difference* = 5.1; 95% CI [-5.3,15.5]). In other words, a Canadian 15 year old Non-Aboriginal, female student with an average socioeconomic status (ESCS = 0.50) and an average perception of organizational learning conditions (Student OL index = 0.04) would score 528.0 in reading performance. A Saskatchewan 15 year old Non-Aboriginal, female student with an average Saskatchewan socioeconomic status (ESCS = 0.43) and an average perception of organizational learning conditions (Student OL index = -0.12) would score 522.9 in reading

performance. Furthermore, there was no significant difference between the two average performances in reading.

In both Canada and Saskatchewan student characteristics models, male students and Aboriginal students underperformed in reading performance in comparison to their counterparts. On average, Saskatchewan male students, in comparison to their female counterparts, underperformed in reading achievement by 34 points. Likewise, Canadian male students, in comparison to their female counterparts, underperformed in reading achievement by 28 points. Additionally, in both Saskatchewan and Canada schools, student socioeconomic status was positively associated with reading performance. Canadian and Saskatchewan students performed higher in reading performance, on average 18 points and 17 points respectively for each unit increase in the ESCS index.

'Student Organizational Learning Index' (i.e., a measure of student perception of conditions in the school that foster organizational learning) was positively associated with student reading performance in the presence of student characteristics in both Canada and Saskatchewan. Canadian students performed on average 18 points higher in reading performance for each unit increase in StudentOL index. Saskatchewan students performed on average 19 points higher in reading performance for each unit increase in StudentOL index.

The inclusion of the student-level variables in Model II accounted for 11.8% of the student-level variation in reading performance and 41.8% of the variation among Canadian school means as compared to 13.7% of the student-level variation in reading performance and 47.9% of the variation among Saskatchewan school means.

Research Question 2: School Organizational Learning Model

> To what extent are school variables (school average socio-economic index, school location, proportion of Aboriginal students, school size, level of conditions that foster organizational learning (collaborative culture, vision-driven strategy, supportive structure, safe environment, and distributive leadership as defined by PISA questionnaire) associated with student 2009 PISA reading performance in Saskatchewan? and in Canada overall?

The school level model was developed to address the second research question regarding the extent to which Canadian and Saskatchewan 15-year-old students' reading performance was associated with the principal perspective of organizational learning conditions in their school in consideration of the significant student level characteristics as well as school contextual factors.

The school contextual factors consisted of school average student socioeconomic status, school location, proportion of Aboriginal students, school size, and school organizational learning index from the principal's perspective. The second research question was investigated in two stages: 1) the school contextual model that included all the significant student-level independent variables and the school-level independent variables and 2) the organizational learning components model that examined the student-level and school-level components of organizational learning conditions rather than the aggregated organizational learning indices. See Table 7 for the detailed Canadian results and Table 9 for the detailed Saskatchewan results. See Appendix D for detailed equations.

School contextual model. The second research question extended to a school-level of conditions that foster organizational learning with the inclusion of the student level significant factors and the school contextual factors. The school-level organizational learning index from the principal's perspective was comprised of four components determined from factor analysis of items within the OECD PISA 2009 school questionnaire that were associated to the research framework. The four components were 1) "School Culture/Environment" that consisted of items relating to the principal perception of student learning facilitated by respectful students, good teacher-student relations, staff engagement, student engagement, staff belief in student potential, low risk of student bullying, and teacher high expectations of students; 2) "Strategy" that consisted of items relating to the principal perception of the frequent occurrence of strategies such as classroom activities in accordance with educational goals, teachers work in accordance with educational goals, ensuring clarity of curriculum responsibility, professional development activities for teachers in accordance with teaching goals, suggestions for teacher improvement, support teachers with classroom problem, and monitor students' work; 3) "Structure" that consisted of items relating to the principal perception of school capacity to provide instruction is not hindered by a shortage of teachers; and, 4) "Leadership" that consisted of an item that related to the principal perception of assessments for school use and diverse leadership consisting of leadership from parents, students, teachers, and principals.

Considering standard error surrounding the estimate, there is a 95% chance that the Canada and Saskatchewan school reading performance means were similar when taking into consideration the student-level independent variables and school contextual variables, 530.6 (*SE* = 2.02) and 530.7 (*SE* = 3.86), respectively (*Mean difference* = 0.1; 95% CI [-8.6, 8.4]);

however, there were differences between the Canada and Saskatchewan school contextual models in the variables that had effects. The two models indicated a positive effect on reading performance for students in a school with a higher average socioeconomic status; however, the magnitude was much greater in Saskatchewan. Across Saskatchewan schools, a student with average characteristics would perform 43 points higher in reading achievement if attending a school with a mean ESCS of 1.25. Across Canada schools, a student with average characteristics would perform 24 points higher in reading achievement if attending a school with a mean of 1.37.

In contrast, there was a small but significant school size effect across Canada schools; but, there was no significant school size effect across Saskatchewan schools. Across Canada, a student with average characteristics would perform 10 points higher in reading achievement if attending a school with a school size of more than 905 students. Possible reasons for the differences could be attributed to differences in average school size across Canada in comparison to Saskatchewan. It can be noted from the descriptives (see Table 6 and Table 8) that the average school size in Saskatchewan was considerably smaller than the average school size across Canada, an average of 138 to 222 students in Saskatchewan schools compared and average of 300 to 378 students in Canada schools. Also, another possibility is that the relationship of school size to reading achievement is not linear as Willms (2004) had found that school size had a nonlinear effect to reading achievement.

There was a positive effect on reading performance across Saskatchewan schools with more than 75% non-Aboriginal students; but, no significant effect was found across Canada schools. Across Saskatchewan, a student with average characteristics would underperform by 38 points in reading achievement if attending a school with more than 25% Aboriginal students.

Whether the school was in a rural or urban community had no significant effect on reading performance across Canada and Saskatchewan schools in the presence of the significant student variables. This finding differed from Cartwright and Allen (2002) who did find an urban-rural difference with PISA 2000 reading achievement in Canada albeit not in Saskatchewan. However, Cartwright and Allen defined an urban school by being located in urban core that includes rural and urban areas that have a high degree of economic integration with urban areas. Furthermore, the authors noted that the rural school students more likely came from lower socioeconomic backgrounds as compared to urban students. This study may not

have found significant urban-rural differences in that student socioeconomic status and school average socioeconomic status were both included in the school contextual model.

Additionally, the variable of interest from the principal perspective, school-level organization learning conditions, had no significant effect on reading performance across Canada and Saskatchewan schools in the presence of the significant student variables. This finding differed from Silins and Mulford (2004) model that found organizational learning premised on the professional community as significantly associated with student outcomes. A few considerations could offer some insight into this difference. Silins and Mulford operationalized organizational learning on a different questionnaire directed more at measuring a collaborative climate, shared goals, encouragement of risk-taking and professional development opportunities from the teachers' perspective (Silins et al., 2002). On the other hand, the measurement of school organizational learning index for this study was constrained by items available within the PISA 2009 school questionnaire such that evidence of construct validity was weakened in the restriction of capturing a richer representation of the organizational learning domains. Another explanation is that this study considered a student perspective of conditions fostering organizational learning which was significant and present when the principal organizational learning index was introduced in the model. It is possible that the student experiences were mediated by the professional learning community within the school and muted the significance of the principal perspective. Further study and investigation of this explanation would be important to test this hypothesis.

The inclusion of school-level variables was notable for both the Canada and Saskatchewan models. The inclusion of school-level variables in the Canada model accounted for about 55.1% of school-level variance and an increase of 13.3% over the amount of variance accounted for by the student characteristics model as compared to an increase of 20.5% explained school-level variance in the Saskatchewan model for a total of 68.4% of the variance.

Student and school organizational learning components model. The second stage to the second research question was to examine the modelling with the organizational learning components as separate variables rather than the composite organizational learning indices to determine if any further insight could be gained to the relationship of organizational learning conditions and student reading performance.

The reading performance averages were similar for the Canadian and Saskatchewan schools that included organizational learning components, 529.4 (*SE* = 2.01) and 529.8 (*SE* = 4.23) respectively; however, there were differences in the component effects in the two models. Student perspective of structure that involve teacher relationships, friend culture, and their leadership contributions had positive effects on reading performance across Canada and Saskatchewan schools. Student perspectives of motivating and relevant instructional strategic approaches as well as a classroom environment conducive to working had an effect on reading performance in Canada schools but not significantly in Saskatchewan schools. In the presence of the other significant student and school variables, student perspective of school culture, that included school as a place to make friends, have friends and feel belonging, had no significant effect on reading performance across Canada and Saskatchewan schools. A possible explanation is that this study only considered linear relationships and these domains may have a non-linear effect on reading achievement that would be more sensitive to the smaller sample size of Saskatchewan schools in comparison to the Canada school sample size.

In the Canada model only, the sole school-level organizational learning component that had an effect on reading performance was the principal perspective of school culture which included respectful students, good student-teacher relations, high teacher expectations, teacher commitment, and student engagement. No school-level organizational learning components were significant in the Saskatchewan model. Again, this finding could point to the consideration that this study only examined linear relationships and these domains may have a non-linear effect on reading achievement.

The Canada and Saskatchewan modelling with the organizational learning components did not add any explanation to the school-level variance but did add some explanation to student-level variance. For both the Canada and Saskatchewan models, the organizational learning components model added 2% more of the proportion of explained student-level variance

compared to both Model II/student characteristics model and Model III/the school contextual model.

Conclusions

This study used data from PISA 2009 to examine the relationship of student and principal perspectives of organizational learning conditions with student reading performance in Canada and Saskatchewan in consideration of selected student and school characteristics. In general, there were more similarities than differences between the Saskatchewan schools and Canada schools overall. Seven of the most important findings emerging from this study are as follows:

1. **In consideration of student and school contextual characteristics, Canadian and Saskatchewan students have similar reading performance**.

In *Measuring Up: Canadian Results of the OECD PISA Study 2009*, it was reported that Saskatchewan students performed below the Canadian average for reading, 504 ($SE = 3.3$) as compared to 524 ($SE = 1.5$) (Knighton et al., 2010). Initially, this study did find that, without taking into consideration student characteristics or school context, Saskatchewan schools average in reading performance was lower than the average of Canada schools overall, 493 ($SE = 7.5$) versus 509 ($SE = 2.6$), respectively. However, in the presence of student (socioeconomic status, Aboriginal status) characteristics and student perspective of school contextual factors (as measured by student OL perspective), reading performance was similar between Saskatchewan students and Canadian students overall, 531 ($SE = 2.0$) and 523 ($SE = 3.9$) in the student characteristics model. This finding suggested that a Non-Aboriginal female, with average socioeconomic status and an average perception of the school's organizational learning conditions will perform comparably across Canada and across Saskatchewan schools. This finding concurred with Goldstein (2004) that surveys, such as the PISA, should be vehicles of informing contextual differences in school organizations and not as much focused on ranking. This finding suggested student characteristics and contextual factors were an important consideration when comparing differences in achievement across Canadian school systems. With this finding in mind, the Saskatchewan education system was comparable to Canadian education systems overall; and, the challenge for policies to promote equal educational opportunities for all students is nation-wide.

2. **Student socioeconomic status, Aboriginal status, and gender, continue to play a role in reading performance.**

In Saskatchewan and in Canada overall in reading performance, girls outperformed boys; Non-Aboriginal students outperformed Aboriginal students; and, students from higher socioeconomic backgrounds were advantaged in achieving successful reading outcomes. These findings concur with results presented by CMEC (2009); Saskatchewan Ministry of Education (2011), and Willms (2004). The average gender effect was comparable for Saskatchewan and Canadian schools. This finding suggests that there continues to be a need for school strategies and policies that are more successful at motivating and engaging male students in reading (Willms, 2004). Likewise, the average effect of socioeconomic advantage was similar for Saskatchewan and Canada schools. This finding suggests that there continues to be a need for school policies to be implemented to counteract effects of being socioeconomically disadvantaged (Willms, 2004). In view of a student organizational learning index effect, this study would suggest that such practices and policies may include an invitation to the male student voice/socioeconomically disadvantage student voice to participate in reading curriculum as well as an affirmation of what they value by making the reading relevant to them.

The Aboriginal/Non-Aboriginal gap was greater in Saskatchewan schools as compared to Canada schools overall. This finding suggests that Canadian schools are more successful at facilitating positive reading outcomes for their Aboriginal students. Thus, Canada's advantage in reading performance over Saskatchewan was mainly attributable to more success with Aboriginal students. Nonetheless, there remains the continued challenge for both Canada and Saskatchewan schools to close the achievement gap between Aboriginal and Non-Aboriginal students while improving performance for all students (CMEC, 2009; Saskatchewan Ministry of Education, 2011). In this regard, Saskatchewan schools are at risk of trailing their Canadian counterparts. While community and demographic factors often fall outside the school's jurisdiction, further investigation is needed to probe the demographic factors in more detail and how students' perceptions of conditions for organizational learning may contribute to providing insights into this gap.

3. **There was a significant school-level contextual effect on reading achievement associated with proportion of Aboriginal students for Saskatchewan schools as well as school average socioeconomic index for both Saskatchewan schools and Canada schools overall.**

In Saskatchewan, students who attended schools with a greater than 25% proportion of Aboriginal students tended to underperform in reading achievement compared to their counterparts. Across Canada schools, this effect was not significant. These findings suggest that perhaps Saskatchewan schools in the public school systems with higher proportion of Aboriginal students may have additional challenges that are not encountered by in Canadian schools of comparable contextual characteristics. The Saskatchewan finding did concur with CMEC (2009) that found schools with higher proportion of students of Aboriginal ancestry was associated with lower reading achievement.

School's average socioeconomic status was able to help explain differences between schools across Canada and Saskatchewan. Across Canada schools, in addition to positive association of school socioeconomic status, school size had a slight but significant school effect associated with reading performance. In consideration of the predominant effect of school mean socioeconomic status and school size across Canada, previous literature has suggested that higher socioeconomic schools or larger schools may be able to provide attractive programming or programs more closely matched to student interests (Willms, 2004).

4. **Student perspective of organizational learning conditions was associated with higher reading achievement.**

A moderate and significant effect of the student perspective of higher organizational learning conditions was associated with more positive reading performance among Canada and Saskatchewan schools in consideration of socioeconomic status, gender, and Aboriginal status. This finding supports the primary hypothesis of the first research question that a higher level of student experience of school conditions that foster organizational learning was associated with student 2009 PISA reading performance in Saskatchewan and in Canada overall. It was noted that the effect was of similar magnitude to that of socioeconomic status effect for both Saskatchewan and Canada schools such that a student with average socioeconomic status but a unit higher perspective of the school's organizational learning conditions could have a reading

performance equivalent to a student with one unit higher socioeconomic status and average perspective of the school's organizational learning conditions.

This finding was important and introduces factors that schools can influence as well as have a link to student outcomes. Student perspective of organizational learning conditions was an index score derived from a composite of factors that consisted of belonging "School Culture", meaningful "Strategy", productive classroom "Environment", positive teacher relationship Structure, a "Friend Culture" that valued school, a "Student Leadership" that related to school and community involvement. Figure 7 illustrates the conditions that foster organizational learning at the student level as it was operationalized for this study. While this model reflects the five dimensions identified in the guiding research framework, differences can be noted. This final model extends to and represents a students' perspective versus a professional community's perspective. Additionally, this model reflects the importance of the friend subculture in addition to the school culture.

The findings from this study supported the hypothesis that organizational learning conditions are associated with student achievement. As such, the results concurred with other studies that factors integral to building school-wide capacity promote student learning (Sackney et al., 1998; Stoll et al., 2006; Wößmann et al., 2007; Vescio et al., 2008). The findings from this study further emphasized the importance of the student voice.
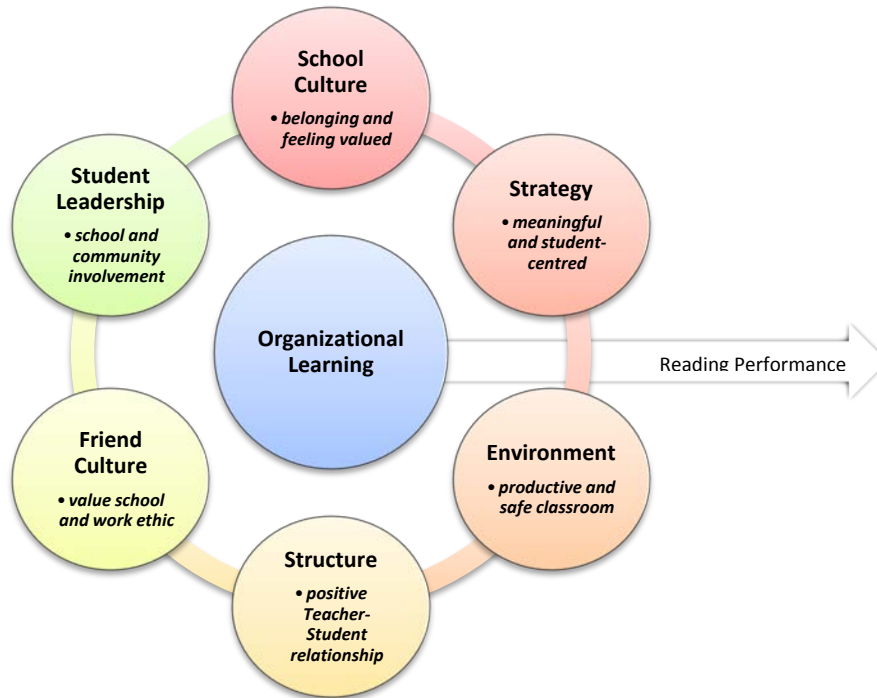
Figure 7. Conditions that foster organizational learning at student level.

5. **Principal perspective of organizational learning conditions did not add any significant association to reading performance.**

In the presence of student characteristics and student perspective of organizational learning conditions, there was no significant effect of principal perspective of organizational learning conditions on reading performance across Saskatchewan and Canada schools. This finding did not provide support for the primary hypothesis of the second research question that a higher level of the principal perspective of the school's organizational learning conditions was associated with student 2009 PISA reading performance in Saskatchewan and in Canada overall. It was anticipated that   the school organizational learning composite index would capture dimensions and conditions of a professional community over and above what would be captured by the students' measure of organizational learning conditions. An explanation is related to limitation within the secondary nature of this study in that there was a limitation of school questionnaire items available from the 2009 PISA to load on the domains of the research framework. There was a minimal number of items available to capture a rich representation of the school-level dimensions of the research framework. For example, School Component 3: Structure was limited to a shortage of teachers that would have impacted teacher-student

relations and student learning. Additionally, since the student organizational learning index was significant and present in the model at the time that the principal organizational learning index was introduced, further research would be necessary to investigate if there was a relationship between the student and principal organizational learning indices that impacted this finding.

6. **Variance decomposition analyses of final models with the inclusion of student organizational learning index indicated that explained between-school variance was significant to provide evidence that schools can influence student achievement.**

An examination of the variance components was conducted with the models that included significant school-level variables and student-level variables associated with reading achievement, such that the explained variation between schools was 55% for Canada, and 68% for Saskatchewan. The final models which include the Student OL Index suggest a link between students perception of their school's capacity for organizational learning with student achievement. See Figure 8 for final Canada model of factors with significant effects on reading achievement model and see Figure 9 for Saskatchewan model of factors with significant effects on reading achievement model.
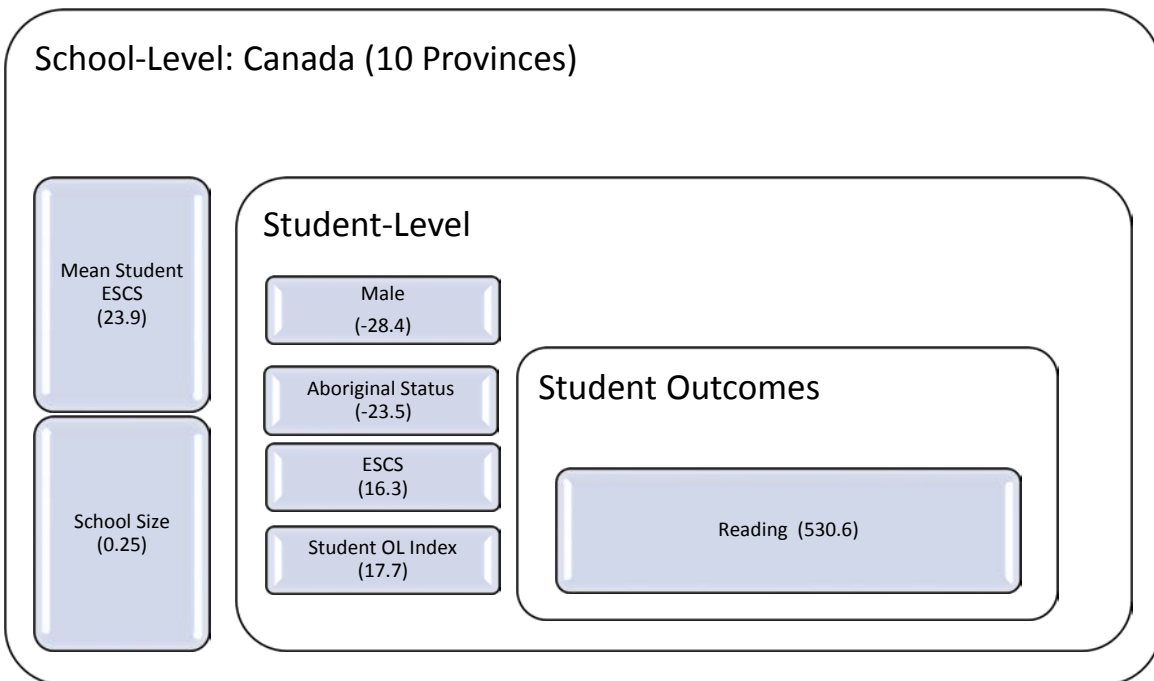
Figure 8. Canada model of significant factors associated with reading achievement.
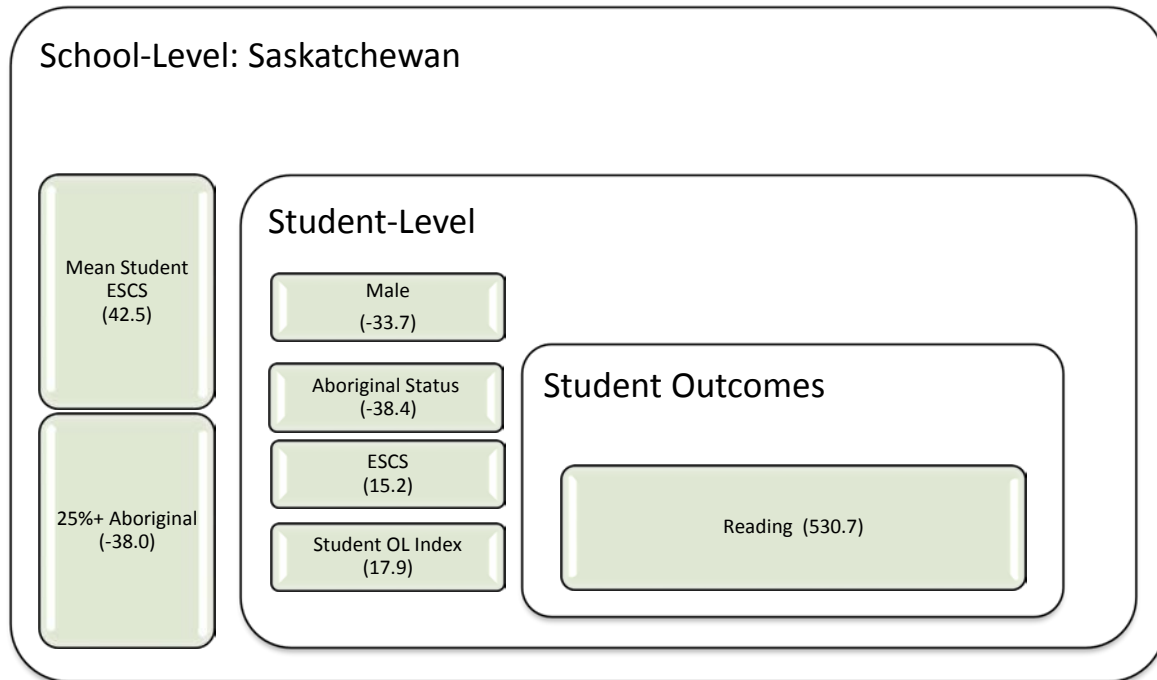
Figure 9. Saskatchewan model of significant factors associated with reading achievement.

Previous multilevel studies have shown the importance of student and school socioeconomic index on student achievement (Willms, 2004). This study has demonstrated that along with the selected student and school characteristics including the socioeconomic indices, higher organizational learning conditions in a school from a student perspective can help to explain differences in reading performance between schools in Canada and Saskatchewan. While this study was exploratory, caution is recommended to generalizing results to other subject domains. Future research of replicate methodology and other subject domains is important to determine how results would generalize to achievement in general. Furthermore, there also remains a significant proportion of unexplained between-school variance. Nonetheless, this study points to a significant between-school variation with empirical evidence that schools with conditions for organizational learning can influence student outcomes.

7. **Organizational learning index as a factor was significant at explaining between-school variance while the individual organizational learning components did explain slightly more variance at the student-level.**

Modelling of the organizational learning components increased explanation of student-level variance of 2% across Saskatchewan schools and Canada schools, however, there was a

very slight decrease of 1% across Saskatchewan schools and a similarity across Canada schools to the explained between-school variance. This finding provides evidence of validity of a multifaceted construct of the organizational learning composite index that it is capturing the phenomenon at an organizational level. Although this study was exploratory, the finding suggests that the organizational learning index may be tapping into a unitary construct that was capturing an organizational-level phenomenon. In particular, the student view of the organizational learning conditions were in fact associated with their learning and vice versa; those students that had a more negative view of organizational learning conditions resulted in lower student outcomes. This result of a unitary construct with a school effect challenges Willms (2004) conclusion that there was no single factor but rather several factors with small effects. Further research such as confirmatory factor analysis, item response theory, and/or structural equation modelling would help to strengthen the hypothesis that the composite score was reflecting a unitary theoretical construct aimed at measuring at an organizational level.

Implications

Findings from this study lead to a number of implications in three areas: 1) practice and policy; 2) future research; and, 3) theory. The following implications are concentrated on how the findings relate to conditions that foster organizational learning characteristic of a living system.

Implications for Practice and Policy

There are important practice and policy implications from this study for educational administrators, principals, and policymakers with goals to provide equitable and quality education for all students. Specifically, this study illuminates the need to consider contextual factors and the student perspective of organizational learning conditions in practices and policies within the use of large-scale assessment to monitor equitable opportunities for all students. The importance to the contextual factors, relationships, connections to patterns point to characteristics essential to learning within living systems. Moreover, this study supports practice and policy orientation towards a view of schools as living systems.

This study confirms the need for administrators and educators to consider contextual factors within the use of large-scale assessment as a way to inform practices and policies. This study illuminates how large-scale assessment can be used to monitor educational goals such as equitable opportunities for all students. Results from this study continue to echo the need to

focus policies and practice to consider equitable opportunities in reading for male students, and lower social status, and Aboriginal students. Additionally, findings from this study identified significant influence of the students' perspective of the schools organizational learning conditions. Therefore, related policy and practice intervention may be key at mediating the impact of disadvantaged subgroups and improving academic achievement for all students. While many factors remain out of the school's domain, there was evidence of school practices and policies better at reducing achievement gaps for these subgroups as well as providing enhanced opportunities for all students. For example, PISA cross national studies have shown that countries like Korea and Finland which have less socioeconomic divide and higher achievement for all students also indicate policies for extra classes for the disadvantaged (Lokan, Greenwood, & Cresswell, 2001). This study points to possible interventions focused on organizational learning as an avenue to address equitable opportunities for socially disadvantaged students as well as to all students. Consider the finding that a student with one unit higher than average in their perceptions of the school's organizational learning conditions has an increase in reading performance equivalent to a unit increase in their ESCS (socioeconomic status). Administrators and policymakers may consider the inclusion of monitoring conditions for organizational learning along with gender, Aboriginal status, and socioeconomic status when evaluating accountability policy and use of large-scale assessment. So often administrators and policymakers approach the use of large-scale assessment from a mechanistic view of schools with a controlling, top-down approach that is threatening to teachers and students. Ingram, Louis, and Schroeder (2004) suggested that an organizational learning framework changes the face of data use and places an emphasis to discussion and uncovering the truth. Within a living systems view of schools, the use of large-scale assessment that includes a measure of conditions for organizational learning becomes an accountability tool for all members to seek ways of improvement.

Implications from this study concurred with Ma and Crocker (2007) who suggested policy orientation towards a focus on school climate rather than materials and Marks et al. (2000) who connected capacity for organizational learning with teacher pedagogy and student achievement. Such sentiments are characteristic of a living systems view of schools. While the aforementioned studies emphasized school improvement and empowerment of teachers, this study extends to policy orientation towards the empowerment of students as well. This policy

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recommendation is not intended to undermine the role and importance of funding, resources and materials; rather, it emphasizes the importance of relationships and the sense of belonging to all members, including the students. If policy is directed in a way where schools can have influence and wherein teachers and students are empowered, growth will follow. Evidence from this study suggested the importance of policies and practice that encourage building positive student-teacher relationships, building on students finding value in their education, building on strategies that making meaningful connections for the students, build on developing student leadership in the school and community for all students, and building on a school culture where students feel they belong. In summary, the findings point to a policy orientation of schools as living systems wherein relationships, caring, interacting, and collaborating involves all members.

Implications for Further Research

Implications to further research relate to two primary themes. First, the significant findings can be further examined in future research. Second, the limitations within this study inform implications for future study.

There are a number of future research implications of the significant findings associated to the breadth and scope of the PISA. The OECD has administered the PISA every three years since 2000. Additionally, 2009 PISA database included other subject domains as well as the participation of 65 countries.

Significant findings resulted within this study with a focus on reading performance. Since the 2009 PISA included assessment in mathematics and science literacy, future research of this study in the other subject domains may determine different results. Additionally, the future research could examine differences across other provinces. While factor analysis would be limited to the OECD questionnaires only, future study could include cross national comparisons as well as comparisons to other years of administration of the PISA.

Nonsignficant findings were encountered with the principals' organizational learning index and the lack of association with student outcomes that in part, may be explained by the limitations and secondary nature of the study. Since the student organizational learning index was introduced into the modelling prior to the principal organizational learning index, this research design may have impacted the result. If there was an association or mediating factor of the principal influencing the student, the principal voice may have been muted. Future research would be necessary to investigate if there were factors impacting the relationship between the

two indices: student and principal. Additionally, future research would be necessary to determine if this result would be replicated in other subject domains. Other implications for future research would include the refinement and improvement of items in future questionnaires that may better capture the dimensions operationalizing conditions that foster organizational learning.

Due to limitations of secondary analysis nature of this study, other important levels to the learning community were unavailable for analysis. Within-school variance of differences in reading performance across Canada and Saskatchewan was almost 80%. Since there was no teacher questionnaire administered, this study was lacking a link to the teacher level that may capture factors that may be specific to that within school variation. Even though the sampling framework may be further complicated to include random collection of classroom level data, future study may consider the development of a teacher questionnaire in addition to the principal and student questionnaires. Second, a parent level may be another consideration to providing insights into organizational learning conditions associated to student outcomes. While the OECD did provide a parent questionnaire option with the PISA, Canada usually did not participate in this option. Since Mitchell and Sackney (2011) acknowledged that the learning community does include members within the broader community of the school, future research could include such groups as parents, district administration, and provincial government.

A second limitation that implicates future research is that the cross sectional nature of this study did not support cause and effect study. Future research could examine longitudinal effects by following students from primary to high school and/or high school to post-secondary education. Human Resources Development Canada and Statistics Canada did collect data from an 18 to 20 year old cohort that links with the PISA 2000 cohort within the Youth in Transition Survey (YITS), a longitudinal survey. While a hypothesis is not within the scope of this study, there is potential for longitudinal investigation with high school to post-secondary/career that could include an organizational learning framework. In terms of cumulative effects of an education system and association to capacity for organizational learning, future research could consider following primary to high school cohorts.

Implications for Theory

Given the limitations and exploratory nature of this study, findings from this study contributed to some theoretical implications. Implications to theory fall into three primary

categories. First, the results from this study suggested further investigation of the theoretical construct of conditions of organizational learning. Second, the findings provided support for the models that guided the research framework and suggest continued investigation into a living systems ontology. Third, the findings provided evidence of a student voice that needs further development within the capacity for organizational learning framework in the educational context. These implications are further explored as follows:

This study examined the conditions that foster organizational learning from a multi-dimensional approach that contributed to a composite organizational learning index. The effects of the individual components were different than the effect of the sum of the components from which the index was derived. Findings suggested that the sum of the organizational learning components was greater than the individual parts, particularly at the organizational or school level. As such, the findings supported Fiol and Lyles (1985) contention of the holistic nature of the contextual elements that support organizational learning. Further research such as confirmatory factor analysis, item response theory, and/or structural equation modelling would help to strengthen the hypothesis that the composite score is reflecting a unitary theoretical construct unique to the capacity for organizational learning. Willms (2004) had concluded that there was no single school factor but rather a large number of factors that contributed with small magnitude but important effects on student outcomes. This study suggested found that the organizational learning composite contributed to an explanation of more between-school variance than the components individually. Some differences to consider was that Willms study focused on the PISA 2000 cohort versus this study's focused on PISA 2009; however, a number of items referenced in the Willms study were similar to the items used in the organizational learning components examined in this study. Willms (2004) concluded that mean socioeconomic status of the school remained the key factor to predicting school difference in reading performance. The evidence of this study pointed to the capacity for organizational learning as a holistic unifying factor and theoretical view that could rival the socioeconomic explanation that has remained entrenched in school effectiveness studies since the Coleman et al. (1966) study.

Findings from this study provided credence to the models and theories upon which the research framework was established. This study focused on an aggregated composite of organizational learning conditions that consisted of school contextual elements drawing upon

Mitchell and Sackney's (2011) organizational capacity model as well as Fiol and Lyles' (1985) four contextual factors that increase the probability for organizational learning. The student organizational learning index consisted of school culture where the student feels valued and belonging, a friend culture where students shared a common beliefs and values of school, a classroom environment that felt safe and productive, a structure that built on positive student-teacher relations, and a student leadership that included school and community involvement. The evidence pointed to an ecological view of a school as a living system that fosters a learning environment. Further research is encouraged to approach schools as living systems as opposed to a mechanistic view of schools.

This study contributed empirical evidence within the organizational learning field that abounds with literature predominantly supported by logical rhetoric. Additionally, the empirical findings point to the student voice that is otherwise silent and sparse within the capacity for organizational learning model. Much of the earlier research on organizational learning explored sets of conditions that influence organizational learning from the teachers or administrators perspectives (Mitchell, 1995; Mitchell & Sackney, 1998; Sackney et al., 1998; Silins & Mulford, 2004). While the Mulford's (2005) model included a student 'voice', it was conceptualized outside of the organizational learning community and measured in terms of non-academic student outcomes. Similar to Marks and Louis (1999), this study acknowledges an theoretical implication that emphasizes a sociocultural group dynamic in the properties of organizational learning rather than Argyris and Schön's notion that focused on individual intersections with the organization. While Marks and Louis focused on teacher empowerment, the empirical findings from this study point to the need to pay attention to the student voice. Perhaps students are better at identifying the school's conditions for organizational learning. It would be beneficial to build on the notion of a student empowerment within the organizational learning community model and further theoretical research to investigate the levels within school capacity for organizational learning.

Epilogue

The field of organizational learning is riddled with multidisciplinary approaches that encompass a variety of organizational theories as well as learning theories. Nonetheless, the organizational learning field provides a shift from a view of schools within mechanistic analogies to a view of schools as living systems. Senge's (1990/2006) definition of a learning

organization best encapsulates a definition to conclude this study and one that schools are encouraged to aspire to – a place where: "people continuously expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to learn together". Capra's (2002) ecological and ontological notion of schools as living systems can provide motivation for educators.

Fiol and Lyles (1985) conditions of organizational learning coupled with Mitchell and Sackney's (2011) model of organizational capacity informed the research framework to guide this study. A key empirical finding of this study was that there was a significant positive effect of student view of organizational learning conditions associated with reading performance. Overall, this study demonstrates that multilevel modelling of complex systems, such as the educational system with students nested within schools, can help unravel patterns in contextual factors that can inform policy orientation and interventions that may improve outcomes for their students.

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Appendices

Appendix A:
PISA 2009 Student Questionnaire (OECD) Item Mapping to Research Model

RESEARCH MODEL	Variable Name	Variable Label
1Stratum	STRATUM	Original stratum
1Stratum	WVARSTRR	RANDOMIZED FINAL VARIANCE STRATUM (1-80)
1Student Characteristic	ST04Q01	Sex
1Student Weight	W_FSTUWT	FINAL STUDENT WEIGHT
1Student/School Characteristic	province	Province
1Student/School ID	SCHOOLID	School ID 5-digit
2 ses student	WEALTH	Wealth
2 ses student economic social and cultural	ESCS	Index of economic, social and cultural status (WLE)
2ses: father	BFMJ	Father SQ ISEI
2ses: highest parental occ status	HISEI	Highest parental occupational status
2ses: mother	BMMJ	Mother SQ ISEI
3 language of test	TESTLANG	Test Language
3 student engagement in reading index	RFSINTRP	Reading for School: Interpretation of literary texts
3learning time - math	MMINS	Learning time (minutes per week) - Mathematics
3learning time - reading	LMINS	Learning time (minutes per week) - Test Language
3learning time - science	SMINS	Learning time (minutes per week) - Science
3Learning time Math	ST28Q02	Min in <class period> for <Maths>
3Learning time Reading	ST28Q01	Min in <class period> for <test lang>
3Learning time Science	ST28Q03	Min in <class period> for <Science>
6Reading attitude	ST24Q01	Read Attitude - Only if I have to
6Reading attitude	ST24Q02	Read Attitude - Favourite hobbies
6Reading attitude	ST24Q03	Read Attitude - Talk about books
6Reading attitude	ST24Q04	Read Attitude - Hard to finish
6Reading attitude	ST24Q05	Read Attitude - Happy as present
6Reading attitude	ST24Q06	Read Attitude - Waste of time
6Reading attitude	ST24Q07	Read Attitude - Enjoy library
6Reading attitude	ST24Q08	Read Attitude - Need information
6Reading attitude	ST24Q09	Read Attitude - Cannot sit still
6Reading attitude	ST24Q10	Read Attitude - Express opinions
6Reading attitude	ST24Q11	Read Attitude - Exchange
7Reading enjoy	ST23Q01	Reading Enjoyment Time
7Reading like	ST25Q01	Like Read - Magazines
7Reading like	ST25Q02	Like Read - Comic Books
7Reading like	ST25Q03	Like Read - Fiction
7Reading like	ST25Q04	Like Read - Non-fiction books
7Reading like	ST25Q05	Like Read - Newspapers
7Reading tasks	RFS2Q01	Reading Tasks - Find information

7Reading tasks	RFS2Q02	Reading Tasks - Explain cause
7Reading tasks	RFS2Q03	Reading Tasks - Explain behaviour
7Reading tasks	RFS2Q04	Reading Tasks - Learn about writer
7Reading tasks	RFS2Q05	Reading Tasks - Explain purpose
7Reading tasks	RFS2Q06	Reading Tasks - Memorise text
7Reading tasks	RFS2Q07	Reading Tasks - Learn history
7Reading tasks	RFS2Q08	Reading Tasks - Describe table
7Reading tasks	RFS2Q09	Reading Tasks - Explain connection
7Reading tasks	RFS1Q01	Reading Texts - Information
7Reading tasks	RFS1Q02	Reading Texts - Poetry
7Reading tasks	RFS1Q03	Reading Texts - Diagrams
7Reading tasks	RFS1Q04	Reading Texts - Fiction
7Reading tasks	RFS1Q05	Reading Texts - Newspapers
7Reading tasks	RFS1Q06	Reading Texts - Manuals
7Reading tasks	RFS1Q07	Reading Texts - Tables
7Reading tasks	RFS1Q08	Reading Texts - Advertising
7Study	ST27Q01	Study - Memorize Everything
7Study	ST27Q02	Study - Figure Out
7Study	ST27Q03	Study - Memorize Details
7Study	ST27Q04	Study - Relate New Information
7Study	ST27Q05	Study - Read Many Times
7Study	ST27Q06	Study - Check if Understand
7Study	ST27Q07	Study - Read Text Repeatedly
7Study	ST27Q08	Study - Useful Outside School
7Study	ST27Q09	Study - Haven't Understood
7Study	ST27Q10	Study - Relate to Experience
7Study	ST27Q11	Study - Important Points
7Study	ST27Q12	Study - Real Life
7Study	ST27Q13	Study - Additional Information
8 DV READING SCORE 1	PV1READ	Plausible value in reading
8 DV READING SCORE 2	PV2READ	Plausible value in reading
8 DV READING SCORE 3	PV3READ	Plausible value in reading
8 DV READING SCORE 4	PV4READ	Plausible value in reading
8 DV READING SCORE 5	PV5READ	Plausible value in reading
Culture: beliefs	ST33Q01	Climate - Little for Adult Life: School has done little to prepare me for adult life when I leave school
Culture: beliefs	ST33Q02	Climate - Waste of Time: School
Culture: beliefs	ST33Q03	Climate - Given Confidence
Culture: beliefs	ST33Q04	Climate - Useful for Jobs
culture: beliefs	ATSCHL	Attitude towards school
culture: beliefs	JOYREAD	Joy/Like Reading
Environment Reading class: safe	ST36Q01	Lessons - Students don't listen
Environment Reading class: safe	ST36Q02	Lessons - Noise and disorder

Environment Reading class: safe	ST36Q03	Lessons - Wait for quiet
Environment Reading class: safe	ST36Q04	Lessons - Cannot work well
Environment Reading class: safe	ST36Q05	Lessons - Long time to start
Environment-control experiment balance Strategy: continuous learning : student engagement	CSTRAT	Use of control strategies: approach to learning
Environment-control experiment balance Strategy: continuous learning : student engagement	ELAB	Use of elaboration strategies: approach to learning
Environment-control experiment balance Strategy: continuous learning : student engagement	MEMOR	Use of memorisation strategies
Strategy Reading class	ST37Q01	Stimulate - Explain text: The teacher asks students to explain the meaning of a text
Strategy Reading class	ST37Q02	Stimulate - Better understanding: The teacher asks questions that challenge students to get a better understanding of a text
Strategy Reading class	ST37Q03	Stimulate - Time to think
Strategy Reading class	ST37Q04	Stimulate - Recommend books
Strategy Reading class	ST37Q05	Stimulate - Express opinion
Strategy Reading class	ST37Q06	Stimulate - Relate to lives
Strategy Reading class	ST37Q07	Stimulate - Build on knowledge
Strategy Reading class	ST38Q01	Strategies - Explain Expectations
Strategy Reading class	ST38Q02	Strategies - Check Concentrating
Strategy Reading class	ST38Q03	Strategies - Discuss work
Strategy Reading class	ST38Q04	Strategies - Explain judgements
Strategy Reading class	ST38Q05	Strategies - Ask if understood
Strategy Reading class	ST38Q06	Strategies - Mark work
Strategy Reading class	ST38Q07	Strategies - Student questions
Strategy Reading class	ST38Q08	Strategies - Motivating questions
Strategy Reading class	ST38Q09	Strategies - Immediate feedback
Strategy Reading class index	STIMREAD	Teachers Stimulation of Reading Engagement
Strategy: continuous learning : student engagement	METASUM	Meta-cognition: Summarising
Strategy: continuous learning : student engagement	UNDREM	Meta-cognition: Understanding and Remembering
StrategyReading class index	STRSTRAT	Use of structuring and scaffolding strategies
Structure: S/T Relationships	ST34Q01	Teachers - Get along well
Structure: S/T Relationships	ST34Q02	Teachers - Interested in well-being
Structure: S/T Relationships	ST34Q03	Teachers - Really listen
Structure: S/T Relationships	ST34Q04	Teachers - Extra help
Structure: S/T Relationships	ST34Q05	Teachers - Treat me fairly
	CNT	Country code 3-character
	COUNTRY	Country code ISO 3-digit
	OECD	OECD country
	SUBNATIO	Adjudicated sub-region
	CAN	Canada
	school	School ID 5-digit

	StIDStd	Student ID 5-digit
	ST01Q01	Grade
	ST02Q01	<Programme>
	ST03Q02	Birth Month
	ST03Q03	Birth Year
	ST05Q01	Attend <ISCED 0> preschool, nursery school, or kindergarten
	ST06Q01	Age at <ISCED 1>
	ST07Q01	Repeat <ISCED 1> grade 1 to 6
	ST07Q02	Repeat <ISCED 2> grade 7 to 9
	ST07Q03	Repeat <ISCED 3> grade 10 to 12
	ST08Q01	At Home - Mother
	ST08Q02	At Home - Father
	ST08Q03	At Home - Brothers
	ST08Q04	At Home - Sisters
	ST08Q05	At Home - Grandparents
	ST08Q06	At Home - Others
	ST09Q01	Mother Occupation
	ST10Q01	Mother <Highest Schooling>
	ST11Q01	Mother <ISCED 6>
	ST11Q02	Mother <ISCED5A>
	ST11Q03	Mother <ISCED5B>
	ST11Q04	Mother <ISCED4>
	ST12Q01	Mother Current Job Status
	ST13Q01	Father Occupation
	ST14Q01	Father <Highest Schooling>
	ST15Q01	Father <ISCED 6>
	ST15Q02	Father <ISCED 5A>
	ST15Q03	Father <ISCED 5B>
	ST15Q04	Father <ISCED 4>
	ST16Q01	Father Current Job Status
	ST17Q01	Country of birth Self
	ST17Q02	Country of birth Mother
	ST17Q03	Country of birth Father
	ST18Q01	Country of birth Age
	ST19Q01	Language at home
	ST20Q01	Possessions desk
	ST20Q02	Possessions own room
	ST20Q03	Possessions study place
	ST20Q04	Possessions computer
	ST20Q05	Possessions software
	ST20Q06	Possessions Internet
	ST20Q07	Possessions literature
	ST20Q08	Possessions poetry

	ST20Q09	Possessions art
	ST20Q10	Possessions textbooks
	ST20Q11	Possessions <technical reference books>
	ST20Q12	Possessions dictionary
	ST20Q13	Possessions dishwasher
	ST20Q14	Possessions <DVD>
	ST20Q15	Possessions <Cntry item 1>
	ST20Q16	Possessions <Cntry item 2>
	ST20Q17	Possessions <Cntry item 3>
	ST21Q01	How many cellular phones
	ST21Q02	How many televisions
	ST21Q03	How many computers
	ST21Q04	How many cars
	ST21Q05	How many rooms bath or shower
	ST22Q01	How many books at home
	ST26Q01	Online - Reading Emails
	ST26Q02	Online - Chat on line
	ST26Q03	Online - Reading News
	ST26Q04	Online - Using Dictionary
	ST26Q05	Online - Particular Topic
	ST26Q06	Online - Group Discussions
	ST26Q07	Online - Practical Information
	ST29Q01	No of <class period> - <test lang> p/wk
	ST29Q02	No of <class period> - <Maths> p/wk
	ST29Q03	No of <class period> - <Sci> p/wk
	ST30Q01	No of ALL <class period> a week
	ST31Q01	<Enrich> in <test lang>
	ST31Q02	<Enrich> in <mathematics>
	ST31Q03	<Enrich> in <science>
	ST31Q04	<Enrich> in other subjects
	ST31Q05	<Remedial> in <test lang>
	ST31Q06	<Remedial> in <mathematics>
	ST31Q07	<Remedial> in <science>
	ST31Q08	<Remedial> in other subjects
	ST31Q09	Lessons to improve study skills
	ST32Q01	Out of school lessons <test lang>
	ST32Q02	Out of school lessons <maths>
	ST32Q03	Out of school lessons <science>
	ST32Q04	Out of school lessons other
	ST35Q01	Attend language class
	ST39Q01	Library - Borrow for pleasure
	ST39Q02	Library - Borrow for work

	ST39Q03	Library - Work on homework
	ST39Q04	Library - Read magazines
	ST39Q05	Library - Read for fun
	ST39Q06	Library - Learn things
	ST39Q07	Library - Use internet
	ST40Q01	Library at school
	ST41Q01	Text - Easy to Understand
	ST41Q02	Text - Read twice
	ST41Q03	Text - Discuss content
	ST41Q04	Text - Underline
	ST41Q05	Text - Summarise
	ST41Q06	Text - Read aloud
	ST42Q01	Summary - Check paragraph
	ST42Q02	Summary - Copy accurately
	ST42Q03	Summary - Read many times
	ST42Q04	Summary - Check important facts
	ST42Q05	Summary - Write own words
	IC01Q01	At home - Desktop Computer
	IC01Q02	At home - Portable laptop
	IC01Q03	At home - Internet connection
	IC01Q04	At home - Video games console
	IC01Q05	At home - Cell Phone
	IC01Q06	At home - Mp3/Mp4 Player
	IC01Q07	At home - Printer
	IC01Q08	At home - USB (memory) stick
	IC02Q01	At School - Desktop Computer
	IC02Q02	At School - Portable laptop
	IC02Q03	At School - Internet connection
	IC02Q04	At School - Printer
	IC02Q05	At School - USB (memory) stick
	IC03Q01	Ever Used Computer
	IC04Q01	At Home - One Player Games
	IC04Q02	At Home - Collaborative Games
	IC04Q03	At Home - Homework
	IC04Q04	At Home - Use email
	IC04Q05	At Home - Chat on line
	IC04Q06	At Home - Browse for fun
	IC04Q07	At Home - Download music
	IC04Q08	At Home - Website
	IC04Q09	At Home - Online forums
	IC05Q01	At Home - Internet for School
	IC05Q02	At Home - Email students

	IC05Q03	At Home - Email teachers
	IC05Q04	At Home - Download from school
	IC05Q05	At Home - Announcements
	IC06Q01	At School - Chat
	IC06Q02	At School - Email
	IC06Q03	At School - Browse for school
	IC06Q04	At School - Download from website
	IC06Q05	At School - Post on website
	IC06Q06	At School - Simulations
	IC06Q07	At School - Practice and Drilling
	IC06Q08	At School - Homework
	IC06Q09	At School - Group Work
	IC07Q01	Time - Language Lessons
	IC07Q02	Time - Mathematics Lessons
	IC07Q03	Time - Science Lessons
	IC07Q04	Time - Other Language Lessons
	IC08Q01	How well - Edit graphics
	IC08Q02	How well - Create database
	IC08Q03	How well - Plot Graph
	IC08Q04	How well - Presentation
	IC08Q05	How well - Multi Media
	IC09Q01	Time outside lessons
	IC10Q01	Attitudes - Very Important
	IC10Q02	Attitudes - Really Fun
	IC10Q03	Attitudes - Very Interested
	IC10Q04	Attitudes - Lose track of time
	EC01Q01	Miss 2 months of <ISCED 1>
	EC02Q01	Miss 2 months of <ISCED 2>
	EC03Q01	Change schools in <ISCED1>
	EC04Q01	Change schools in <ISCED2>
	EC05Q01A	Expected completed levels <ISCED level 2
	EC05Q01B	Expected completed levels <ISCED level 3B or C
	EC05Q01C	Expected completed levels <ISCED level 3A
	EC05Q01D	Expected completed levels <ISCED level 4
	EC05Q01E	Expected completed levels <ISCED level 5B
	EC05Q01F	Expected completed levels <ISCED level 5A or 6
	EC06Q01	Enrichment in <test language>
	EC06Q02	Remedial in <test language>
	EC06Q03	One to one private tutoring
	EC07Q01	Report Mark
	BOOKID	Booklet ID
	AGE	Age of student

	COBN_F	Country of Birth National Categories- Father
	COBN_M	Country of Birth National Categories- Mother
	COBN_S	Country of Birth National Categories- Self
	GRADE	Grade compared to modal grade in country
	FAMSTRUC	Family Structure
	FISCED	Educational level of father (ISCED)
	MISCED	Educational level of mother (ISCED)
	HISCED	Highest educational level of parents
	FSECATEG	Father White collar/Blue collar classification
	MSECATEG	Mother White collar/Blue collar classification
	HSECATEG	Highest parent White collar/Blue collar classification
	IMMIG	Immigration status
	ISCEDD	ISCED designation
	ISCEDL	ISCED level
	ISCEDO	ISCED orientation
	LANGN	Language at home (3-digit)
	PARED	Highest parental education in years
	PROGN	Unique national study programme code
	ATTCOMP	Attitude towards computers
	CULTPOSS	Cultural Possessions
	DISCLIMA	Disciplinary climate
	DIVREAD	Diversity reading
	ENTUSE	ICT internet/entertainment use
	HEDRES	Home educational resources
	HIGHCONF	Self-confidence in ICT high level tasks
	HOMEPOS	Home Possessions
	HOMSCH	ICT for school related tasks
	ICTHOME	ICT availability at home
	ICTRES	ICT resources
	ICTSCH	ICT availability at school
	LIBUSE	Use of Libraries
	ONLNREAD	Online Reading
	STUDREL	Teacher student Relations
	USESCH	Use of ICT at school
	RFSNCONT	Reading for School: Non-continuous materials
	RFSTRLIT	Reading for School: Traditional literature courses
	RFSFUMAT	Reading for School: Functional reading materials
	PV1MATH	Plausible value in math
	PV2MATH	Plausible value in math
	PV3MATH	Plausible value in math
	PV4MATH	Plausible value in math
	PV5MATH	Plausible value in math

	PV1SCIE	Plausible value in science
	PV2SCIE	Plausible value in science
	PV3SCIE	Plausible value in science
	PV4SCIE	Plausible value in science
	PV5SCIE	Plausible value in science
	PV1READ1	Plausible value in reading - access and retrieve
	PV2READ1	Plausible value in reading - access and retrieve
	PV3READ1	Plausible value in reading - access and retrieve
	PV4READ1	Plausible value in reading - access and retrieve
	PV5READ1	Plausible value in reading - access and retrieve
	PV1READ2	Plausible value in reading - integrate and interpret
	PV2READ2	Plausible value in reading - integrate and interpret
	PV3READ2	Plausible value in reading - integrate and interpret
	PV4READ2	Plausible value in reading - integrate and interpret
	PV5READ2	Plausible value in reading - integrate and interpret
	PV1READ3	Plausible value in reading - reflect and evaluate
	PV2READ3	Plausible value in reading - reflect and evaluate
	PV3READ3	Plausible value in reading - reflect and evaluate
	PV4READ3	Plausible value in reading - reflect and evaluate
	PV5READ3	Plausible value in reading - reflect and evaluate
	PV1READ4	Plausible value in reading - continuous text
	PV2READ4	Plausible value in reading - continuous text
	PV3READ4	Plausible value in reading - continuous text
	PV4READ4	Plausible value in reading - continuous text
	PV5READ4	Plausible value in reading - continuous text
	PV1READ5	Plausible value in reading - non-continuous text
	PV2READ5	Plausible value in reading - non-continuous text
	PV3READ5	Plausible value in reading - non-continuous text
	PV4READ5	Plausible value in reading - non-continuous text
	PV5READ5	Plausible value in reading - non-continuous text
	CNTFAC	Country weight factor for equal weights (1000)
	RANDUNIT	RANDOMLY ASSIGNED VARIANCE UNIT
	VER_STU	Version of student database and date of release

Appendix B:
PISA 2009 Student Questionnaire (Canada) Item Mapping to Research Model

RESEARCH MODEL	Variable Name	Variable Label
1 School ID		linking variable
1 Student ID		linking variable
2 student characteristic	QA1a	self reported mark in English
2 student characteristic	QA12	Aboriginal identification
2 student characteristic	QA13	Cultural identification
2 student characteristic	QA14	Status Indian
Culture	QA5 school aspiration	expect to stay in school until graduate from high school
Culture	QA6 post school aspiration	highest level of ed like to get
Culture	QH1a	school relevant to future
Culture	QH1a	need to go to college
Culture	QH1d	would enjoy college/university
Culture	QH1e	smart enough to do well in college
Culture	QH1f	smart enough to do well in university
Culture - alienation	QA7	number of days absent from school
Culture - alienation	QA8 skipped	number of days skipped school
Culture - alienation	QA9a	feel like outsider
Culture - alienation	QA9c	feel awkward
Culture - alienation	QA9e	lonely
Culture - alienation reverse	QA9b	make friends
Culture - peer	QA9d	other students like me
Culture - peer	QA9h	I have friends whom I can talk about personal things
Culture - peer	QA9i	have friends who can help me with school,.
Culture - peer	Q3a	high school important
Culture - peer	Q3d	plan further educ
Culture - peer	Q3g	okay to work hard at school
Culture - peer reverse	Q3b	skip classes
Culture - peer reverse	Q3c	drop out without graduating
Culture - peer reverse	Q3e	cause trouble
Culture - peer reverse	Q3f	smoke
Culture - relationships	QA9f	people at school are interested in what I have to say
Environment	QD1c	I cause trouble at school
Leadership student	QB2c	participate in student council or student government
Structure	QC1a	if something went wrong, no one would help me
Structure	QC1f	there are people I can count on in times of trouble

Appendix C:
PISA 2009 School Questionnaire Item Mapping to Research Model

RESEARCH MODEL	Variable Name	Variable Label
1 Principal Gender	SC27Q01	Gender
1School Characteristic: School ID	SCHOOLID	5 digit school ID
2-School Characteristic	province	Province
2 School Characteristic	SC02Q01	Public or private
2 School Characteristic	SC04Q01	School Community
2 School Characteristic	SC05Q01	Available Schooling
2 School Characteristic	SC06Q01	Number of boys
2 School Characteristic	SC06Q02	Number of girls
2 School Characteristic	SC10Q01	Total number of students
2 school stratum	STRATUM	Original stratum
2 School Weight	W_FSCHWT	Final school weight
3 school characteristic	PROPCERT	Proportion of certified teachers
3 school characteristic	PROPQUAL	Proportion of qualified teachers
3 school characteristic	SCHSIZE	Total school enrolment
3 school characteristic	SCHTYPE	School Type
3 school characteristic	STRATIO	Student-Teacher ratio
3 school Characteristic	SCMATEDU	Quality of the schools educational resources
Culture	SC17Q08	Students lacking respect
Culture	SC17Q13	Students not encouraged to reach full potential
Culture and Environment index teacher behavior	TEACBEHA	Teacher behaviour
Culture index	STUDBEHA	Student behaviour
Culture index teacher quality	TCSHORT	Teacher shortage
Culture: T beliefs about st	SC17Q01	Teacher's low expectations
Culture – student engagement	SC17Q07	Skipping classes
Culture: student engagement, participation	SC17Q02	Student absenteeism
Culture: teacher commitment, participation	SC17Q06	Teacher absenteeism
Environment: change/stability balance	SC17Q09	Staff resisting change
Environment: safe	SC17Q04	Student Disruption
Environment: safe	SC17Q12	Students being bullied
Leadership	SC24Qa1	Responsibility teacher hire - Principal Q24a1
Leadership	SC24Qa2	Responsibility teacher hire - Teachers Q24a2
Leadership	SC24Qa3	Responsibility teacher hire - School governing board Q24a3
Leadership	SC24Qa4	Responsibility teacher hire - Regional or local educational authority Q24a4
Leadership	SC24Qa5	Responsibility teacher hire - National education authority Q24a5
Leadership	SC24Qb1	Responsibility firing teachers - Principal Q24b1
Leadership	SC24Qb2	Responsibility firing teachers - Teachers Q24b2
Leadership	SC24Qb3	Responsibility firing teachers - School governing board Q24b3

Leadership	SC24Qb4	Responsibility firing teachers - Regional or local educational authority Q24b4
Leadership	SC24Qb5	Responsibility firing teachers - National education authority Q24b5
Leadership	SC24Qc1	Responsibility starting salaries - Principal Q24c1
Leadership	SC24Qc2	Responsibility starting salaries - Teachers Q24c2
Leadership	SC24Qc3	Responsibility starting salaries - School governing board Q24c3
Leadership	SC24Qc4	Responsibility starting salaries - Regional or local educational authority Q24c4
Leadership	SC24Qc5	Responsibility starting salaries - National education authority Q24c5
Leadership	SC24Qd1	Responsibility salary increases - Principal Q24d1
Leadership	SC24Qd2	Responsibility salary increases - Teachers Q24d2
Leadership	SC24Qd3	Responsibility salary increases - School governing board Q24d3
Leadership	SC24Qd4	Responsibility salary increases - Regional or local educational authority Q24d4
Leadership	SC24Qd5	Responsibility salary increases - National education authority Q24d5
Leadership	SC24Qe1	Responsibility formulate budget - Principal Q24e1
Leadership	SC24Qe2	Responsibility formulate budget - Teachers Q24e2
Leadership	SC24Qe3	Responsibility formulate budget - School governing board Q24e3
Leadership	SC24Qe4	Responsibility formulate budget - Regional or local educational authority Q24e4
Leadership	SC24Qe5	Responsibility formulate budget - National education authority Q24e5
Leadership	SC24Qf1	Responsibility budget allocations - Principal Q24f1
Leadership	SC24Qf2	Responsibility budget allocations - Teachers Q24f2
Leadership	SC24Qf3	Responsibility budget allocations - School governing board Q24f3
Leadership	SC24Qf4	Responsibility budget allocations - Regional or local educational authority Q24f4
Leadership	SC24Qf5	Responsibility budget allocations - National education authority Q24f5
Leadership	SC24Qg1	Responsibility student discipline - Principal Q24g1
Leadership	SC24Qg2	Responsibility student discipline - Teachers Q24g2
Leadership	SC24Qg3	Responsibility student discipline - School governing board Q24g3
Leadership	SC24Qg4	Responsibility student discipline - Regional or local educational authority Q24g4
Leadership	SC24Qg5	Responsibility student discipline - National education authority Q24g5
Leadership	SC24Qh1	Responsibility student assessment - Principal Q24h1
Leadership	SC24Qh2	Responsibility student assessment - Teachers Q24h2
Leadership	SC24Qh3	Responsibility student assessment - School governing board Q24h3
Leadership	SC24Qh4	Responsibility student assessment - Regional or local educational authority Q24h4
Leadership	SC24Qh5	Responsibility student assessment - National education authority Q24h5
Leadership	SC24Qi1	Responsibility student admission - Principal Q24i1
Leadership	SC24Qi2	Responsibility student admission - Teachers Q24i2
Leadership	SC24Qi3	Responsibility student admission - School governing board Q24i3
Leadership	SC24Qi4	Responsibility student admission - Regional or local educational authority Q24i4
Leadership	SC24Qi5	Responsibility student admission - National education authority Q24i5

Leadership	SC24Qj1	Responsibility textbook use - Principal Q24j1
Leadership	SC24Qj2	Responsibility textbook use - Teachers Q24j2
Leadership	SC24Qj3	Responsibility textbook use - School governing board Q24j3
Leadership	SC24Qj4	Responsibility textbook use - Regional or local educational authority Q24j4
Leadership	SC24Qj5	Responsibility textbook use - National education authority Q24j5
Leadership	SC24Qk1	Responsibility course content - Principal Q24k1
Leadership	SC24Qk2	Responsibility course content - Teachers Q24k2
Leadership	SC24Qk3	Responsibility course content - School governing board Q24k3
Leadership	SC24Qk4	Responsibility course content - Regional or local educational authority Q24k4
Leadership	SC24Qk5	Responsibility course content - National education authority Q24k5
Leadership	SC24Ql1	Responsibility courses offered - Principal Q24l1
Leadership	SC24Ql2	Responsibility courses offered - Teachers Q24l2
Leadership	SC24Ql3	Responsibility courses offered - School governing board Q24l3
Leadership	SC24Ql4	Responsibility courses offered - Regional or local educational authority Q24l4
Leadership	SC24Ql5	Responsibility courses offered - National education authority Q24l5
Leadership	SC25Qa1	Regional or national authority - Influence staffing Q25a1
Leadership	SC25Qa2	Regional or national authority - Influence budget Q25a2
Leadership	SC25Qa3	Regional or national authority - Influence instructional content Q25a3
Leadership	SC25Qa4	Regional or national authority - Influence assessment Q25a4
Leadership	SC25Qb1	School governing board - Influence staffing Q25b1
Leadership	SC25Qb2	School governing board - Influence budget Q25b2
Leadership	SC25Qb3	School governing board - Influence instructional content Q25b3
Leadership	SC25Qb4	School governing board - Influence assessment Q25b4
Leadership	SC25Qc1	Parent groups - Influence staffing Q25c1
Leadership	SC25Qc2	Parent groups - Influence budget Q25c2
Leadership	SC25Qc3	Parent groups - Influence instructional content Q25c3
Leadership	SC25Qc4	Parent groups - Influence assessment Q25c4
Leadership	SC25Qd1	Teacher groups - Influence staffing Q25d1
Leadership	SC25Qd2	Teacher groups - Influence budget Q25d2
Leadership	SC25Qd3	Teacher groups - Influence instructional content Q25d3
Leadership	SC25Qd4	Teacher groups - Influence assessment Q25d4
Leadership	SC25Qe1	Student groups - Influence staffing Q25e1
Leadership	SC25Qe2	Student groups - Influence budget Q25e2
Leadership	SC25Qe3	Student groups - Influence instructional content Q25e3
Leadership	SC25Qe4	Student groups - Influence assessment Q25e4
Leadership	SC25Qf1	Examination board - Influence staffing Q25f1
Leadership	SC25Qf2	Examination board - Influence budget Q25f2
Leadership	SC25Qf3	Examination board - Influence instructional content Q25f3
Leadership	SC25Qf4	Examination board - Influence assessment Q25f4
Leadership	SC26Q01	Professional development

Leadership	SC26Q02	Educational goals - Teachers
Leadership	SC26Q03	Observe in classrooms
Leadership	SC26Q04	Student performance
Leadership	SC26Q05	Give suggestions
Leadership	SC26Q06	Monitor student's work
Leadership	SC26Q07	Teacher's problems
Leadership	SC26Q08	Teachers Updating skills
Leadership	SC26Q09	Educational Goals - Classroom
Leadership	SC26Q10	Exam results into account
Leadership	SC26Q11	Curriculum Responsibility
Leadership	SC26Q12	Classroom problems
Leadership	SC26Q13	Disruptive behaviour
Leadership	SC26Q14	Take over lessons
Leadership index	LDRSHP	School leadership
Leadership index	RESPCURR	School responsibility: curriculum and assessment
Leadership index	RESPRES	School responsibility: resource allocation
Leadership index teacher participation	TCHPARTI	Teacher participation
Strategy: feedback, monitoring	SC15Q01	Standardised Tests
Strategy: feedback, monitoring	SC15Q02	Teacher-developed tests
Strategy: feedback, monitoring	SC15Q03	Teacher judgements
Strategy: feedback, monitoring	SC15Q04	Student portfolios
Strategy: feedback, monitoring	SC15Q05	Student Assignments
Strategy: feedback, monitoring	SC16Q01	Assessments - Child's Progress
Strategy: feedback, monitoring	SC16Q02	Assessments - Student Promotion
Strategy: feedback, monitoring	SC16Q03	Assessments - Instruction
Strategy: feedback, monitoring	SC16Q04	Assessments - National Perform
Strategy: feedback, monitoring	SC16Q05	Assessments - School's Progress
Strategy: feedback, monitoring	SC16Q06	Assessments - Teachers
Strategy: feedback, monitoring	SC16Q07	Assessments - Curriculum
Strategy: feedback, monitoring	SC16Q08	Assessments - Other Schools
Strategy: feedback, monitoring	SC22Q01	Achievement Public
Strategy: feedback, monitoring	SC22Q02	Achievement Principal
Strategy: feedback, monitoring	SC22Q03	Achievement Teachers
Strategy: feedback, monitoring	SC22Q04	Achievement Resources
Strategy: feedback, monitoring	SC22Q05	Achievement Tracked
Structure: S/T relationships	SC17Q03	Student-teacher relations
Structure: S/T relationships	SC17Q11	Teachers too strict
Structure: supporting teamwork	SC10Q02	Computers for Education
Structure: supporting teamwork	SC10Q03	Computers with Internet
Structure: supporting teamwork	SC11Q03	Shortage <test lang> Teachers
Structure: supporting teamwork	SC17Q05	Student's needs not met
	CNT	Country code 3-character

	COUNTRY	Country code ISO 3-digit
	CAN	Canada
	OECD	OECD country
	SUBNATIO	Adjudicated sub-region
	SC01Q01	Grade 1
	SC01Q02	Grade 2
	SC01Q03	Grade 3
	SC01Q04	Grade 4
	SC01Q05	Grade 5
	SC01Q06	Grade 6
	SC01Q07	Grade 7
	SC01Q08	Grade 8
	SC01Q09	Grade 9
	SC01Q10	Grade 10
	SC01Q11	Grade 11
	SC01Q12	Grade 12
	SC01Q13	Grade 13
	SC01Q14	Ungraded school
	SC03Q01	Funding Government
	SC03Q02	Funding Student fees
	SC03Q03	Funding Benefactors
	SC03Q04	Funding Other
	SC07Q01	Repeat <grade> at <ISCED2>
	SC07Q02	Repeat <grade> at <ISCED3>
	SC08Q01	First lang not test lang
	SC09Q11	Ftime Teach in TOTAL
	SC09Q12	Ptime Teach in TOTAL
	SC09Q21	Ftime Teach fully certified
	SC09Q22	Ptime Teach fully certified
	SC09Q31	Ftime Teach ISCED5A Qual
	SC09Q32	Ptime Teach ISCED5A Qual
	SC11Q01	Shortage of Sci Teachers
	SC11Q02	Shortage of Math Teachers
	SC11Q04	Shortage Qualified Teachers
	SC11Q05	Shortage library staff
	SC11Q06	Shortage other personnel
	SC11Q07	Shortage sci lab equip
	SC11Q08	Shortage instruct material
	SC11Q09	Shortage computers
	SC11Q10	Shortage internet
	SC11Q11	Shortage computer software
	SC11Q12	Shortage library materials

	SC11Q13	Shortage audio-visual
	SC12Q01	Streaming by levels
	SC12Q02	Streaming by content
	SC13Q01	Band or choir
	SC13Q02	School Play
	SC13Q03	School Yearbook
	SC13Q04	Volunteering
	SC13Q05	Book Club
	SC13Q06	Debating Club
	SC13Q07	School competition
	SC13Q08	<Academic Club>
	SC13Q09	Art Activities
	SC13Q10	Sporting Team
	SC13Q11	Lectures or Seminars
	SC13Q12	Local Libraries
	SC13Q13	Local Newspapers
	SC13Q14	<Country Specific>
	SC14Q01	Additional Instruction
	SC14Q02	Preparatory Programme
	SC14Q03	Some <first lang> instruction
	SC14Q04	More <first lang> instruction
	SC14Q05	Class size reduced
	SC17Q10	Student drug use
	SC18Q01	Pressure Academic standards
	SC19Q01	Admission - Residence
	SC19Q02	Admission - Academic record
	SC19Q03	Admission - Feeder schools
	SC19Q04	Admission - Parent's endorsement
	SC19Q05	Admission - Special Programme
	SC19Q06	Admission - Family members
	SC19Q07	Admission - Other
	SC20Q01	Transfer - Low Achievement
	SC20Q02	Transfer - High Achievement
	SC20Q03	Transfer - Behaviour problems
	SC20Q04	Transfer - Special learning
	SC20Q05	Transfer - Parents request
	SC20Q06	Transfer - other reasons
	SC21Q01	Relative to other students
	SC21Q02	Relative to benchmarks
	SC21Q03	Relative to same grade
	SC23Q01	Student Achievement tests
	SC23Q02	Teacher peer review

	SC23Q03	Principal staff
	SC23Q04	External observers
	ABGROUP	Ability grouping between classes
	COMPWEB	Proportion of computers connected to the Internet
	IRATCOMP	Ratio of computers and school size
	PCGIRLS	Proportion of girls in the school
	SELSCH	Index of academic school selectivity
	EXCURACT	Extra-curricular activities offered by school
	VER_SCH	Version of school database and date of release

Appendix D:
HLM Model Formulas

Fully Unconditional Model

     The fully unconditional models for Canada and Saskatchewan are the first models to be examined within the HLM analysis before determining the requirement for multilevel models.

Level 1 model – Student (i)

$$Y_{ij} = \beta_{0j} + r_{ij} \qquad \text{(Equation D1)}$$

Level 2 model – School (j)

$$\beta_{0j} = \gamma_{00} + u_{0j} \qquad \text{(Equation D2)}$$

Level 3 model – by national level of Canada/by provincial level of Saskatchewan

> where Y_{ij} is the reading score for the student i in school j in Canada/Saskatchewan;
> β_{0j} is the intercept/average reading score in school j in Canada/Saskatchewan;
> r_{ij} is the error/ student level residual of using mean reading score in school j in Canada/Saskatchewan to predict the reading performance of student i in school j;
> γ_{00} is the grand (overall, across-school) mean of reading scores for Canada/Saskatchewan;
> u_{0j} is the error or unique school effect/school-level residual of using grand mean reading score to predict the average reading score in school j;
> $Var(r_{ij}) = \sigma^2 =$ level-1 residual variance
> $Var(u_0) = \tau_{00} =$ level-2 variance in intercept

The fully unconditional model results can be used to evaluate whether school mean reading scores vary across schools and whether Canada mean reading scores vary across the nation/Saskatchewan mean reading scores vary across the province. Additionally, estimates of the proportion of total variance in reading performance explained between schools or at the school level [i.e. intraclass correlation coefficient $= \rho$, where $\rho = \tau_{00}/(\tau_{00} + \sigma^2)$] (Raudenbush & Bryk, 2002, p. 24).

Student Characteristics Model

Once fully unconditional models are evaluated, multilevel models are examined based on the a priori hypothesis starting with the level-1 predictors. In this case, level-1 variables include economic, social and cultural status (ESCS), Aboriginal status, (SDAboriginal=1), Gender (Male=1) and student organizational learning index (StudentOL Index):

$$Y_{ij} = \beta_{0j} + \beta_{1j}(ESCS)_{ij} + \beta_{2j}(SDAboriginal)_{ij} + \beta_{3j}(Male)_{ij}$$
$$+ \beta_{4j}(StudentOL\ Index)_{ij} + r_{ij} \qquad \text{(Equation D3)}$$

Level 2 model – School (j)

$$\beta_{0j} = \gamma_{00} + u_{0j}$$ (Equation D4)
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30}$$
$$\beta_{4j} = \gamma_{40}$$

where SDAboriginal and Male are a dichotomous dummy variables;
$\beta_{20}\ and\ \beta_{30}$ are the mean differences between reading performance of the 0 and 1 groups in the dichotomous student-level variables;
γ_{00} is the average intercept/reading performance across schools
γ_{10} to and γ_{40} are the across-school slope averages, a fixed effect parameter;
u_{0j} is the error/unique increment to the intercept associated with school j

The proportion of variance explained by adding student level-1 predictors into to the student characteristics model can be determined by comparing it the within school variance of the fully unconditional model:

$$R^2{}_{Model\ II\ level\text{-}1} = Var\ (r_{Fully\ unconditional}) - Var\ (r_{Model\ II})]/Var\ (r_{Fully\ unconditional})$$

(Equation D5)

By looking at a student's reading performance outcomes within his/her school, the student characteristics model could examine how a student's Reading score is conditional on the socioeconomic status (ESCS) of the student, student's Aboriginal status, student's gender, and the status of the student's organizational learning index of the school.

The proportion of variance explaining the between school variance by adding student level-1 predictors into to the student characteristics model can be determined by comparing it the between school variance of the fully unconditional model (Raudenbush & Bryk, 2002, p. 74):

$$R^2{}_{Model\ II\ level\text{-}2\ intercept} = Var\ (u_{0Fully\ unconditional}) - Var\ (u_{0Model\ II})]/Var\ (u_{0Fully\ unconditional})$$

(Equation D6)

School Contextual Model

Once the level-1 model is established with non-significant variables removed, level-2 variables may then be added to the model to determine if there are level-2 variables related to the school contextual model. The level-2 predictors selected for the analysis include SchoolOL Index (School Organizational Learning Index, a continuous variable, centered around grand

mean), PROP25AB (25% or more students Self-identified as Aboriginal, dichotomous dummy

variable), SCSZPTIL (School Size Percentile with following classification: (1 to 60=10) (61 to

138=20) (139 to 222=30) (223 to 300=40) (301 to 378=50) (379 to 518=60) (519 to 714=70)

(715 to 905=80) (906+=90), centered around grand mean), XESCS_M (school mean ESCS

derived from student ESCS index and missing imputed with mean and centered around grand

mean), and URBAN (Urban community size with 15,000+ population, dichotomous dummy

variable).

Level-1 Model*: Student-Level*

$$PV1READ_{ij} = \beta_{0j} + \beta_{1j}(StudentOL\ Index)_{ij} + \beta_{2j}(MALE)_{ij} +$$
$$\beta_{3j}(SDABORIG)_{ij} + \beta_{4j}(ESCS)_{ij} + r_{ij} \qquad \text{(Equation D7)}$$

Level-2 Model: School Level

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(SchoolOL\ Index)_j + \gamma_{02}(XESCS\_M)_j +$$
$$\gamma_{03}(PROP25AB)_j + \gamma_{04}(SCSZPTIL)_j +$$
$$\gamma_{05}(URBAN)_j + u_{0j} \qquad \text{(Equation D8)}$$
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30}$$
$$\beta_{4j} = \gamma_{40}$$