Culturally Situated Self-Regulated Learning in Statistics in a Computer-Supported Collaborative Environment

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July 2010

A Thesis Submitted to McGill University in Partial Fulfilment of the Requirement of the Degree of Doctor of Philosophy

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Acknowledgement

As the long process of the dissertation writing nears its end, I am especially conscious of the help that I have received all along the way. Special thanks were given to my supervisors Carl Frederiksen and Krista Muis for their continued support throughout the dissertation writing process, including editorial comments, and numerous discussions about literature review, research design, data collection, and data analysis. Especially, Carl Frederiksen has spent a lot of time in setting up the server for my experiments, coding for reliability coefficients, and helping me develop the coding scheme. I would like to thank them for their generosity in sharing with me their experiences on many aspects of research. Their enthusiasm and wisdom for conducting research will benefit me all my life.

I would like to express my deepest gratitude to Dr. Alenoush Saroyan, Dr. Robert Bracewell, and Dr. Mark Aulls for their comments in many enlightening discussions and their constant encouragement.

I am indebted to the advice and comments of Dr. Susanne Lajoie, Dr. Janet Donin, Dr. Panayiota Kendeou, and other professors earlier in their classes. I also wish to express my appreciation to my peers, colleagues, participants, and my family for their generous support and encouragement.
Abstract

This thesis examines the role of context, especially cultural context, in contemporary theoretical models of self-regulated learning. A critical review of prominent models revealed that although current models of self-regulated learning recognize the role of social contexts in forming self-regulatory competency, they assume that, once established, self-regulation functions largely independently of the social context. However, this is not the case in social situations, nor is it the case in Eastern cultures and many non-mainstream Western sub-cultures, in which individuals typically self-regulate in relation to others. To address this issue, a situated discourse model of self-regulated learning was developed to involve both individually oriented and socially oriented regulatory processes.

This model was then tested in a context of computer-supported learning in statistics. Participants were 30 Canadian male students and 30 Chinese male students who were enrolled in a major university in Canada. The students were randomly paired to learn analysis of variance for one hour as they solved a data analysis problem by using a computer tutor. Pairs were allowed to learn in a way of their own choice or simply by
following the directions prescribed by the researcher. The students had little or no prior knowledge of analysis of variance.

The results were consistent with research hypotheses derived from the proposed model. Compared with Chinese pairs, Canadian pairs engaged more with tasks of their own choice as revealed in the computer logs, and favoured more individually oriented actions both in solving their problem and in learning on the computer tutor as shown in their discourse. Moreover, Canadian pairs demonstrated a stronger preference for the employment of individually oriented self-regulatory strategies in the forethought and performance phases of self-regulated learning than did Chinese pairs. Furthermore, there were significant differences between Canadian pairs and Chinese pairs in monitoring, motivation, elaboration, clarification, and environment structuring with stronger individual orientation for the Canadian pairs. In addition, the findings from comparisons between the Canadian pairs and Chinese pairs were largely replicated by those findings from contrasts between Canadian participants and Chinese participants within the mixed pairs.
Résumé

La présente thèse consiste à examiner le rôle du contexte social, particulièrement celui du contexte culturel, dans les modèles théoriques contemporains d’apprentissage auto-régulé. Une revue critique des modèles proéminents relève que bien que les modèles présents d’apprentissage auto-régulé reconnaissent le rôle du contexte social dans la formation des compétences auto-régulées, ils assument le fait qu’une fois établi, l’apprentissage auto-régulé fonctionne indépendamment du contexte social. Pourtant, ceci n’est pas le cas dans les contextes sociaux, ni dans les cultures orientales et ni dans les sous-cultures occidentales minorités, dans lesquels les individus s’auto-régulent en se référant aux autres. Pour faire face à ce problème, un discours de modèle de mise en situation de l’apprentissage auto-réglementé est présenté afin de s’adresser aux processus réglementaires, qui se concentrent autant sur les individus et sur les sociétés.

Ce modèle a été testé dans le contexte d’apprentissage aux ordinateurs. Les participants étaient 30 étudiants mâles canadiens et 30 étudiants mâles chinois qui étudiaient dans une université majeure du Canada. Ils étaient appariés aléatoirement pour connaître l’analyse de variance pour une heure pendant lequel ils résolvaient un problème.
d’analyse des données avec l’assistance d’un ordinateur. Les pairs pouvaient soit apprendre d’une façon de leur propre choix ou soit de suivre simplement les directions prescrites par le chercheur. Les étudiants n’avaient aucune connaissance sur l’analyse de variance.

Les résultats obtenus correspondent avec l’hypothèse de recherche dérivée du modèle proposé. Par rapport à leurs collègues chinois, les participants canadiens s’engagent davantage dans les tâches de leur propre choix comme ce que révèlent les logs de l’ordinateur et préfèrent une approche plus individuelle autant dans la résolution des problèmes que dans l’apprentissage durant le tutorat comme ce qu’ils le montrent dans leurs échanges. De plus, les pairs canadiens démontrent une forte préférence pour l’utilisation des stratégies auto-régulées individuelles dans les phases de la préméditation et de l’exécution de l’apprentissage auto-régulé que leurs confrères chinois. En outre, il y avait des différences significatives entre les participants canadiens et chinois lors de la surveillance, de la motivation, de l’élaboration, de la clarification et de la structuration de l’environnement avec une plus grande tendance vers l’orientation individuelle pour les sujets canadiens. Par ailleurs, les conclusions des comparaisons entre les paires canadiennes et chinoises étaient largement duplicables par les conclusions tirées des contrastes entre les participants canadiens et chinois dans les paires mixtes.
# Table of Contents

Acknowledgement ........................................................................................................... ii  
Abstract ............................................................................................................................ iii  
Résumé ............................................................................................................................... v  
Table of Contents................................................................................................................ vii  
List of Tables......................................................................................................................... xi  
List of Figures......................................................................................................................... xiv  
Chapter 1 - Introduction........................................................................................................ 1  
  Chapter 2 - Research Background in Self-Regulated Learning ........................................... 7  
    2.1 Contexts in Self-Regulated Learning ........................................................................... 7  
    2.1.1 Definition of Context ........................................................................................... 9  
    2.1.2 Types of Contexts .............................................................................................. 9  
    2.1.3 Bandura’s Classification System ......................................................................... 10  
    2.1.4 Individual Learning Contexts ............................................................................. 13  
    2.1.5 Social Learning Contexts .................................................................................. 14  
    2.1.6 Cultural Contexts ............................................................................................. 20  
    2.2 A Critique on the Role of Contexts in Current SRL Models ...................................... 24  
    2.2.1 Social Cognitive Theories of Self-Regulated Learning ......................................... 24  
    2.2.2 Information Processing Theories of Self-Regulated Learning .............................. 28  
    2.2.3 A Vygotskian View of Self-Regulated Learning ................................................. 32  
    2.3 The Role of Contexts in Current SRL Research ....................................................... 35  
    2.3.1 Variations across Contexts ............................................................................... 35  
    2.3.2 Variations in Cross-Cultural Contexts: Individualism versus Collectivism ........ 38  
Chapter 3 - A Situated Discourse Model of Self-Regulated Learning ................................. 63  
  3.1 Mead’s Dual Construal of Self as a Theoretical Basis of SRL ..................................... 63  
  3.2 The Model .................................................................................................................. 67  
  3.3 The Specific Phases .................................................................................................... 75  
  3.4 Examples ..................................................................................................................... 78  
  3.5 Methodological Implications .................................................................................... 80  
Chapter 4 - Rationale and Research Questions Addressed in the Study ............................. 87  
  4.1 Research Questions ................................................................................................... 87  
  4.2 Research Hypotheses ............................................................................................... 90  
  4.3 Specific Objectives ................................................................................................... 92  
Chapter 5 - Research Method ............................................................................................. 96  
  5.1 Design of the Study .................................................................................................. 96  
    5.1.1 General Description of the Design ..................................................................... 96
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2.5 Summary of Results Pertaining to Research Question One</td>
<td>158</td>
</tr>
<tr>
<td>6.3 Differences between Chinese Participants’ and Canadian Participants’ Orientation of Actions in the Mixed Pairs Group</td>
<td>159</td>
</tr>
<tr>
<td>6.3.1 Overall Differences in Orientation of Actions between Chinese Participants and Canadian Participants within the Mixed Pairs Group</td>
<td>160</td>
</tr>
<tr>
<td>6.3.2 Differences between Chinese Participants and Canadian Participants with respect to Orientation of PS Actions</td>
<td>164</td>
</tr>
<tr>
<td>6.3.3 Differences between Chinese Participants and Canadian Participants with respect to Orientation of SRL Actions</td>
<td>164</td>
</tr>
<tr>
<td>6.3.4 Summary of Results Pertaining to Research Question Two</td>
<td>165</td>
</tr>
<tr>
<td>6.4 Differences in Orientation of Actions among Chinese, Canadian, and Mixed Pairs Group with Respect to Self-Regulatory Phases and Specific Types of SRL Actions</td>
<td>166</td>
</tr>
<tr>
<td>6.4.1 Overall Differences in Orientation of Actions with Respect to SRL Phases</td>
<td>167</td>
</tr>
<tr>
<td>6.4.2 Differences in Orientation of Actions among Chinese, Canadian, and Mixed Pairs Group with respect to SRL Phases</td>
<td>169</td>
</tr>
<tr>
<td>6.4.3 Differences among Chinese, Canadian, and Mixed Pairs with Respect to Orientation of Specific SRL Actions</td>
<td>172</td>
</tr>
<tr>
<td>6.4.4 Summary of Results Pertaining to Research Question Three</td>
<td>175</td>
</tr>
<tr>
<td>6.5 Differences in Orientation of Actions in SRL Phases and Specific SRL Actions between Chinese Participants and Canadian Participants within the Mixed Pairs Group</td>
<td>176</td>
</tr>
<tr>
<td>6.5.1 Differences in SRL Phases between Canadian Participants and Chinese Participants in the Mixed Pairs Group</td>
<td>177</td>
</tr>
<tr>
<td>6.5.2 Differences Between Chinese and Canadian Participants within the Mixed Pairs Group in terms of Specific SRL Actions</td>
<td>179</td>
</tr>
<tr>
<td>6.5.3 Summary of Results to Research Question Four</td>
<td>181</td>
</tr>
<tr>
<td>6.6 Qualitative Evidence of Individually and Socially Oriented Self-Regulated Learning in the Canadian Pairs Group, Chinese Pairs Group, and Mixed Pairs Group</td>
<td>182</td>
</tr>
<tr>
<td>6.6.1 Differences between the Canadian Pairs Group and the Chinese Pairs Group with regard to Orientation of Self-Regulated Learning</td>
<td>182</td>
</tr>
<tr>
<td>6.6.2 Differences in Orientation of Self-Regulated Learning between Chinese Participants and Canadian Participants within the Mixed Pairs Group</td>
<td>188</td>
</tr>
<tr>
<td>6.6.3 Summary of the Qualitative Evidence</td>
<td>191</td>
</tr>
<tr>
<td>6.7 Group Differences with respect to Quality of Solutions</td>
<td>192</td>
</tr>
<tr>
<td>Chapter 7 - Discussion</td>
<td>194</td>
</tr>
<tr>
<td>7.1 Discussion of the Research Questions</td>
<td>194</td>
</tr>
<tr>
<td>7.1.1 Research Question One: Cultural Construal of the Self and Orientation toward Actions in Social Contexts of Learning</td>
<td>195</td>
</tr>
</tbody>
</table>
7.1.2 Research Question Two: Cultural Construal of Self and Orientation toward Actions in Social Contexts Involving Cross-Cultural Collaboration 202
7.1.3 Research Question Three: Cultural Construal of the Self and Differences in Learning Strategies between Cultural Groups 205
7.1.4 Research Question Four: Self-Construal and Learning Strategies in Situations of Collaboration with Individuals from Other Cultures 210
7.2 General Discussion of the Role of Social Contexts and Cultural Backgrounds 213
7.2.1 Contexts of Cultural Identity 214
7.2.2 Contexts of Interpersonal Relationships 216
7.2.3 Contexts of Authority 220
7.2.4 Contexts of Task 222
7.2.5 Knowledge Construction as a Product of Learning Activity and Contexts 224
7.3 Conclusions 226
7.3.1 Summary of Conclusions 226
7.3.2 Implications for Culturally-Situated SRL Theory and for Education in a Culturally Pluralistic Society 230
7.3.3 Limitations of the Study 235
7.3.4 Suggestions for Future Research 237
References 240
Appendix A: The Project from a Technical Perspective 265
Appendix B: Problem Description 266
Appendix C: Pre-test 271
Appendix D: Four-Step Coding Guide 272
Appendix E: Problem Solving (PS) Codes 279
Appendix F: Self-Regulated Learning (SRL) Codes 292
Appendix G: Scoring Rubrics 319
Appendix H: Data Analysis Plan 320
Appendix I: Transcription Conventions 322
Appendix J: A Sample of Transcript 324
Appendix K1: Informed Consent Form 331
Appendix K2: A Letter of Solicitation for Participation 334
Appendix K3: A Website to Learn about This Project 336
Appendix K4: A Website to Book a Time Interval for Participation 337
List of Tables

Table 2.1: *Cross-Cultural Research on Self-Regulated Learning (1996 -2010)* ..........42

Table 3.1: *Examples of Cyclic Phases of Self-Regulated Learning in a Sequence of Discourse* ................................................................................................................. 82

Table 6.1: Proportion of Correct Answers in Pre-Test ................................................. 143

Table 6.2: Frequencies (Row Pct) of Orientation of Action by Group Types .............. 148

Table 6.3: Effect Sizes (Odds Ratios) of Overall Orientation of Actions for Group Comparisons ........................................................................................................... 149

Table 6.4: Frequencies (Row Pct) of Orientation of PS Actions and SRL Actions by Groups ........................................................................................................................................ 151

Table 6.5: Effect Sizes (Odds Ratio) of Overall Orientation of Action for Group Comparisons ........................................................................................................... 152

Table 6.6: Frequencies (Row Pct) of Explored Learning Topics Categorized by Group Type ........................................................................................................................................ 155

Table 6.7: Odds Ratios (Effect Sizes) of Group Differences in Frequency of Engagement in Specific Learning Tasks ................................................................. 157

Table 6.8: Frequencies (Row Pct) of Overall Orientation of Actions, Orientation of PS Actions and SRL Actions by Cultural Identity of Participants in the Mixed Pairs Group. 161
Table 6.9: Effect Sizes (Odds Ratio) of Overall Orientation of Actions, Orientation of PS Actions, and Orientation of SRL Actions for Comparisons between the Canadian and Chinese Participants in the Mixed Pairs Group ................................................................. 162

Table 6.10: Frequencies (Row Pct) of Orientation of Actions by SRL Phases among Chinese, Canadian, and Mixed Pairs Group .................................................................................. 168

Table 6.11: Effect Sizes of Successive Differences between SRL Phases with respect to Orientation of Actions ............................................................................................................. 169

Table 6.12: Effect Sizes of Differences in Orientation of Actions between Chinese, Canadian, and mixed pairs group with respect to Specific SRL Phases ...................... 171

Table 6.13: Frequencies of Orientation of SRL Actions across the Chinese, Canadian, and Mixed Pairs Group .............................................................................................................. 173

Table 6.14: Effect Sizes of Differences in Orientation for Contrasts among the Canadian, Chinese and Mixed Pairs Group with respect to Orientation of Specific SRL Actions ... 174

Table 6.15: Frequencies (Row Pct) of Orientation of Actions by SRL Phases between Canadian and Chinese Participants in the Mixed Pairs Group ........................................... 177

Table 6.16: Effect Sizes of Differences in Orientation between Canadians and Chinese in the Mixed Pairs Group with respect to a Specific SRL Phase ........................................... 178

Table 6.17: Frequencies (Row Pct) of Orientation by Specific SRL Actions between Canadians and Chinese in the Mixed Pairs Group ......................................................... 180
Table 6.18: Frequencies (Pct) of Correct Answers in Each Group .................................. 192

Table 6.19: Effect Sizes of Differences in Solutions to the Prescribed Problem between

the Canadian Pairs Group, the Chinese Pairs Group and the Mixed Pairs Group ........ 193
List of Figures

Figure 5.1: A pair of participants sat together before a computer in a corner of the lab. 104

Figure 5.2: The researcher sat at another corner of the lab. ........................................ 105

Figure 5.3: McGill Statistics Tutor interface ................................................................. 107

Figure 5.4: McGill Statistics Tutor general interface ...................................................... 113

Figure 6.1: Learning activity influenced by one’s own choice and the requirements of the
prescribed problem ...................................................................................................... 156

Figure 6.2: The effect of prior knowledge on orientation of actions depends on cultural
identity in the mixed pairs group ................................................................................ 163
Chapter 1 - Introduction

Through decades of research, self-regulated learning has become well established as a construct in the field of educational psychology (Zimmerman, 2001). From the perspective of this research, learners who engage in self-regulation manage their own learning, engage in more metacognitive monitoring and control, are more intrinsically motivated (Zimmerman, 1990), are more strategic, and perform better than less self-regulated learners (Pressley & Ghatala, 1990). Theoretically, individuals who self-regulate effectively would be expected to be more aware of task demands, better able to meet those demands, more efficacious in learning, more likely to attribute outcomes to facets of learning under their control, and more likely to have a repertoire of learning strategies that they use appropriately under various learning situations (e.g., see Winne, 2001).

According to Schunk (2001), self-regulated learning (SRL) is defined as, “learning that results from students’ self-generated thoughts and behaviours that are systematically oriented toward the attainment of their learning goals” (p. 125). Researchers in this field have sought to explore how various constructs may help or hinder self-regulatory
processes, and models of those processes have become increasingly complex. As empirical evidence accumulates, researchers have identified multiple facets of self-regulation and factors that influence students’ learning. Some of these factors include the importance of students’ knowledge of self-regulation (Lefebvre-Pinard & Pinard, 1985; Nelson, 1996; Paris & Winograd, 1990), as well as their metacognition (Borkowski, Chan, & Muthukrishna, 2000; Winne & Hadwin, 1998), motivation (Boekaerts, 1992; Pintrich & De Groot, 1990; Schunk, 2001; Zimmerman, 1998), and beliefs (Muis, 2007).

Although current models of SRL all share some general assumptions and features, such as the phase-like nature of SRL (Pintrich, 2000; Puustinen & Pulkkinen, 2001), certain issues are still inadequately addressed. In particular, Pintrich (2000) noted that the role of context is absent in some self-regulatory models. While most self-regulatory models have recognized context as a component, Martin (2007a) has argued that context has been downplayed to the extent that only proactive agency can be seen in self-regulatory processes. Under such circumstances, especially when social and cultural context constraint in models of self-regulated learning disappears out of view, it will be hard to understand why a student meet great difficulty in a highly collaborative program
whereas he/she has been successful in a traditional classroom context. In a different cultural context, a student may be criticized as a poor learner while he/she was actually an excellent student in the home country. This dilemma is also reflected in current cross-cultural research in self-regulated learning. On the one hand, Asian students have been observed as strong competitors in academic classrooms (Stigler et al., 1982; Stevenson, Lee, & Stigler, 1986; Stevenson et al., 1986; Mayer, Tajika, & Stanley, 1991; Bempechat, & Drago-Severson, 1999). On the other hand, they were rated as students with lower self-regulatory competency except for memorization when such self-regulatory theory was applied (e.g. Purdie & Hattie, 1996; Salili, Tong, & Tabatabai, 2001).

In fact, as early as 1990, Bruner traced this drawback to changes that took place during the cognitive revolution in the 1960s. Bruner (1990) maintained that the original intention was to understand the meaning of symbolic activities that human beings employ not only in making sense of the world but also of themselves. Later, meaning came to be viewed more narrowly as symbolic information, which humans, like computers, could process. In the end, though successful, this information processing conception of human cognition effectively shifted attention away from contexts of cognition, including social and cultural contexts. When context
disappears from view, a complete understanding of meaning making is impossible. Based on his own criticisms of the limitations of a strictly information processing view of cognition, Bruner called for a “renewal of the cognitive revolution" to bring meaning back to the forefront.

Why is context so important in making meaning of one’s symbolic activities? As many researchers have argued (e.g. Goodwin & Duranti, 1992; Greeno, 2006; Mead, 1934; Vygotsky, 1935), context can frame what action is appropriate in a specific situation. If we consider the cultural context, for example, we can identify how it frames one’s thinking and learning. To illustrate, consider the case of a new immigrant student who was judged the best student in the classroom by his/her teachers in the home country, but was later criticized as a poor self-regulatory learner in the new country. There are several possible explanations for this difference across contexts, but as many psychologists studying cultural differences have argued (e.g. Markus & Kitayama, 2003, 1991; Iyengar & Lepper, 1999; Norenzayan, Choi, & Peng, 2007 ), one major reason is that different cultures have different criteria for framing what types of actions are preferred during learning, and these differences influence teachers’ judgments of student behaviors.
As such, one’s social and cultural experience may play an inextricable role in making meaning of one’s learning activity in different contexts. Moreover, learning contexts may provide various affordances for one’s learning, and simultaneously require different types of organization of one’s learning resources to promote learning efficiency within these contexts. When students encounter new demands in their lives, their self-regulatory learning competencies will need to be frequently updated if they are to adapt to the affordances and demands of new learning contexts.

Therefore, the major purposes of this dissertation are to review the role of contexts, especially social and cultural contexts in framing the meaning of one’s learning activity, to establish a context-sensitive theoretical framework for self-regulated learning, and to apply this framework to study how cultural differences are reflected in self-regulatory learning processes within social and problem-based learning contexts.

The thesis begins with a review of the role of context in self-regulated learning, which leads to a proposal for a situated discourse model of self-regulated learning. Research hypotheses and research questions are then derived from this model, and tested through a research design that studies students from two different cultures (mainland Chinese and English Canadian) in a context of problem-based computer-supported
collaborative learning in which students learn with a partner in pairs. It is expected that the role of socio-cultural context can be made explicit when students’ self-regulation is embedded in it. The results of the study are then reported, followed by a detailed discussion of the results, their implications for the questions addressed in this study, the potential importance of these conclusions as a contribution to knowledge and practice, the limitations of the study, and suggestions for future research.
Chapter 2 - Research Background in Self-Regulated Learning

2.1 Contexts in Self-Regulated Learning

Context is a phenomenon of interest in many fields of research. The extent of interest in the phenomenon of context across disciplines is exemplified by six interdisciplinary conferences that were held on modeling and using context (Context97 in Rio de Janeiro, Brazil; Context99 in Trento, Italy; Context01 in Dundee, Scotland; Context03 in Stanford, USA; and Context07 in Roskilde, Denmark). Scholars attending these conferences have presented perspectives on context from multiple disciplines including: Psychology, Sociology, Artificial Intelligence, Logic, Natural Language, Machine Learning, Linguistics, Pragmatics, and Philosophy. For example, in computer science, “Context is any information that can be used to characterize the situation of an entity” (Dey, 2001); and in logic, context is used to deal with preferences, beliefs, and presuppositions (McCarthy, 1993).

A classic reference on context in Anthropology and Interactive Sociolinguistics is the volume *Rethinking context: language as an interactive phenomenon*, edited by Alessandro Duranti and Charles Goodwin (Goodwin & Duranti, 1992). These authors offer a
characterization of context as concerned with focal events in behaviour that are “interpreted by reference to context” which includes talk and other behaviour that occurs within a social situation. Context extends “beyond the event itself to other phenomena (for example cultural setting, speech situation, shared background assumptions) within which the event is embedded”. “Features of the talk itself invoke particular background assumptions relevant to the organization of subsequent interaction (Gumperz, 1992). The central research question is to understand, from the standpoint of the participants in a situation, “what in each other’s behavior do they treat as ‘focal’ and what as ‘background’ ”. The context is thus a frame (Goffman, 1974) “that surrounds the event being examined and provides appropriate interpretation” (Duranti and Goodwin, 1992, p. 3).

The phenomenon of context has important implications for understanding processes of self-regulated learning as they occur in natural social situations of learning and for understanding cultural differences in self-regulated learning. In this section, a working definition of context from a perspective of sociology, social psychology, and educational psychology is provided. Then a classification of the contextual system is introduced, followed by discussion of three types of contexts (i.e.
individual, social, and cultural contexts) which function to frame one’s self-regulatory actions differently.

2.1.1 Definition of Context

Generally speaking, a context functions as a frame that surrounds the current event being examined and provides resources for its appropriate interpretation (Goffman, 1974). Here, the current event is the learning activity in which students set their learning goals, make plans, search information, take notes, or reflect on what they have done. Surrounding the focused event is its context, which is perceived by students as providing relevant resources for their interpretation of their learning activity. We describe various types of contexts next.

2.1.2 Types of Contexts

Classification of contexts is important because different types of contexts may provide different affordances for students and generate different constraints on how to regulate their learning. However, researchers employ different terms and criteria for what constitutes a context. For example, researchers may prefer to use the term "context" (Goodwin & Duranti, 1992), “environment” (Bandura, 2008), “situation,
context, or environment” (Greeno, 2006), or “situation or context” (Brown, Collins, & Duguid, 1989). These terms sometimes vary in meaning but are often used to refer to the same phenomenon. Therefore, we will not differentiate these terms here but use the term “context” in as inclusive a manner as possible. What is more imperative is to distinguish between various types of contexts that may influence SRL. We begin with Bandura’s (2008) classification system.

2.1.3 Bandura’s Classification System

Bandura (2008) identified three categories of context: imposed, selected, and created. An imposed context is one pre-determined by others, and can be individual or social. An example of this type is a lab environment in which experimental procedures and group activities are governed by rules that are pre-defined by textbooks and teachers. According to Bandura, students cannot self-regulate in imposed contexts because they have relatively little opportunity to control their physical and social environment; they can only construe it and/or react to it. However it may be argued that students’ reactions toward imposed contexts are still important expressions of their self-regulatory competency. Students may find that it is reasonable and efficient to follow the teacher’s advice and
expectations to complete the assignment because the advice might help to relieve their cognitive load and emotional burdens. Of course, it is important to value the role of the student’s free choices in construction of their own self-regulatory strategies; however, it is also important for the student to refrain from going off task. It is the self-regulated learner’s responsibility, then, to balance the advantages and disadvantages of the context and select appropriate reactions toward it.

In selected contexts, people can select or alter their environment, which can be individual or social, by choosing a particular context in which to work. For example, a student who requires a quiet space to study may find a silent individual work space in a library. According to Bandura (2008), students have great potential to self-regulate their learning if contexts are carefully selected and deliberately arranged, but such contexts may be difficult to change. Although we acknowledge that selected contexts may lead to more student control, we disagree that a selected context is always more advantageous over an imposed context. Rather, a selected context has different affordances and risks, which the learner must attend to; ignoring some risks may have a negative effect on learning.
Finally, a *created* context is one that is constructed by an individual to provide support for effective self-regulation to reach his or her own personal goals. For example, an individual may change the constraints of an environment to create a more favorable one. In this case, an individual can exert a high degree of control over his or her environment. Bandura’s (2008) concept of a created context can apply as well to social environments. Individuals often work or learn in socially constructed environments such as a project group in which members mutually construct and organize their activities through interactions with others within the group. Here, the members of the group cooperate to exert a high degree of control over their working environment, and they do so through negotiation and communication with one another to establish both their goals as a group and their own individual goals. Indeed, a created context allows the greatest control by students over their own learning activities. Moreover, learners may gradually increase their learning competency as they gain control over their environment. However, not all created contexts may work well without the guidance provided by a more experienced student, tutor or coach. Again, it is the learner’s responsibility to evaluate the affordances and risks that a created context may provide for them, and make appropriate decisions accordingly.
In summary, Bandura’s (2008) classification of contexts emphasizes different degrees and ways in which individual or social environments can function to constrain or support learners’ ability to actively control and shape their own learning activity. We will further explore Bandura’s categories in our own classification system in which we focus on individual, social, and cultural contexts. When we examine one’s self-regulated learning processes within an individual learning context, a social or collaborative context, or a cultural context, a balanced consideration of affordance and risks associated with particular learning contexts is imperative, since it may lead to a more complete understanding of the relationship between contexts and learning activities including self regulation. We elaborate our classification next.

2.1.4 Individual Learning Contexts

An individual learning context occurs when a student learns relatively independently from others. This type of context has been investigated most frequently in the SRL literature. For example, initially, researchers like Bandura (1977) assumed that self-regulatory functions are generated by individuals but are occasionally supported by social factors. It was assumed that once established one’s self-regulatory
competency can function independently from its social origins. Thus, learning in this type of context is called *individually oriented self-regulated learning*, or just self-regulated learning. Its feature is the emphasis on individually created contexts wherein students can proactively set their own learning goals, develop plans, and reorganize learning resources to reach their goals. However, we argue that since most individual learning contexts occur within larger social contexts (e.g., working individually on a research project in the library to produce a report on a topic negotiated with the teacher, supported by the teacher through class discussions, and for presentation to the class at the end of the term), individual learning contexts are likely to be framed by their larger social contexts, and consequently an individual’s self-regulation processes are likely to reflect both individually oriented and socially oriented self regulation processes.

### 2.1.5 Social Learning Contexts

A social learning context occurs whenever students learn within groups, for example, with others in their classrooms, in collaborative learning groups in school or community settings, with a tutor or coach, or with family members at home. A social learning context may be, to varying degrees, created, selected, or imposed. For example, in a *created social*
social environments are organized to allow individuals within a
group a high degree of freedom of action. For selected social contexts,
students might be given the opportunity to select their group partners, or
groups might choose a task from a fixed set of tasks. Finally, for imposed
social contexts, learning groups may involve the participation of an
authority, such as a teacher, parent, older brother, or a more experienced
classmate. In these situations, constraints set out by the authority figure to
some extent may not be negotiable; hence, such a context becomes to
some extent imposed.

Whether social contexts are created, selected, or imposed, they
share many features. First, students can obtain social support from and be
challenged by others in a social context. For example, when an authority is
involved, students may seek advice, guidance or other types of support
from that authority to increase self-regulatory efficiency. In this case,
students may self-regulate their own learning if they realize their own
performance might positively influence their group’s overall performance.
That is, they may autonomously regulate themselves to meet the concerns
of others or the group in which they learn. We will refer to this type of
learning, which occurs within social contexts, as socially oriented self-
regulated learning. We classify this type of learning as “self-regulated”
because students’ thoughts and regulatory actions are self-generated, actively performed, and goal-oriented. We also classify this type of learning as “socially oriented” because it aims to meet the needs and expectations of the group and other individuals within the group.

While students can benefit through the process of satisfying the needs of the group and of other members of the group, others’ opinions may interrupt or interfere with an individual’s goals. In such situations, the individual may then choose to ignore, refute, or challenge others, or may decide to maintain his or her own individual goals, which leads to individually oriented self-regulated learning within the social context. As such, social contexts encompass both socially oriented and individually oriented self-regulated learning, and arise depending on the focus of one’s actions (e.g., for one’s self or for others).

When we propose the new concept of socially oriented self-regulated learning in social contexts, we are aware of other similar concepts: social self-regulation (Patrick, 1997), externally facilitated SRL (Azevedo et al., 2008), and co-regulation (McCaslin & Hickey, 2001) in the current SRL research literature. The concept that we propose differs, however, from these other concepts in important ways. First, to Patrick, social self-regulation is the application of self-regulatory principles to the
domain of interpersonal relationships and is similar to Zimmerman’s SRL framework in terms of underlying processes. In contrast, socially-oriented self-regulation does not necessarily focus on socializing with others; it concentrates on tasks or one’s learning with a concern about the expectations of others. It follows processes that are different from those involved in the individually oriented self-regulatory framework. Second, for externally facilitated SRL, external scaffolds are arranged to assist self-regulatory processes, which follow processes that are the same as those in Zimmerman’s SRL framework in terms of the underlying processes.

Finally, McCaslin and Hickey’s co-regulation is a multicomponent concept consisting of relationships among selves, others, tasks, and settings in a social classroom; coordination of the relationship; and learned coordination competency. They assume that goals or demands external to oneself, such as others’ goals, tasks, and settings may be contradictory to one another and to one’s own goals. Therefore, students must learn how to coordinate or regulate the relationship among them to attain meaningful social activity. However, the kinds of roles played by members of groups and by activities within social contexts (i.e. teachers, parents, classmates, tasks, settings) in this framework differ from what we propose. Specifically, McCaslin and Hickey assert that all of these co-regulated “objects” need to be deliberately arranged or coordinated to promote students’ SRL. Thus,
co-regulation is more like a scaffold which is instrumental to intrapersonal self-regulation. In a sense, co-regulation is closer to Azevedo’s concept of externally facilitated self-regulation than it is our concept of socially oriented self-regulation, which is in our theory one of two fundamental types of responses of students to their contexts.

Generally, we view individually oriented and socially oriented self-regulation as two approaches that students can take to the social contexts in which they learn. Both approaches to self-regulation will be involved in any social context of learning, and the balance between them will be adapted to specific characteristics of a learning context. How might differences in individually oriented vs. socially oriented self-regulation arise across various social contexts? And what characteristics of social contexts are likely to influence individually oriented versus socially oriented self-regulation? To begin to answer this question, consider how created social contexts and constructed social contexts might have characteristics that could influence students’ use of individually oriented versus socially oriented self-regulatory learning processes.

Within “created” social contexts, we would expect social contexts, learning activities, tasks, goals, role of individuals in groups, and group organization to be freer and relatively unconstrained. In such situations
we would expect students to be more likely to engage in a freely chosen mixture of individually oriented and socially oriented self-regulatory actions to attain their individual learning goals while contributing as well to those of the group. In contrast, within more “imposed” social contexts (i.e., contexts having more constraints on students learning activities, tasks, goals, roles in the group, and group organization), we would expect students to engage in more socially oriented self-regulated learning to meet the goals prescribed for the group, while it would be more difficult for them to achieve their personal learning goals leading to fewer individually oriented self-regulatory actions.

We believe the distinction between socially versus individually oriented self-regulation is particularly important for cross-cultural research on SRL. Specifically, since some cultures place a greater value on authority and others favor individual freedom, cultures can be characterized in relation to Bandura’s classification of imposed contexts and created contexts. Thus, we may predict that culturally based preferences and expectations will predict the type of self-regulation that is adopted in social contexts. We will elaborate the role of cultural context next.
2.1.6 Cultural Contexts

A cultural context occurs when one's cultural knowledge, attitudes and beliefs influence one's perception of what actions are appropriate during learning. According to Triandis (1972), culture refers to variables that are attributes of the cognitive structures and knowledge of groups of people. When people live and work together for a significant period of time, they may accumulate common attributes such as shared values, attitudes, and beliefs about appropriate ways to eat, dress, or act in their group. Triandis (1995) classified these attributes into two distinct cultural syndromes: collectivism and individualism.

(1) Collectivism is defined as:

“a social pattern consisting of closely linked individuals who see themselves as parts of one or more collectives (family, coworkers, tribe, nation); are primarily motivated by norms of, and duties imposed by, those collectives; are willing to give priority to the goals of these collectives over their own personal goal; and emphasize their connectedness to members of these collectives” (Triandis, 1995, p. 2).

(2) In contrast, individualism refers to:
“a social pattern that consists of loosely linked individuals who view themselves as independent of collectives; are primarily motivated by their own preferences, needs, rights, and the contracts they have established with others; give priority to their personal goals over the goals of others; and emphasize rational analyses of the advantages and disadvantages to associating with others” (Triandis, 1995, p. 2).

Collectivist cultures can be seen in most countries in Asia, Africa, South Europe, and South America whereas individualist cultures are most prominent in North America, North Europe, and Australia. Apart from the different cultural contexts between countries, many variations can exist within a country. Markus and Kitayama (2003) argued that in the U.S. many minority groups, lower income working people, and White females have their own distinct cultures that may be relatively more collectivistic and less individualistic.

If we link Triandis’s notion of individualist and collectivist cultures to Bandura’s classification system for contexts, we might predict that a person from an individualist culture would emphasize the importance of independence and freedom of action; therefore, such a cultural belief system could be thought of as scaffolding for creating contexts which
facilitate individually oriented modes of self-regulated learning. In this view, people who are brought up in an individualistic culture will take for granted that creation of their own learning contexts is permitted and even preferred by others; therefore, individually oriented SRL actions are likely to be frequently performed. In contrast, we might expect people who are brought up in collectivist cultures to place greater stress on the role of authority and the well being of a group; therefore, such a belief system could be thought of as scaffolding for creating contexts that facilitate socially oriented modes of self-regulated learning. Hence, we would expect people who grow up in a collectivistic culture to believe that it is beneficial and even necessary to consult others and give priority to the benefit of the group; therefore, socially oriented SRL actions are likely to be performed.

Clearly, cultural contexts may play a key role in selecting acceptable actions that people perform (Bruner, 1990; Triandis, 1995; Plaut & Markus, 2005; Choi, Choi, & Norenzayan, 2004). Over time, children learn to perform actions in agreement with their culture’s preference. This is the formation of one’s cultural identity, which is defined as one’s incorporation of the cultural values, beliefs, and practices of one’s ethnic group (McInerney, 2008).
In summary, individualistic and collectivist cultures provide different affordances to their people, which may foster an individual orientation or a social orientation of the self. On the one hand, individualist cultures stress the importance of the individual self; hence, people focus on the internal state and change the environment to fit their intentions and goals. On the other hand, collectivist cultures underscore the social self; as a consequence, people change themselves to match the expectations of others (Norenzayan et al., 2007). As such, we would expect that it is the interaction between individuals and their social contexts that lead an individual to prefer individually oriented or socially oriented self-regulatory actions, preferences that are strengthened by the cultures in which individuals live. Students’ knowledge construction is thus a product of their learning activity and context, be it material or non-material, social or cultural (e.g., Brown, Collins, & Duguid 1989; Collins, Brown, & Newman, 1989; Greeno, 2006; Lave & Wenger, 1991). In other words, the idea that context consists of more than information resources that individuals can obtain or omit needs to be coherently embedded within current SRL models. We elaborate this next.
2.2 A Critique on the Role of Contexts in Current SRL Models

Given that several reviews of SRL models and their theoretical underpinnings have been published (e.g., Pintrich, 2000; Puustinen & Pulkkinen, 2001), we will not review each of these models in detail; rather, we provide a more general discussion of the nature of three prominent theories that have influenced the development of models of SRL. These include social cognitive theory, information processing theory, and co-regulation from a Vygotskian perspective. For each framework, we focus on the extent to which the role of context has been appropriately addressed.

2.2.1 Social Cognitive Theories of Self-Regulated Learning

Social cognitive theory (SCT) was originally proposed by Bandura (Bandura, 1977, 1986) and later elaborated by Zimmerman and Schunk (e.g. Schunk, 2001; Zimmerman, 1990, 2008a). Briefly, SCT describes learning as reciprocal interaction between behavior, the environment, and the individual. People do not operate autonomously, nor is their behavior wholly determined by situational influences (Bandura, 2008). According to Bandura (1986, 2008), learning is determined by the reciprocal relationship between personal and behavioral factors: people’s internal
biological endowment and psychological goals and values can influence their behavior, which in turn can have a reciprocal effect on their thought processes and affective states. In the relationship between behavioral and environmental factors, behavior can change environmental conditions, and behavior can in turn be altered reciprocally by the conditions it creates. Finally, environmental factors such as social modeling and instructional practices can alter personal attributes. In turn, these intrapersonal characteristics can have a reciprocal effect on a student's environment (Bandura, 1986, 2008).

The role of context is especially reflected in the environmental component of the triadic model. Recall that Bandura (2008) proposed three types of contexts or environments: imposed, selected, and created. Bandura posited that people have little control over an imposed physical and social environment; rather, what people can do is to construe it and react to it. Fortunately, people can select their own environment most of the time. Moreover, the environment is just a potentiality, which may function both as a support and as a constraint. Whereas some people take advantage of the support aspect of the environment and focus on changing the constraint aspect, others may be enmeshed in constraints of the environment that are perceived as aversive and become annoyed or
frustrated (Bandura, 2008). Therefore, in different environments, the relative strength of personal, behavioral, and environmental factors are not symmetrical as factors determining the production of given outcomes. The relative contribution a person can make to this to this codetermination in a triadic system depends on one’s personal resources as an independent agent, the types of activities that are involved in the environment, and situational circumstances. In addition, a given determinant and its effects do not occur concurrently; the reciprocity of the three factors does not mean holistic simultaneous influence (Bandura, 1986).

In addition to shaping their external environment, Bandura (1977, 2008) suggests that people also live in a psychological environment largely of their own making. The self-management of inner life is also part of the agentic process, which plays a large role in SRL. When individuals self-regulate their learning, they set goals, monitor their thinking and behavior, and evaluate the consequences of their actions to function effectively in this reciprocal triadic system. Bandura further argued that self-regulatory functions are created and occasionally supported by social factors, but that once established, self generated regulation can work independently to partly determine which actions to perform. Thus, within the triadic interplay of determinants, external environments cannot
autonomously and unidirectionally determine the outcome because individuals are not solely reactive to external input. Rather, people can deliberately regulate themselves to break the chain of determination from the outside world, alter the relation between environment and behavior, and further foster a proactive action toward the social and physical environment (Bandura, 2008).

Based on this framework, self-regulation has been conceptualized as involving three key sub-processes: self-observation, self-judgment, and self-reaction (Bandura, 1986; Schunk, 2001). Recently, SRL processes have been reframed as three similar cyclical sub-processes (i.e. forethought, performance, and self-reflection) in which the proactive stance of a student plays a key role (Zimmerman, 2004, 2006, 2008a). To a great extent, the self is very active in the social cognitive model. Even if another person is involved in the social context, that person is just counted as an object to be regulated proactively by the self, rather than an object with which the self has to negotiate (Zimmerman, 2001, p.1). Importantly, for optimal SRL, created contexts are preferred; with created contexts, one’s initiatives can be undertaken. Selected and imposed contexts, however, may interrupt a student’s initiatives; therefore, such contexts should be avoided, or carefully arranged in educational practices.
There is no doubt that students have the power to self-regulate their learning in a created context. However, it is not always the case that students are provided such contexts, particularly for school-based learning. Under most circumstances, learning contexts are selected or imposed, which provides both affordances and constraints for students. How can students learn effectively in such contexts? Unfortunately, social cognitive theory does not address how students might function under these circumstances. Without tackling this issue in full detail, however, it is difficult, if not impossible for SRL researchers to recommend how educators or students might guide learning in such situations.

2.2.2 Information Processing Theories of Self-Regulated Learning

Information-processing theories of cognition describe the specific mechanisms by which learner characteristics interact with other aspects of SRL to influence academic performance. In the SRL literature, Winne has developed an information processing model of SRL that is informed by current information processing theory and that he has applied to guide the development of learning tools and instruction in SRL competence (Winne & Perry, 2000; Winne, 2001, Winne & Hadwin, 1998, 2008). Viewed from the perspective of Winne’s model, memory is regarded as a system of
sensory memory, working memory (WM), and long-term memory (LTM). Among them, WM is where information is actively processed. The capacity of WM, however, is believed to be very limited. When people solve a complex problem, for example, the demand of information units is usually higher than the actual capacity of WM. This phenomenon is called cognitive overload. When this happens, individuals have few resources left to use effective problem solving strategies. Therefore, an important aspect of this model is to consider effective ways to break through the bottleneck of information processing within WM.

According to Winne (2001), there are five fundamental types of information processing which he refers to as: Searching, Monitoring, Assembling, Rehearsing, and Translating (the acronym “SMART”). Searching is the retrieval of particular information from long-term memory according to a link from input information to a node in LTM. Monitoring is a process that compares two chunks of information. One chunk serves as a standard; the other is compared to that standard. Assembling is the same as encoding, which refers to adding a new chunk of information to LTM. Rehearsing is the repetition of new information and is usually combined with assembling processes to function effectively. He refers to this blending process as elaborative rehearsal. The last basic process is
translating, by which he means the process of using one representational format as a basis for creating another, e.g. mapping from words to images.

Like the acronym “SMART”, “COPES” was coined by Winne to refer to “elements of students' learning” which he refers to as: Conditions, Operations, Products, Evaluations, and Standards. Drawing heavily on the cognitive science literature, he views these elements as five slots in a particular kind of schema or a script for working on a task. Thus, the “slots” in a schema can be completed across four phases of students' learning: definition of the task, goals and plans, studying tactics, and adaptations. In Phase 1, students analyze conditions of a task, which include two types: task conditions and cognitive conditions. Task conditions refer to information from the external environment, including resources related to the task, instructional cues, time limit, and the social context. Here, Winne includes the social context to make the model more adaptive to social classrooms. Cognitive conditions, on the other hand, refer to information retrieved from memory, which are comprised of beliefs and dispositions, motivational factors and orientations, domain knowledge, knowledge of task, and knowledge of study tactics and strategies. Thus, students define a task by combining the two types of conditions. The combining process is monitored metacognitively relative to standards. In Phase 2, students set goals for the task and develop plans to realize them. In Phase 3, students
enact their plans by applying tactics and strategies by coupling “SMART” operations with knowledge of the subject area to produce products for the task. In Phase 4, students make adaptations to schemas by accreting or deleting conditions under which operations are carried out, tuning conditions that articulate tactics in strategies, and restructuring cognitive conditions, tactics, and strategies for further use. Important to Winne’s model is metacognitive monitoring, which he considers to be the “hub” of SRL (Winne & Hadwin, 1998). That is, these authors believe that metacognitive monitoring is key to successful self-regulation in each phase of students’ learning. Its outcome is a list of matches or mismatches between the standards of a task and the product representation in each phase. The frequent updates of the list constitute just-in-time feedback for students to improve their performance.

In general, Winne and Hadwin’s model goes into considerable detail regarding how information processing operations may function in SRL. The role of context, however, is greatly downplayed when contexts become reduced to mere conditions for performing a specific action or learning resources that a student consults if needed. Although the authors do refer to social and cultural contexts in their model, they are viewed more as influencing factors than as objects of negotiation. Although there are feedback loops between conditions and specific self-regulated actions
indicated in their graphic model, the arrows are unidirectional ones, which imply that conditions are merely influencing factors, rather than objects of simultaneous negotiation.

2.2.3 A Vygotskian View of Self-Regulated Learning

In contrast to the two individual-oriented frameworks previously described, McCaslin and colleagues (McCaslin, 2009; McCaslin, 2004; McCaslin and Hickey, 2001) put forward a co-regulation model that represents a Vygotskian perspective on self-regulated learning. Vygotsky wanted to account for how individuals adapt a rapidly changing society by applying Marx and Engles’ dialectic materialism in his theorizing about learning and development of the human mind. Marx stated that historical changes in society and material life produce changes in human consciousness and behavior. Simultaneously, labor and the use of cultural tools alter the objects of labor as well as the laborer. Applying these notions, Vygotsky proposed his cultural-historical theory of the development of higher mental functions as the product of cultural-historical activities mediated through signs represented by language and cultural tools. Vygotsky conceived of mind as the product of social life, rather than something that works independently. To understand higher mental
functioning, one always had to refer to the social context (Vygotsky, 1935; Wertsch & Toma, 1995; McCaslin & Hickey, 2001).

Based on Vygotsky’s theory, McCaslin and Hickey (2001) proposed a co-regulation model, which includes three fundamental concepts. First, the basic unit of analysis is the relationship between individuals, objects, and settings. Second, a student’s task is not simply to solve a problem, but to coordinate expectations and goals of multiple social worlds. Third, goal coordination is difficult to learn and needs scaffolding. Therefore, co-regulation among teachers, students, and opportunities are the links to eventual student self-regulation within a particular context. Moreover, in this co-regulation model, the ultimate goal of the educational system is not to shift the burden of pursuing education onto the individual; rather, co-regulation means shared responsibility. The goal is to foster self-regulation which in turn facilitates the participation in meaningful social activity.

McCaslin and Hickey (2001) further elaborated SRL processes, which are afforded by social classrooms and communities. They proposed three phases of SRL: motivation, enactment, and evaluation. Both co-regulation with contexts and self-regulated learning occur in each phase. In Phase 1, students’ internal interests, desires, and self-efficacy interact with outside environments such as their family, classroom, community, television, and magazines so that their identity can emerge within a
historical cultural context. In Phase 2, students enact covert strategies to regulate themselves (intrapersonally directed) and overt strategies to regulate others (environmentally directed) with the help of teachers. In Phase 3, teachers can provide self-evaluation instructions and kinds of opportunities of self-evaluation for students.

In summary, McCaslin and Hickey’s model stresses the importance of spoken language as a communication tool for students and teachers to co-construct learning opportunities, which in turn fosters self-regulatory competence and group participation.

It can be seen from our analysis of these three theoretical frameworks that each one treats context slightly differently: as created in social cognitive theory, as conditions or learning resources in information processing theory, or as malleable scaffolds in co-regulation theory, all of which may be embedded in an individually oriented perspective about the nature of the self and self-regulated learning. To further evaluate this assumption, in the next section, we review context-oriented empirical studies in SRL research, which provide support for the existence of socially oriented self-regulation.
2.3 The Role of Contexts in Current SRL Research

Empirical studies in SRL research are reviewed in this section to examine the role of individual, social, and cultural context in framing self-regulation. Since individual learning is the default context of self-regulation and it was reviewed extensively by other researchers (e.g. Zimmerman, 2008a; Greene, 2007), it will not be reviewed here in detail; but rather, close attention is paid to social and cultural context. Moreover, quantitative research studies usually start with a hypothesis that is derived from an individually oriented self-regulation framework, and then seek evidence from its default individual learning context; therefore, the role of context is not the focus of such studies. Even if social context is involved in a quantitative study, it is usually detached from focused self-regulation events and is counted as an influencing factor in final data analysis. Thus, constraints of a social context largely disappear from view. Based on this consideration, only qualitative empirical studies in SRL research will be reviewed in the next sub-section.

2.3.1 Variations across Contexts

In a previous paper, Shi (2010) reviewed 56 studies involving qualitative or mixed research related to context-specific self-regulation; that is, self-regulation embedded in a specific context such as subject
matter or group learning. An article was selected without considering whether qualitative or quantitative analyses were employed as long as it mainly collected qualitative data. This is primarily because (a) qualitative data usually include intact contexts; (b) inductive or bottom-up research strategy may be employed so that something different from the traditional individually oriented self-regulatory framework might be exposed.

Nearly forty percent of the reviewed articles were concerned with individual learning contexts in which social constraints were confined to some extent. Moreover, the most frequent method used to measure self-regulation was think-aloud protocols. When the context became more social (i.e., more constrained), such as in classrooms, collaborative groups, or apprenticeship situations, context had to be deliberately arranged for self-regulation to occur. As a result, the tension between self-regulation and its context was high; individuals were limited in what they could do given that others had to be considered in the learning process. When the context became primarily social, such as in problem-based learning groups (PBL), the proactive stance of individually oriented self-regulated learning became maladaptive (Evensen, Salisbury-Glennon, & Glenn, 2001).
This body of literature is generally consistent with predictions from an individually oriented SRL framework: the more freedom, the more individuals can self-regulate. When context becomes more constrained (e.g., social), one’s self-regulation is limited. From this, one could hypothesize that students in highly social contexts are less self-regulated in the sense of individually oriented self-regulation. However, we argue that they may be self-regulated in relation to others. Different kinds of contexts demand different types of self-regulation, either to reach one’s own goals, to meet the requirements of the context, or both. In many cases, social contexts are not necessarily more constraining than individual contexts. They may afford high degrees of opportunity for socially oriented regulation of activity within the context by the participants in a group. In such situations, regulation is likely to be collaborative, occurring through interaction and negotiation with others in the group. Accordingly, we argue that researchers should consider two types of self-regulation: individually oriented self-regulation, and socially oriented self-regulation. As we describe below, this distinction is particularly valuable not only for examining SRL across various contexts, but particularly to explore differences that may arise across cultures. We examine these studies next.
2.3.2 Variations in Cross-Cultural Contexts: Individualism versus Collectivism

According to Plaut and Markus (2005), modern individualism in North America is a form of liberal individualism that advocates the abstraction, prioritization, and detachment of the individual from the particular social context. Its value system underlies many contemporary psychological theories such as self-efficacy, self-determination, and self-regulation, which are believed to support initiative, cooperation, helping, and other psychological functions (Plaut & Markus, 2005). The essence of this individualism lies in the autonomous and independent functioning of the pure self as differentiated from the sociocultural context. It has been argued that these cultural beliefs are evident in North American classrooms, which encourage choice, self-control, intrinsic motivation, proactive learning, and internal attribution (Markus, Steele, & Steele, 2002). When asked to describe the most important components of a good self, students in North America mentioned (a) problem-solving ability; (b) verbal ability; and (c) social competence such as interest in the world at large (Sternberg et al., 1981). Clearly, this view of a good self emphasizes the importance of internal interest and ability. If social environments are
mentioned, these are merely objects of regulation, or scaffolds that need to be carefully arranged to avoid interrupting students, rather than objects of negotiation (Zimmerman, 2008a; Bandura, 2008; Azevedo et al., 2008).

In contrast to the construal of selves in individualist cultures, Azuma and Kashiwagi (1987) argue that students in collectivist cultures believed that a good student does not merely mind him or herself, but rather the family, parents, teachers, and the society as a whole. Therefore, when one wants to do something, one cannot solely consider one’s own intentions, interest, and goals. One has to benefit both oneself and at the same time important others. When conflicts occur, others’ interests are the priority and one’s personal interests become subordinate to the greater society. Accordingly, one must become sensitive to the needs and expectations of others and regulate oneself to be adaptive to them. For example, when Japanese respondents were asked to characterize intelligence, they first emphasized sociability and leadership, then modesty and sympathy, followed by the ability to take the perspectives of others (Azuma & Kashiwagi, 1987).

Based on such cultural differences, we then conducted a review of the empirical literature on SRL across cultures. Relevant literature was identified using the following procedure. First, the time period searched
was from 1996 to 2010. This period was chosen to provide a profile of the status of the most recent research. Second, three on-line databases, PsycINFO, Educational Resources Information Center (ERIC), and Google were searched using the following key words: “culture + self-regulation”. Alternative key words such as “cultural differences”, “cross-cultural”, “ethnic differences”, “racial differences”, “cross-national”, “national differences”, or “multi-cultural” were used to supplant the key word “culture”; “self-regulated learning”, “SRL”, “self-efficacy”, “motivation”, “learning strategies”, “cognitive strategies”, “metacognitive strategies”, “self-monitoring”, and “metacognition” were used to replace “self-regulation”. This search resulted in a total of 495 items. Abstracts of articles were then examined to see whether they were empirical studies dealing with cultural differences in SRL. This examination resulted in a total of 31 articles.

Of the 31 articles, 20 were published in journals or books. Moreover, with exception of two articles, the authors used large samples and employed self report questionnaires such as the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia, & McKeachie, 1991), the Patterns of Adaptive Learning Survey (PALS, Midgley et al., 2000), the Self-Regulated Learning Interview Schedule (SRLIS,
Zimmerman & Martinez-Pons, 1986), and various self-efficacy measures.

In addition, the authors sampled from a large variety of collectivist cultures, such as the Chinese culture, to be compared to individualist cultures, such as the culture in North America and Australia. Samples also included a broad range of students at various levels of education, from elementary to university (both undergraduate and graduate levels). A summary of the results from all 31 articles is presented in Table 2.1.
Table 2.1: Cross-Cultural Research on Self-Regulated Learning (1996 -2010)

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample</th>
<th>Measure</th>
<th>Procedure</th>
<th>Major findings</th>
<th>Context</th>
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</thead>
<tbody>
<tr>
<td>Algera</td>
<td>196 Canadian and Russian high school students</td>
<td>Achievement Goals Questionnaire (Elliot &amp; Church); Self-Regulated Learning Strategies Interview Schedule (Zimmerman &amp; Martinez-Pons)</td>
<td>Students voluntarily completed the survey.</td>
<td>Russian students scored higher in mastery goal, seeking information, reviewing texts, self-evaluation, rehearsing and memorizing while Canadian students scored higher in performance goal, seeking teacher assistance, goal setting, and planning.</td>
<td>vignettes definition</td>
</tr>
<tr>
<td>Author</td>
<td>Sample</td>
<td>Measure</td>
<td>Procedure</td>
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<tr>
<td>Bhattacharyya</td>
<td>343 pre-service teachers in the U.S. or in India</td>
<td>MSLQ (Pintrich et al.)</td>
<td>The researcher administered the tests in both countries</td>
<td>U.S. students scored higher in effort regulation while Indians were better in most of the other strategies.</td>
<td>no</td>
</tr>
<tr>
<td>Biemans &amp; Van Mil</td>
<td>41 Dutch and Chinese sophomores</td>
<td>Inventory of Learning Style (Vermunt)</td>
<td>Data were collected in class.</td>
<td>Dutch students scored higher in deep processing strategies while Chinese students scored higher in SRL strategies and were test-oriented.</td>
<td>no</td>
</tr>
<tr>
<td>Blom &amp; Severiens</td>
<td>650 immigrant and nonimmigrant 10th graders in the Netherlands.</td>
<td>Motivated Strategies for Learning Questionnaire (Pintrich et al.)</td>
<td>Data were collected after other tests in class.</td>
<td>No effects were found between immigrants and nonimmigrants; Girls preferred self-regulated surface learning but immigrant girls preferred self-regulated deep learning.</td>
<td>no</td>
</tr>
<tr>
<td>Author</td>
<td>Sample</td>
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<td>Brown, Aoshima, Bolen, Chia, &amp; Kohyama</td>
<td>325 voluntary university students from USA, Taiwan, &amp; Japan</td>
<td>The Study Process Questionnaire (Briggs) &amp; Levenson’s IPC Scale</td>
<td>Data were collected from volunteers in a course of Educational Psychology.</td>
<td>USA students scored higher in surface strategies, internal locus of control; Taiwan students scored higher in external locus of control and lower in achieving approach;</td>
<td>no definition</td>
</tr>
<tr>
<td>Chen &amp; Zimmermann</td>
<td>295 American and Chinese middle school students</td>
<td>Maths self-efficacy scale; math effort judgment scale; self-evaluation scale; math performance scale</td>
<td>All students followed the same procedure to participate during two class periods.</td>
<td>Taiwanese surpassed Americans in math achievement. Americans scored higher in self-efficacy for easy tasks, then declined quickly as item difficulty level increased.</td>
<td>math tasks</td>
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<td>Author</td>
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<tr>
<td>Eaton &amp; Dembo</td>
<td>526 high school students, either Asian Americans or non-Asian Americans in California</td>
<td>Self-efficacy beliefs, fear of failure, a novel English composition task</td>
<td>Data were collected in schools</td>
<td>Asian students scored significantly lower on self-efficacy beliefs albeit they performed better in a novel task. Moreover, self-efficacy was a good predictor for non-Asian students while fear of failure best explained their performance for Asian students.</td>
<td>a novel English compositon task, general experiences.</td>
</tr>
<tr>
<td>Guss &amp; Wiley</td>
<td>327 university students from Brazil, India, and USA</td>
<td>Metacognitive knowledge about problem solving strategies (Anonietti, Ignazi, &amp; Perego)</td>
<td>Data were collected through flyers and announcements in classes.</td>
<td>US students were better in the analogy method while students from Indian and Brazil scored higher in the free production method and the combination method</td>
<td>no</td>
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<tr>
<td>Gorrell, Hwang, &amp; Chung</td>
<td>215 children in America or South Korea</td>
<td>Self-Regulated Problem-Solving Situations (SRPSS) &amp; Personal Self-Regulation (PSR)</td>
<td>Children were interviewed individually to answer questions about hypothetical learning situations.</td>
<td>American children scored higher in self-regulation on school-based problems while Korean children scored higher in self-regulation on non-school-based problems.</td>
<td>no definition</td>
</tr>
<tr>
<td>Klassen</td>
<td>270 high school students, either Anglo-Canadian non-immigrants or Indo-Canadian Immigrants</td>
<td>Self-efficacy measure, math task, and other measures</td>
<td>Measures were administered in classes.</td>
<td>Self-efficacy predicted math performance very well for Anglo-Canadians while other-oriented self-concept was needed to predict math performance for Indo-Canadians in addition to self-efficacy.</td>
<td>a math task and general experiences.</td>
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<tr>
<td>Klassen et al.</td>
<td>612 Canadian and Singaporean adolescents</td>
<td>Tuckman’s procrastination measure; self-efficacy; self-esteem; and test anxiety.</td>
<td>Students completed the questionnaires in class with no time limit.</td>
<td>Canadian students scored higher in self-efficacy but lower in procrastination than Singaporean students did.</td>
<td>No</td>
</tr>
<tr>
<td>Kurman</td>
<td>200 college students in Israel or in Singapore</td>
<td>The number of points earned for correct solutions to specific anagrams.</td>
<td>Students majoring in psychology, social work played games for money in computer labs.</td>
<td>Israelis earned more points than Singaporean Chinese, showing Chinese culture may be detrimental to self-regulatory efficiency.</td>
<td>A computerized anagram-solving task</td>
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<td>Levinsohn</td>
<td>32 university students who were either international Chinese students or European students in New Zealand</td>
<td>Inventory of Learning Styles (Vermunt)</td>
<td>Students in four courses were invited to complete the survey.</td>
<td>Chinese scored higher for external regulation of learning processes and external regulation of learning results than European students.</td>
<td>online learning</td>
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<tr>
<td>Lim</td>
<td>236 university students in Korea or the US</td>
<td>MSLQ (Pintrich et al.) and IMMS (Keller)</td>
<td>Students completed the survey through online courses.</td>
<td>US students scored higher in course relevancy, course interest, affect, reinforcement, and self-efficacy except learning control than Korean students.</td>
<td>online learning in Education</td>
</tr>
<tr>
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<td>Niemi &amp; He</td>
<td>525 high school students in Finland or in China</td>
<td>Purpose in Life Test</td>
<td>Students answered questions according to their life experiences.</td>
<td>Finish students seemed more self-regulated and self-determined than Chinese students.</td>
<td>their life experience</td>
</tr>
<tr>
<td>Olaussen &amp; Braten</td>
<td>349 college students in Norway</td>
<td>Learning and Study Strategies Inventory (LASSI)</td>
<td>Students in a teacher training program answered questions about their application of general learning strategies.</td>
<td>No differences were found in terms of self-regulation strategies between the outcome in this study and the outcomes in other studies in the U.S.</td>
<td>no</td>
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<td>Pelt</td>
<td>89 African American and European American high school students</td>
<td>MSLQ (Pintrich et al.) and SRLIS (Zimmerman &amp; Martinez-Pons)</td>
<td>Students completed the survey within regular school hours.</td>
<td>No ethnic differences in SRL; however, high achieving students and students with high SES are more self-regulated.</td>
<td>vignettes</td>
</tr>
<tr>
<td>Pillay, Purdie, &amp; Boulton-Lewis</td>
<td>390 high school students in Australia or in Malaysia</td>
<td>Conceptions of Learning Inventory &amp; MSLQ (Pintrich et al.)</td>
<td>Students answered questions according to their general learning experiences.</td>
<td>No differences were found in terms of surface strategy, deep strategy, and conceptions of learning between the two groups of students.</td>
<td>no</td>
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<td>Pintrich et al.</td>
<td>325 university students in the USA or Germany</td>
<td>MSLQ (Pintrich et al.)</td>
<td>Students completed the survey three times in a semester.</td>
<td>US students exhibited higher extrinsic goals, self-efficacy, elaboration, and metacognition; however, no country differences were found for other strategies.</td>
<td>no</td>
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<tr>
<td>Purdie &amp; Hattie</td>
<td>493 high school students in Japan or in Australia</td>
<td>Self-Regulated Learning Interview Schedule (SRLIS)</td>
<td>Students answered questions about imagined learning scenarios.</td>
<td>Japanese students scored significantly lower in most strategies of self-regulation except memorization.</td>
<td>vignettes</td>
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<td>Purdie, Hattie, &amp; Douglas</td>
<td>493 high school students in Japan or in Australia</td>
<td>Student Learning Survey adapted from Self-Regulated Learning Interview Schedule (SRLIS)</td>
<td>Students answered general questions or questions about imagined learning scenarios.</td>
<td>Japanese students believed that memorization and understanding are compatible while Australian students tended to think memorization undermined understanding.</td>
<td>Vignettes definition</td>
</tr>
<tr>
<td>Ramburuth &amp; McCormick</td>
<td>188 Australian or newly immigrant Asian university students</td>
<td>Study Process Questionnaire (Briggs) and Perceptual Learning Style Performance Questionnaire (Reid)</td>
<td>Data were collected in disciplines of arts, science, and education.</td>
<td>Australian students scored higher in deep strategies and surface motivation. Asian students scored higher in surface strategies and deep motivation.</td>
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<td>Salili, Fu, Tong, &amp; Tabatabai</td>
<td>571 high school students in Hongkong or in Montreal</td>
<td>Motivated Strategies for Learning Questionnaire (MSLQ) &amp; Patterns of Adaptive Learning Survey (PALS)</td>
<td>Students answered general questions about their learning experiences.</td>
<td>Hongkong Chinese students spent more time in studying, yet scored lower on self-regulation except memorization strategy than Montreal Canadian students.</td>
<td>no</td>
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<tr>
<td>Schommer-Aikins &amp; Easter</td>
<td>264 university students who were either European Americans or Asian Americans</td>
<td>LASSI (Weinstein &amp; Palmer) and Attitude toward Thinking and Learning Survey</td>
<td>Surveys were completed at the beginning of each class before other activities.</td>
<td>European American students earned higher score in control of anxiety, selecting main ideas, preparing for tests, information-processing strategies, and academically motivated than Asian American students.</td>
<td>no</td>
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<td>Tang &amp; Neber</td>
<td>315 gifted 12&lt;sup&gt;th&lt;/sup&gt; graders in the U.S., China, and Germany</td>
<td>MSLQ (Pintrich et al.); goal orientation scale (Cobb et al.); cognitive strategies (Stipek &amp; Gralinski)</td>
<td>Students filled in the questionnaire in class.</td>
<td>U. S. students were higher in intrinsic goals, understanding goals, active cognition, and SRL strategies. Chinese were higher in avoidance goals.</td>
<td>Chemistry as context</td>
</tr>
<tr>
<td>Turingan &amp; Yang</td>
<td>394 university students in Korea or Fillipine</td>
<td>MSLQ (Pintrich et al.)</td>
<td>Students answered the questionnaire in class with no time limit.</td>
<td>Filipino students scored higher in SRL skills (cognitive strategies, metacognition, and resource management) than Korean students.</td>
<td>No context</td>
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<td>Urdan &amp; Giancarlo</td>
<td>731 high school immigrant students in California</td>
<td>Patterns of Adaptive Learning Survey (PALS)</td>
<td>Students answered general questions about their learning strategies and goal orientations.</td>
<td>Students’ mastery goal structure and self-regulation were highly positively associated with family obligation.</td>
<td>no</td>
</tr>
<tr>
<td>Volet &amp; Renshaw</td>
<td>126 Australian students or international students from South-East Asia</td>
<td>Perceptions of Study (Boekart); Goal Questionnaire; usefulness of study settings</td>
<td>Questionnaires were answered at the first week and the last week of the semester.</td>
<td>Southeast Asian students rated solo learning as the least useful settings while Australian students rated it as the most useful. Southeast Asian students scored higher in goal levels at the beginning but the difference disappeared at the end.</td>
<td>one semester economic course</td>
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<td>Yamauchi &amp; Greene</td>
<td>202 high school students in rural Hawaii</td>
<td>Children's Multidimensional Self-efficacy Scales</td>
<td>Self-efficacy was measured with reference to students' nine subject areas.</td>
<td>Rural Hawaii students scored lower in self-efficacy in comparison with their partners on the mainland, the U.S.</td>
<td>no</td>
</tr>
<tr>
<td>Zhu, Valcke &amp; Schellens (2008a)</td>
<td>722 university students in China or in Belgium</td>
<td>Conception of Learning Inventory (Purdie &amp; Hattie) and Approaches and Study Skills Inventory (Tait et al.)</td>
<td>Questionnaires were answered in class.</td>
<td>Chinese students scored higher in understanding, personal change, and development of social competence while Flemish students were better in surface approaches.</td>
<td>no</td>
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<tr>
<td>Zhu, Valcke &amp; Schellens (2008b)</td>
<td>381 university students in China or in Belgium</td>
<td>MSLQ (Pintrich et al.)</td>
<td>Pre-test and post-test were administered.</td>
<td>At the pretest level, Chinese were higher in self-efficacy but Flemish students were better in elaboration, rehearsal, self-regulation, and peer learning. After learning, Chinese students changed significantly.</td>
<td>an introduction on science course with online discussion</td>
</tr>
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</table>
The results of the 31 studies are not directly comparable given that different authors applied various instruments, which have different underlying theories of SRL (see Muis et al., 2007). However, a general theme is that Eastern students have much lower SRL scores than Western students, with the exception of surface strategies such as memorization (McInerny, 2008). Moreover, most authors of the 31 articles argued that current SRL models are generalizable across cultures and may be used for educational reform in other countries (Zimmerman, 2004).

For example, Purdie and Hattie (1996) sampled from Australian and Japanese high schools and implemented Zimmerman and Martinez-Pons’ (1986) SRLIS questionnaire. For this questionnaire, students were presented with several vignettes wherein a range of typical learning contexts were described (e.g., in class, at home). Students were asked to indicate the general strategies they might use to assist learning in such situations. They found that Japanese students showed a higher preference for memorization and reviewing textbooks, whereas Australian students had a preference for deeper strategies such as other-checking, self-testing, outlining and drafting, organizing notes and files, goal setting and planning, keeping records, using self-consequences, seeking teacher
assistance, reviewing notes, reviewing tests, and reviewing other completed work.

Interestingly, Purdie, Hattie, and Douglas (1996) conducted another comparative study using the same sample and design. Two open-ended questions were added to the questionnaire to investigate students’ conceptions of learning. Participants were given the opportunity to define learning in their own words and to describe what they meant when they said they had learned something. Participants were also asked to provide examples to illustrate their answers. The authors found that Japanese students’ memorization strategy was not the same surface strategy as researchers typically assume. The Japanese students believed that memorization and understanding are compatible and that the former can promote the latter, and vice versa.

In another study, Gorrell, Hwang, and Chung (1996) compared South Korean and U.S. elementary students by asking them open-ended questions based on “schemes” of Self-Regulated Problem-Solving Situations (SRPSS) and Personal Self-Regulation (PSR). The SRPSS schemes were extended from Kreutzer, Leonard and Flavell’s (1975) work and consisted of twenty hypothetical situations or vignettes that highlighted certain general self-regulation issues within and outside of the
classroom. The PSR scheme was developed by the authors and mainly focused on self-regulation attempts in a child’s academic life. Face-to-face interviews were implemented by trained interviewers to ensure that the children understood the questions. They found that for the SRPSS schemes, American children had higher self-regulation scores on school-based problems when compared to Korean children, whereas Korean children scored higher in self-regulation on non-school-based problems. With the PSR scheme, the researchers found that Korean students emphasized more direct effort or participation to complete homework, whereas the U.S. students mentioned help-seeking more frequently. This result is somewhat consistent with the results in Purdie and Hattie’s (1996) study wherein Asian students asked for less help and were relatively poor self-regulators in school.

As a third example, Olaussen and Bräten (1999) used the Learning and Study Strategies Inventory (LASSI, Weinstein, 1987) for Norwegian college students and compared their results with those of similar studies in the U.S. In contrast to the SRLIS (Zimmerman & Martinez-Pons, 1986), the LASSI does not provide a vignette for questions to be answered. Rather, it lists various statements and asks the students to rate on a five-point scale how well the statement describes them generally. Olaussen
and Bråten hypothesized that different cultures vary in their values on education, ability and effort, and level of importance for social support. Given these differences, they argued that variations in cultural dimensions likely led to unique meanings of SRL. Although they did not report many differences between the two cultural groups in terms of SRL strategies, they did detect variations in motivation and attitude toward SRL. They reported that Norwegian students tended to value education more than U.S. students, but that U.S. students had a stronger belief in the value of effort. They concluded, however, that SRL principles could be generalized to the Norwegian sample despite their position that these two groups likely differed in their interpretation of SRL.

In summary, this literature typically used large samples and self-report questionnaires that are confined by individually oriented SRL models to explore differences between cultures. Students’ answers depend on what questions researchers ask. If questions asked by researchers are deliberately designed to measure individually oriented SRL, culturally-bound socially oriented SRL may completely disappear from view, and meaning making of cultures in framing students’ learning becomes impossible. As several theorists have speculated, individually oriented self-regulation frameworks may fail to capture the essence of
SRL practices in Eastern cultures (Hacker & Bol, 2004; Hickey & Granade, 2004; Jackson, Mackenzie, & Hotfoll, 2000; Martin, 2007b). This is indeed the case in the studies we reviewed on cross-cultural SRL research. One way to calibrate the tools used in cross-cultural research is to create measures which have the potential to reveal important differences in meaningful activity. When an acceptable guiding theory is impossible, qualitative research such as grounded theory may be needed to make meaning of students' learning because context-bound learning activity can be studied as a whole in this approach. Therefore, a guiding theory of context sensitive SRL research is urgently needed. We elaborate our theoretical framework next.
Chapter 3 - A Situated Discourse Model of Self-Regulated Learning

In this chapter, we describe our theoretical framework. We use Mead’s dual construal of self (i.e. “I” and “me”) as a theoretical basis of our model because this construal coherently binds self-regulatory functions of “I” with their context “me” so that students’ self-regulation can be understood in relation to their contexts in a learning activity. We then present a situated discourse model of SRL in which students’ self-regulatory functions gradually unfold in their discourse processes when they are engaged in social negotiations during an activity. Next, we further elaborate the three phases of self-regulation. We then provide two examples to illustrate students’ learning in individual and social contexts. Finally, we discuss how students’ self-regulatory functions can be studied across different discourse contexts (i.e., methodological implications).

3.1 Mead’s Dual Construal of Self as a Theoretical Basis of SRL

Like William James and John Dewey, Mead proposed a dual construal of the self (Mead, 1934; Mead & Deegan, 2001; Mead & Miller, 1982; Mead & Murphy, 1932; Mead et al., 1938). According to
Mead (1934), the genesis of the self is particularly represented in the activities of play and game. For example, when a child is pretending to be a mother, the child plays the role of the mother. The role itself, which the child intends to play, is the stimulus that would call out a group of (maybe imagined) responses. When the responses are given, the self gets the meaning. In other words, the self has double meanings: the subject “I” and the object “me.” The “me” is the interpreted perspectives of the others whereas the “I” is the child’s response to these perspectives. Thus, the self is the response of the “I” toward the object “me.” When children get older, they have to play the role of a good student, or a good citizen. When this larger social context is involved, the “me” is the perspectives of the school or the whole society, which Mead called the generalized others. The social act of the “I” acquires meaning when the perspectives of others are assumed.

Imagine that the “me” is the situation while the “I” is the traditional person; we find the inalienable interdependent relationship between the human being and the environment. However, when Bandura proposed his self-regulation theory, he rejected the dual construal of self (Bandua, 1977); he preferred the agent “I” to the context “me.” Without the constraints of “me,” the role of “I” can be played to the extreme. Thus,
individually oriented self-regulation is established whereas socially oriented self-regulation disappears from view. If we contradict the two as Bandura does (i.e., separate personal agency from its environment, rather than apply one’s agency with reference to others), we have to determine which one is more dominant and ignore the other. However, if we take Mead’s social pragmatism position, we find the problem much easier to resolve.

For example, when a student is learning in a classroom, several perspectives might be encountered. An efficient strategy might be (a) interpret the teacher’s, classmates’ and others’ perspectives involved in the learning situation; then (b) take action toward these perspectives such as acceptance, integration, or expressing one’s unique opinion. Here, what kind of action should be performed depends on the nature of the context (i.e. cultural, social, or individual). An imposed context can afford efficiency of students’ learning whereas a created context may encourage students’ initiatives. The key is to identify the nature of the context, balance its benefits and risks, and then make an appropriate decision as to what kind of action should be taken. If risks outweigh benefits, then students can ignore, persuade, or reject others, and propose their unique opinions. Such a reaction is individually oriented self-regulation.
We provide an illustration here of an individually oriented self-regulatory action, which is performed when one’s own concern is addressed and someone else’s is ignored. Let’s assume that two students, Joe and Nat, are working together to learn statistics in a computer-based learning environment (CBLE). Nat decides that she is done reading through the information and moves onto the next component. Joe says to Nat, “Wait a minute, I didn’t finish yet.” Here, Nat’s reaction toward Joe is negative, indicating the emergence of an independent idea, which we call an individually oriented self-regulatory action because Nat has not considered that her partner has not finished his task. In this example, Joe rejected Nat’s expectation of moving forward because he was not prepared to move on, so the risks for him were high.

If benefits exceed risks, however, then students can accept, compromise, or follow others’ actions. This might occur if Joe realizes the information he is reviewing is something he already knows, or perhaps he recognizes that time is running out to complete the task and Nat will be able to complete the task without much input from him. As another example, let’s assume two other students, Lee and Pak, are working on the same task in the same social learning context. When Lee states a concern, “I don’t know what the alpha level is,” Pak immediately proposes
a plan to relieve Pak’s concern even if he was not asked to do so because the benefits outweigh the costs. Pak realizes that this piece of information is essential to understanding the content and the two of them, as a pair, cannot move forward to complete the task until both students understand.

3.2 The Model

In our review of the various models of SRL, like others (Pintrich, 2000; Puustinen & Pulkkinen, 2001), we noted that the models all share some general assumptions and features. Importantly, most models propose that self-regulated learning includes different phases. That is, most models propose four phases or processes, which include a preparatory phase of forethought, planning, and activation as the first phase, monitoring as the second phase, control as the third phase and, finally, reaction and reflection as the last phase (e.g., Boekaerts, 1992; Borkowski et al., 2000; Pintrich, 2000; Schunk, 2001; Winne & Hadwin, 1998; Zimmerman, 2000). Each of the models we reviewed provides an excellent framework for conceptualizing how SRL processing occurs at a general level. However, to empirically study how learning processes and contexts interact to influence learning, macro-level SRL processes such as
“planning” and “reaction and reflection” must be operationalized and measured.

To address this issue, Greene and Azevedo (2009) demonstrated how each of over 30 specific learning activities, which they called micro-level SRL processes, can be used as indicators of the macro-level processes outlined in SRL models. They proposed that specific learning activities, such as searching, can be observed and used as micro-level evidence of an individual engaging in macro-level SRL strategy use, or what Winne and Hadwin (1998) call operations. This operationalization of macro-level SRL processes into component micro-level processes allows for a much more detailed examination of the many ways learners self-regulate, but also presents challenges in terms of measurement.

Specifically, instruments designed to measure SRL must be capable of capturing the many ways that learners self-regulate at the micro-level. Moreover, methodologies must be used to not only capture the micro-level processes but why these processes are enacted and how individuals’ interpret the context within which they are enacted. To address this need, we propose a theoretical model that can be integrated with any SRL model. That is, rather than propose a series of new or differentially defined phases of macro-level SRL processing, we focus more on micro-
level events that occur during these macro-level phases that inform how context influences the macro-level processing as well as how individuals interpret that context (e.g., as social or individual). Accordingly, by embedding our micro-level model within any of the more broadly defined SRL models, context can be appropriately addressed. Our model, as previously noted, is developed from Mead’s dual construal of the self.

In relation to Mead’s dual construal of self, self-regulation can be conceived of as a process of dynamic negotiation between the agent “I” and context or situation “me,” which is embedded in the conversation between potential participants. This leads to a situated discourse model of SRL. To learn in a dialog, we propose three micro-level cyclic phases that a student might engage in across any of the macro-level phases of SRL, whether working individually or with others. That is, a student might (a) Take the perspectives of others (object “me”): the student could acquire information by observing and interpreting the situational context, listening to or reading the natural language discourse embedded in the context, or asking others for their opinions, then interpret the language units and generate a meaningful representation of situations and knowledge through interaction of the current situational input with one’s schemas in long term memory; (b) take an appropriate action toward these perspectives (the
role of subject “I”): apply cultural knowledge and other schemas to identify advantages or disadvantages of the current representation, organize propositions or meanings into natural language, and express these ideas to others in the context; and, (c) acquire self-regulatory competence when others (or imagined others) respond to him or her. Thus, one’s self-regulatory competence is built and rebuilt in a constant integration and interaction between the “I” and the “me” in which self-regulatory actions, problem-solving actions, and knowledge building representations are frequently performed or revised.

Importantly, the three micro-level cyclic phases of SRL (interpretation of contexts, reaction, and adaptation) in our situated discourse model are similar to the various macro-level phases in other models: forethought, performance, and reflection (Zimmerman, 2008a); definition of task, goals and plans, studying tactics, and adaptations (Winne & Hadwin, 2008); and, motivation, enactment, and evaluation (McCaslin & Hickey, 2001). However, our model differs from others because it takes into consideration the specific context within which students’ actions must be interpreted. Importantly, our model allows for the interpretation of individually oriented SRL (like Zimmerman’s and Winne
and Hadwin’s) as well as socially oriented SRL (like co-regulation in McCaslin and Hickey’s model).

To some extent, McCaslin and Hickey’s model is similar to our theoretical framework. For example, we proposed a concept of socially oriented self-regulation to deal with social contexts; both emphasize the negotiation process between students and their contexts and both include the notion of “individual” self-regulated learning. However, their theory is different from ours in many ways. First, the purposes of each framework are different. McCaslin and Hickey identified a tension or conflict among goals of many existing entities (e.g. individuals, others, tasks, schools, communities) within a socio-cultural activity system, which requires co-regulation, coordination, struggle and negotiation to create opportunities to solve problems. In contrast, we observe there are different affordances and limitations for different contexts; therefore, students need to be sensitive to the nature of various contexts to make an appropriate decision: either follow the expectations of others or work independently to achieve one’s own goals.

Second, the focus of each framework is on different levels of an activity system. Co-regulation focuses on coordination among different entities within a system; specific problems of an entity should be solved by
coordinating the relationships in the system. In this regard, macro-level solutions are of interest. In contrast, socially oriented self-regulation emphasizes individuals situated in contexts; specific problems of individuals can be solved by making an appropriate decision depending on the nature of contexts. In this regard, micro-level solutions are preferred.

Third, understanding of the role of contexts is different. McCaslin and Hickey assume that everything in an activity system is malleable when conflicts occur. Teachers, parents, and classmates can help individuals when they struggle with their lives; tasks can be tailored to challenge students in their zone of proximal development and social communities and even the entire culture of a country can be accommodated to meet individuals’ needs. However, we suggest that a specific context surrounding an individual may be less malleable; therefore, a best strategy might be to fit into that context rather than attempt to change it.

Fourth, co-regulation competency can lead to individual SRL competency. For example, self-regulatory strategies in guiding interpersonal relationships may be similar to those of solving a problem in a specific subject domain (Patrick, 1997). Further, when a teacher co-regulates with a student, the teacher can function as a scaffold to support the development of the student’s learning competency (Azevedo et al.,
2008). However, in our theoretical framework, socially oriented SRL and individually oriented SRL are two fundamental responses of students to their contexts; they do not necessarily benefit each other, nor does individually oriented SRL develop from socially oriented SRL. On the contrary, they are mutually exclusive in many cases.

Finally, the last key difference between our framework and McCaslin and Hickey’s is that applicable domains are different. Co-regulation theory is designed to develop meaningful social activities in a classroom, school, or other institutions such as a community. It is difficult to apply co-regulation theory to deal with meaning making in cross-cultural encounters (McCaslin, 2009). In contrast, our framework is designed specifically for developing meaningful activities in highly social contexts. It is also an ideal platform on which cross-cultural comparisons can be made between different cultural groups or cultural encounters.

Accordingly, in the situated discourse model of SRL, the major concern is whether a student takes an appropriate self-regulatory action depending on the context; therefore, we emphasize the student’s sensitivity to the nature of his/her context in making decisions and how to react. The model begins with interpreting the meaning of one’s context (i.e. a “me” sub-process) which nourishes the focal event of problem-
solving. What is relevant to the focal event might include all contributions of one’s individual contexts, social contexts, as well as cultural contexts, which in turn frame one’s expression or response of the agent (i.e. an “I” subprocess). A self-regulatory process ends with updating one’s self-regulatory competence when one is responded to by others.

The advantage of our model is its sensitivity to variations of contexts. If configurations of individual, social, and cultural contexts are altered, students’ learning strategies or reactions will change correspondingly. Thus, students’ learning patterns or characteristics can be identified and studied. We imagine that different learning activities consist of different configurations of contexts, which demand reorganization of one's learning strategies. Therefore, it is pivotal to be attentive to the nature of contexts surrounding a learning activity. Likewise, another advantage of this model is that it can function as a suitable overarching theoretical framework for cross-cultural SRL research. We do not deny the role of individually oriented SRL in created contexts, but we also cannot ignore the function of socially oriented SRL in other contexts, which may afford convenience, efficiency, and harmony in students’ learning. Thus, the situated discourse model of SRL greatly extends our
current SRL research to the highly social and cultural domains, which are not well suited to traditional individually oriented SRL models.

3.3 The Specific Phases

In Phase 1, interpretation of contexts (i.e. a “me” subprocess in Mead’s theory) aims at identifying and interpreting one’s contexts, which may include: (a) the physical environment (e.g. the computer, the software, a physical and spatial setting of individuals), (b) representational resources (e.g. a text used for reference), (c) the task-action environment (e.g. a problem to be solved and sequences of actions taken to solve the problem), (d) one’s own background knowledge and knowledge of other members of the group, (e) the social and interactional environment (e.g. the social organization of the group, the status and roles of its members, the social and institutional setting of the group, and patterns of social interaction within the group), and (f) cultural knowledge (e.g. cultural norms for an appropriate action). Interpretation of these contexts may then require students to: (a) gather enough information from contexts by listening, reading, observing, and even asking others if needed; (b) interpret the language units generated from the first step; (c) construct a
meaningful representation of situations and knowledge through interaction of the current situational input with one’s schemas in long term memory.

In Phase 2, the *reaction* (i.e. an “I” subprocess in Mead’s theory) focuses on one’s response to the context, i.e., response to the talk and actions of others, to acknowledge, refuse, accept, or compromise on perspectives expressed by others. Such a negotiation process between “I” and contexts may involve (a) considering the nature of contexts (i.e. imposed, selected, or created); (b) balancing benefits and risks of the representation that contexts afford a person by applying cultural knowledge and other schemas; (c) making a decision about how to react to contexts; or, (d) communicative process of organizing propositions or meanings into natural language and expressing them to others. In this regard, one’s decisions may be greatly influenced by cultures. That is, a context may be interpreted as changeable and such change may be highly endorsed by relevant cultural norms so that individual proactive action toward that context may be performed. This is usually the case in Western culture. Alternatively, a context may be thought of as authoritative, and a close fit between one’s own opinion and the expectations of others may be highly encouraged by cultural norms so that a socially oriented stance
toward context may be preferred. This scenario often occurs in Eastern cultures.

In Phase 3, *adaptation* involves updating one’s self-regulatory competence and emphasizes the importance of meaning making in relation to one’s self-regulatory practice. Whether one’s self-regulation is individually oriented or socially oriented, an individual must validate his or her response by referencing it to the responses of others, or the response of one’s own practice. Once one’s self-regulatory stance (i.e. either individually oriented or socially oriented) is positively validated, such a stance may be maintained and the individual may continue to the next cycle of self-regulatory processing. If not, an individual might change his or her stance in the next cycle if the person is context-sensitive. In addition, one’s adaptation also may be elicited by one’s own discovery of an impasse. However, an individual may still maintain one’s invalidated stance if the person is context-insensitive or is influenced by one’s cultural norms. In this case, no adaptation occurs. In relation to the validation or invalidation of one’s self-regulatory response, the meaning-making aspect of one’s self-regulatory practice then leads to interpretation of the responses of others, which may help one formulate the “me” subprocess in the next cycle.
3.4 Examples

We present two examples to illustrate how students learn in an individual learning context or in a social learning context. First, envisage a scenario in which a student is solving a mathematics problem by him or herself. To solve the problem, the student may have to read the text, construct an interpretation of the intended meaning of the text based on propositions expressed through language in the text, apply prior mathematics knowledge to construct a representation of the problem, and take into account other people’s suggestions about how to construct a valid representation of the problem and derive a solution. In this way, the student is interacting with the mathematics text, activating various schemas in long term memory, and considering others’ opinions to make a decision about what to do next. If the problem is solved smoothly, the student’s competency in problem solving will be reinforced. In this example, the role of the environment (i.e., text, task, imagined others, and cultural context) is to foster understanding of the problem and gaining insight into possible ways of using one’s own knowledge to solve the problem. Once a student gains the insight (i.e. understands how to solve the problem), she or he may operate independently with little consideration
of the environment except to monitor and control the problem-solving activity.

In contrast, when a person is learning to reason and solve problems in an interactive social context, social influences may be rich and very powerful; the interaction which takes place in the social environment provides affordances for and constrains one’s actions. In this case, one must negotiate with others within the context to plan and enact optimal actions, and cooperate and collaborate with other participants to solve a problem successfully. Under these circumstances, one needs to take the perspectives of others into consideration, and adopt a shared perspective that may not correspond closely to one’s own. However, individually oriented self-regulation can also be fostered in social contexts, in which students disagree with each other, persuade each other, and challenge each other.

In both situations described above, individuals have to first interpret the perspectives of the others (i.e. “me” or situation), then take action (i.e. “I” or agent) toward “me.” Obviously, the social action (i.e., self-regulated actions) of “I” cannot be understood without thinking of “me.” They are integrated to form the identity of the self. The question we address now is how researchers can use this theoretical framework to investigate the two
modes of self-regulation and to develop a better understanding of how context influences learning.

3.5 Methodological Implications

In relation to Mead’s dual construal of self, an appropriate way of making meaning of SRL in contexts may be a transactional stance toward an emergent situation. If a researcher focuses solely on what happens in an individual’s mind, the meaning of contexts in framing self-regulation may be lost. Moreover, it is also be important to be aware of students’ background knowledge, which is usually inconspicuous and functions in an implicit way. In addition, SRL should be studied in sequences of contexts that gradually unfold in students’ learning activities in order to construe the meaning of SRL, which may be individually oriented or socially oriented. Six decision rules can help researchers differentiate between individually oriented and socially oriented learning actions. Specifically, a student’s regulatory action is socially oriented if it meets one or more of the following criteria:

(1) The student tries to meet the needs of other members of the group.

(2) The student tries to build shared understanding of a concept, formula, or principle with other members of the group.
(3) The student acts to satisfy a shared interest with others in the group.

(4) The student demonstrates a concern about the performance of the group.

(5) The student shows a concern about the interests of others.

(6) The student expresses a concern about others’ opinions.

Otherwise, a regulatory action is individually oriented. For example, a student might ask, “What’s your opinion about my explanation?” after he illustrates his understanding about a concept. This utterance is an action of socially oriented self-evaluation because the student tries to evaluate him- or herself by listening to others. In contrast, a student might say to her partner, “But it seems a little different from the t-test we learned last term” after her partner addresses her understanding about an analysis of variance problem by using t-test principles. This utterance is an individually oriented self-evaluation because the student tries to evaluate herself by serving one’s own evaluation criteria (see Table 3.1 for more examples).
Table 3.1: *Examples of Cyclic Phases of Self-Regulated Learning in a Sequence of Discourse*

<table>
<thead>
<tr>
<th>SRL phase</th>
<th>Individually oriented SRL</th>
<th>Meaning making</th>
<th>Socially oriented SRL</th>
<th>Meaning making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1:</td>
<td>Partner: Go to part two.</td>
<td>The actor understood that the partner had finished reading part 1 and wanted to read part 2.</td>
<td>Partner: Score model.</td>
<td>The actor understood from the previous context that the partner wanted to read the chapter of ANOVA score model.</td>
</tr>
<tr>
<td>Context</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>interpretation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2:</td>
<td>Actor: No, I want to make sure I understand everything.</td>
<td>The actor evaluated the risks and affordance of shifting to part 2 and assumed that the partner would like to wait. The actor then made a decision to utter a unique learning goal. Hence, this is an action of individually oriented goal setting.</td>
<td>Actor: So the first thing we have to do is to find information about the score model for our problem, right?</td>
<td>The actor evaluated the affordance and risks of going to the topic of score model and assumed that the proposal of the partner was possibly right. The actor then made a decision to make the learning goal clearer with an aim at fitting the expectation of the partner. Thus, this is an action of socially oriented goal setting.</td>
</tr>
<tr>
<td>Reaction to context</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRL phase</td>
<td>Individually oriented SRL</td>
<td>Meaning making</td>
<td>Socially oriented SRL</td>
<td>Meaning making</td>
</tr>
<tr>
<td>-----------</td>
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<td>-----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Phase 3: Adaptation to the response of others</td>
<td>Partner: Ok.</td>
<td>When receiving the positive response of the partner, the actor validated the initial assumption about the partner and this learning orientation likely continued later.</td>
<td>Partner: Exactly.</td>
<td>When receiving the positive response of the partner, the actor validated the initial assumption about the partner and this learning orientation likely continued later.</td>
</tr>
<tr>
<td>Remarks</td>
<td>Roles of a partner and an actor are exchangeable in sequences of conversation so that they are context to each other.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Importantly, we argue that students’ regulatory actions need to be construed in a sequence of conversational context, which can be captured in a discourse analysis approach (Frederiksen, 1999; Frederiksen et al., 2010). In each phase of SRL, students’ reference to context can be indexed. An individual’s responses to the perspectives of others (i.e. social context) can then be analyzed in relation to their goals, plans, feelings, self-monitoring, and self-evaluation to examine processes of individually oriented and socially oriented SRL in social contexts.

Interactive discourse in learning situations can also be analyzed from the point of view of its semantic (propositional) content (Frederiksen, 1986; Frederiksen, 2001; Frederiksen & Donin, 1991; Frederiksen & Breuleux, 1990), how the discourse content reflects cognitive activities in contexts of learning to reason and solve problems (Frederiksen, 1999) including certain types of SRL processes (Mercier & Frederiksen, 2007), and the conversational processes involved in situated discourse interaction (Frederiksen, 1999; Frederiksen, Roy, & Bedard, 2010). Data resulting from such discourse analysis can be analyzed both qualitatively to provide rich evidence of thinking and conversational processes, and
quantitatively to identify consistent patterns in discourse and problem-solving activity (Chi, 1997; Muis, 2008).

In one example of such an approach, discourse analysis methods were applied to study dialogue between students who used a problem-based computer coach to learn a statistical method for data analysis while working in pairs (Mercier & Frederiksen, 2007; Frederiksen & Donin, 2005). Certain types of students’ dialog were transcribed and segmented into conversational turns and dialog units consisting of main clause units, clauses that are bound by adjuncts, and non-clausal conversational acts. They were coded in terms of problem-solving actions, SRL processes, or propositions of knowledge construction and were then analyzed quantitatively (categorical data) or qualitatively (graphic propositional representations). As students collaborated to obtain information from the computer tutor to learn and solve problems, their SRL processes were clearly reflected in the dialogue between them. The relationship between students’ SRL processes and knowledge construction was also reflected in the discourse.

Although our model is a situated discourse model, we do not deny the appropriateness of other methodological approaches to studying SRL. Traditional research methods such as self-report questionnaires, computer
traces, think alouds, observations and interviews can still be used to triangulate data (see Zimmerman, 2008b; Butler, 2002, Winne, Jamieson-Noel, & Muis, 2002 for a review of methodological issues). Our framework and methodological approach adds another layer to these approaches to better inform how context influences students’ SRL processes and how cultural differences may arise given the stance students take with regard to their SRL orientation.

In summary, this model has extended the traditional individually oriented self-regulation framework to a socially oriented self-regulation framework so that SRL processes in social contexts and in culturally different populations can be more adequately accounted for. Based on this model, numerous research hypotheses can be derived and tested to make clear how various contexts, especially the social and cultural contexts, support and constrain students’ self-regulated learning. In the following section, four hypotheses are derived from this model, and will be tested in a cross-cultural context.
Chapter 4 - Rationale and Research Questions Addressed in the Study

In this chapter, four research questions are first raised in a cross-cultural learning context, followed by an elaboration of research hypotheses that were derived from the situated discourse model of SRL. The chapter ends with a detailed description of specific aims of the research.

4.1 Research Questions

In the discourse model of situated self-regulated learning, it is suggested that people in Western cultures may accept a person-dominate-environment mode of self-regulation, and consequently self-regulate personally (individually), whereas people in Eastern cultures may adopt a person-fit-into-environment mode of self-regulation, which leads to socially oriented or other-oriented thinking and behaving, and more social modes of self-regulation. Such a cultural difference in self-regulation may be detected by obtaining representative samples of students from different cultures and setting up a collaborative learning environment for these individuals to learn within a specific subject-matter domain in pairs.
In this study, Chinese students studying in Canada were sampled as representative of "collectivists" (related to their home Eastern culture), and Anglo-Canadian students were sampled as representative of "individualists" (related to their home Western culture). Students were asked to learn statistics in a collaborative context by working in pairs to solve a problem and compose a short report as they learned a statistical model and method. Student pairs consisted of either (a) pairs of students who shared the same cultural background, or (b) pairs of students who had different cultural backgrounds. Students worked in the same computer-supported learning environment that was used in the Frederiksen and Donin (2005) study. Thus, three types of learning groups were formed: Canadian pairs (pairs consisting of Canadian students); Chinese pairs (pairs consisting of Chinese students); and mixed pairs (pairs consisting of a Canadian student and a Chinese student). In all cases, the students worked together by communicating in English and then prepared a short report based on the results of their engagement with the program.

Four research questions were explored using audio-video recordings of each pair of students to trace their dialog and actions during the learning sessions.
1. Are there differences in the orientation of actions among the Canadian pairs group, the Chinese pairs group, and the mixed pairs group?

2. Are there differences in the orientation of actions between Canadian and Chinese partners within the mixed pairs group?

3. Are there differences in SRL learning phases and specific SRL strategies (regulatory actions) employed between the Canadian pairs group, the Chinese pairs group, and the mixed pairs group?

4. Are there differences in SRL learning phases and specific SRL strategies between partners in the mixed pairs group?

This study was designed to investigate the validity of the proposed model using a well-specified and authentic problem-based learning situation, and to explore whether application of the proposed model can identify differences in SRL strategies that reflect variations in the socio-cultural contexts of the three types of groups. If differences are found, then results provide evidence for the validity of the model and its sensitivity to cultural differences in socially and individually oriented SRL actions. Moreover, if cultural differences are detected across SRL processes, then the model could be usefully applied to multicultural classrooms and other learning situations for future research.
4.2 Research Hypotheses

To validate the proposed model, four hypotheses were investigated that are consistent with culturally-based differences identified in the research literature:

**Hypothesis 1.** Given that individuals who grew up in collectivistic cultures are likely to prefer social norms in which the individual (self) fits into the social environment, we would (a) expect that Chinese students will engage in more socially oriented actions in their learning activities and interactions with their partner in a situation of collaborative learning in pairs; and (b) that English Canadian students, who grew up in a more individualistic culture in which “individual dominates environment” is a prevalent way of living, will engage in more individually oriented actions in their learning activities and interactions with their partner.

**Hypothesis 2.** Individuals who grow up in collectivistic or individualistic home cultures may generalize their construal of the self differently in situations wherein they encounter people from other cultures, so that their original self-construal may play a significant role in governing their interactions with individuals from a different home culture. Thus, it is expected that Chinese students in the sample will engage in more socially
oriented SRL actions when learning in the mixed pairs group than English
Canadian students, and that English Canadian students will engage in
more individually oriented actions than Chinese students in the mixed
pairs group.

Hypothesis 3. An individual's construal of the self is likely to be
reflected in one's preference for an individual orientation or a social
orientation in their self-regulatory phases and use of specific SRL
strategies. Consequently, we expect that the Chinese students and the
English Canadian students will display different patterns of SRL strategy
use that are reflected in (a) differences in their self-regulatory phases, and
(b) differences in their patterns of use of specific SRL strategies when
learning in the language-matched groups, i.e., the Chinese pairs group
and the English Canadian pairs group.

Hypothesis 4. Since an individual's construal of self may also be
generalized to a situation in which they encounter people from other
cultures, an individual's culture-specific preference for particular types of
SRL strategies and for particular SRL learning phases would be expected
to persist in situations of learning in mixed pairs group. Consequently, we
would expect the Chinese and English Canadian students in our sample to
display patterns of specific SRL strategy use and SRL learning phases
when learning in the mixed pairs condition that are similar to those they exhibited in their respective culturally-matched pairs conditions.

These four hypotheses were tested in the context of the computer-supported problem-based collaborative learning conditions used in this study.

4.3 **Specific Objectives**

The principal objective of this study, which is reflected in the research questions and hypotheses, is to examine the role of cultural context (i.e. cultural identity in this study) in framing the meaning of students’ self-regulatory practice. By comparing students from an individualistic culture to students from a collectivistic culture as they learn a specific topic in a collaborative learning environment, the role of invisible cultural context may become visible in their discourse and in their learning activities.

Practically, in a multicultural world (which is increasingly the case in Canada), individuals with different cultural backgrounds often come to learn together. They may learn in self-selected sub-groups in which all group members have the same cultural background; or they may often find themselves working with groups whose members have different cultural
backgrounds. Therefore, it is meaningful to assign participants randomly into a Canadian pairs group, a Chinese pairs group, or a mixed pairs group for them to learn in pairs.

Because participants learn in pairs through talking, the role of sociocultural context can be brought to the forefront. When conflicts arise, researchers may assess how participants resolve them. Participants may try to dominate others or try to fit with others. Hence, individually oriented self-regulation and socially oriented self-regulation can be differentiated. By comparing participants across the three learning groups and within the mixed pairs group, the role of cultural context may be exposed.

It can be expected that individuals who have different cultural backgrounds will demonstrate different ways of using self-regulatory strategies to solve problems. Therefore, by answering the research questions that were proposed previously, differences in the meaning individuals ascribe to learning situations and individuals’ self-regulatory practices in these situations can be explored in relation to their cultural backgrounds. Thus, support for the hypotheses based on the results of this study may provide evidence of the validity of the predictions derived from the proposed model.
A broader exploratory aim of this research is to examine the role of aspects of contexts such as type of task, presence of authoritative others, and interpersonal relationships in framing the meaning of self-regulated learning, although it is not expressed in the form of specific research questions and research hypotheses. Cultural identity never works alone. It can only be revealed through performing a task in a particular context, talking to others in a social context of interaction with others, or being guided by activity rules or by important others in an authoritative context. All of these aspects of contexts are likely to have significant effects on the individual or social orientation of self-regulated learning as described in this model. Therefore, exploratory examination of the role of these aspects of learning contexts in shaping orientation of self-regulation can provide evidence for the validity of this model. In addition, we will also explore students’ learning quality to see which group of participants will learn better.

It is impossible to study the role of all aspects of learning contexts in a single study. Therefore, one strategy that can be used is to counterbalance these aspects of contexts, use random assignment techniques, or involve particular aspects of contexts as additional independent variables in data analyses, while maintaining the focus
on cultural differences. This is the strategy that was used in the present study.

Since the principal objective of this study was to test hypotheses derived from the proposed model, participants were sampled deliberately from representative cultures: Chinese students studying at a major university in Canada, and English Canadian students studying at the same university. The research design employed an experimental format in which the learning context was intended to simulate aspects of participants’ everyday learning situations to make the learning context a natural one. A prescribed coding system was developed according to the proposed model and was revised in pilot coding to ensure that the coding system adequately represents the data obtained from participants.
Chapter 5 - Research Method

This chapter discusses the research design, the procedures used to collect, transcribe and code the data, and the methods used in analyzing the data. Research design is explained first, followed by an examination of data collection and data sources. Data preparation, transcription, and coding are discussed next, and methods of data analysis are described at the end of the chapter.

5.1 Design of the Study

5.1.1 General Description of the Design

As specified in the section on the research aims, Canadian pairs, Chinese pairs, and Canadian-Chinese mixed pairs were arranged as different group configurations to learn statistics in a computer-supported problem-based collaborative environment at the time of study. Orientation of participants’ actions was the dependent variable, or the predicted variable (obtained from coding discourse units and coded as individual or social) which was the binary dependent variable (individual / social).

*Group configuration* (cultural identity at the group level) was the first independent variable in the research design, consisting of three levels: (a)
Canadian-Canadian pairs, (b) Chinese-Chinese pairs, and (c) Canadian-Chinese mixed pairs.

Cultural difference between English Canadian and Chinese students (cultural identity at the within-group level in the mixed pairs group) was the second independent variable in the research design. The factor *culture* had two levels: (a) Chinese and (b) Canadian.

Cultural identity as a context of learning occurs when participants learn something in a task context, talk to others in an interpersonal relationship context, or participate in an activity with experienced others as a context. All three of these aspects of contexts can play an important role in shaping students’ orientation of self-regulation. Thus, they become potential confounding variables if one’s focus is specifically on cultural differences. Other possible confounding variables may include gender, age, educational level, economic factors, political positions, educational institution, learning settings, apparatus and material, the role of the researcher, and numerous other contexts. It is a challenging task to rule out all competing explanations so that a plausible conclusion can be drawn from the study.

To evaluate or control these variables, four types of control techniques were adopted for this research. First, contexts were held constant for each pair and each participant. For example, all participants
experienced the same learning conditions in the same setting by using the same tools and materials to learn. The researcher’s participation and activity were also held constant for each pair. Second, a selective sampling technique was used in this study. For example, due to practical limitations, effects of gender were controlled by selecting only male university students for participation in this study. It was expected that other factors such as age, educational level, and educational institution could be controlled at an acceptable level.

Third, random assignment of the participants to different group configurations allowed the researcher to rule out confounding background differences among participants. For example, background factors such as age, educational level, and political positions, which might be significant contributors to self-regulated learning, were thus randomized between groups and between participants within a group.

Fourth, the technique of building confounding variables into the research design was used to control for their influence on cultural differences. For example, one may reasonably imagine that different tasks place different demands on self-regulated learning; therefore, they may constrain participants’ self-regulation differently. In this study, participants worked on a statistical problem-solving task in a context of problem-based learning of a statistical method and model through the McGill Statistics
Tutor. When participants worked on the problem, they engaged in two main types of activities and actions: they produced particular types of problem-solving actions in working on the problem, and they generated learning actions (including SRL actions) in using the Tutor as a source of knowledge about analysis of variance (ANOVA) and about the methods used to solve the problem. Thus, type of action was controlled for its influence on cultural difference. Moreover, in the situated discourse model of self-regulated learning, it was suggested that participants might be differentially sensitive to their in-group (i.e. group members with the same cultural background) or out-group (i.e. group members with different cultural background) interpersonal relationship. For example, one may say group differences are not a result of cultural identity per se, but a result of different responses of participants to the nature of the interpersonal relationship (same cultural background or mixed cultural backgrounds). Indeed, group differences are likely to be a mixture of participants’ cultural identity and their response to the character of the interpersonal relationship. If we had only the Canadian in-group configuration and the Chinese in-group configuration, one might conclude that group difference is due to the groups’ different cultural identity, to different responses of the groups to the in-group interpersonal relationship, or both. However, if cultural differences were found to exist in the same fashion within the
mixed pairs group, one could not say that the Chinese students’ social orientation is only the result of their sensitivity to the in-group interpersonal relationship. The only valid explanation would be that the difference reflects factors related to the participants’ cultural identity. Finally, prior knowledge may also be an important predictor to orientation of self-regulated learning. Students may have more confidence to self-regulate their learning individually if they are more experienced on a task. However, they may demonstrate a more socially oriented pattern of self-regulated learning if they are less experienced. Correspondingly, effects of prior knowledge were further included as an additional independent variable in analyzing the effects of cultural identity.

5.1.2 Participants and Procedure for Recruitment of the Sample

Participants in this study were 60 male volunteer university students, who were recruited by following the requirements of the Research Ethics Board of the University. They included 30 Anglo-Canadians and 30 Chinese. The subjects were randomly assigned to a Canadian group (i.e. two Canadians paired together), a Chinese group (two Chinese paired together), or a mixed group (i.e. a Canadian paired with a Chinese). Thus, 10 pairs of participants were included in each group.
Sampling criteria were as follows. Each participant had to: (a) be a male university student, (b) speak English fluently enough to carry out a discussion with partners in the learning situation, (c) have elementary statistics knowledge and be interested in updating his competency in statistics. Moreover, Canadian participants were selected who met the following criteria: they were born in Canada or the United States, their father or mother was born in Canada or the United States, and they spoke English as their principal language at home. In contrast, Chinese participants were selected if they met the following criteria: they were born in mainland China, they had lived in Canada or the U.S for less than five years, and they spoke Chinese at home.

These criteria were included in notices used to solicit participation from students (see Appendix K2), which were posted in strategic areas on two university campuses after gaining permission from relevant staff members at those locations. Moreover, the letters were posted on the advertisements webpage of McGill University, and a Montreal-based Chinese website. In addition, they were emailed to individuals at the McGill Chinese Students Association, who then forwarded the letters to the members. In the notices or letters, all students were informed of the
fact that they would be working with another student when they came to
do the experiment.

To familiarize potential participants with this project before they
decided to participate, a personal blog http://cssrl.blogspot.com was
created to introduce the researcher and his intentions (see Appendix K3).
In addition, there was an appointment hyperlink called Book Now at the
top left corner of the blog page, which led to an appointment-booking page
(see Appendix K4). Appointments were separated in several time intervals
in a day because the time required for one appointment (experimental
session) was two hours. Available time intervals would appear at that page
and each time interval could be booked by two participants. A time interval
would disappear if it had already been booked by other two participants.
Participants were free to select any time interval that was available. When
a time interval was booked by only one participant, he would be contacted
to reschedule his appointment.

Participants made their appointments by clicking on the time
interval they preferred, which was followed by a small window for them to
fill in their telephone number and email address. Then, they clicked on ok
at the small window to finish their appointments. Their telephone numbers
and email addresses would be kept confidential and would only be used
for appointment rescheduling. Thus, participants could select their preferred time interval to participate, but they did not know who the learning partner was going to be. The ads for potential Chinese participants were updated more frequently than the ads for Canadians to synchronize the recruitment of both Canadian and Chinese participants. As a result, all three groups progressed in approximately the same way.

To guarantee that all participants had read the participation criteria before engaging in the problem solving session, they were reminded four times. First, they were told of the participation criteria for the first time when they saw the ad. Second, they had to go to the researcher’s blog to make an appointment if they were interested in participation, and just beside the booking tool on the blog were the participation criteria. If they decided to participate by clicking on a preferred time interval, the criteria appeared on the confirmation page. Finally, four hours prior to their session, a reminder letter was sent to them about their participation time, and place, and the criteria were repeated again. Their qualification for participation was confirmed before they read and signed the informed consent forms (see Appendix K1). In this way, at each stage of the sampling procedure, there were participants whose qualifications for
participation were denied. Just before participants signed the informed consent forms, two participants were disapproved for further participation.

Sixty participants were finally recruited, 20 for each group. Most of the participants were upper-level undergraduates although some were graduates, or freshmen. They were distributed across several disciplines, ranging from Faculty of Engineering, Faculty of Science, Faculty of Management, Faculty of Arts, and Faculty of Education. They were compensated for $10 an hour with $20 for each student in total.

5.1.3 Description of the Learning Setting

Figure 5.1: A pair of participants sat together before a computer in a corner of the lab.
The learning setting for participants was a spacious room at the university. It was a common education lab with tables, bookshelves, computers, and chairs. A pair of participants were greeted with cups of tea when they came to the lab, and then sat together to learn at a corner of the lab (see Figure 5.1). Although a camera and a microphone were used to videotape participants’ learning activities, they were arranged in a way that did not attract too much attention. The researcher sat at another corner of the lab and was ready to help when technical problems occurred (see Figure 5.2). An attention reminder was posted on the outside of the door during experimental sessions so that no interruption would occur.

Figure 5.2: The researcher sat at another corner of the lab.
5.1.4 Description of the Computer Environment: The McGill Statistics Tutor

The McGill Statistics Tutor is a web-based hypermedia system, which was designed by Frederiksen, Donin and several other researchers (see Frederiksen & Donin, 2005 for more details) and can be accessed online by authorized users at http://appliedcogsci.mcgill.ca (see Figure 5.3). Its goal is to provide learners with a series of interesting, challenging, and authentic problems with scaffolding similar to that provided by an experienced instructor. Based on an expert model of problem-solving in statistics, the Tutor’s scaffolding includes: (a) explanation of hierarchical concepts which may refer to a piece of declarative knowledge or procedural knowledge; (b) examples of modeling experts’ processes of problem-solving and hints or prompts for embedded coaching; and (c) a tree index that depicts the hierarchical structure of the content of the tutor. The deeper one goes towards the tree’s leaves, the more specific scaffolding one can receive.
Apart from a modelling tool (i.e. “ask tutor”) which provides “tutor” modelling of declarative and procedural knowledge required to perform a task, there is another tool (i.e. “coaching”) on the tutoring system, which asks general questions (e.g. What is the ANOVA score model for your research design?), deep questions (e.g. How is this "decomposition" of subjects' scores related to the population means for the groups in your
study?), and provides simple hints and clarifications. The coaching tool functions like a coach who can scaffold learners to solve a problem more and more independently and critically. Moreover, it is also an ideal tool used to test what one knows and what one does not know so that one can adjust learning accordingly (metacognition tool).

5.1.5 Description of the Computer-Supported Problem-Based Collaborative Learning Environment

Problem-based learning (PBL) (Barrows, 1986) was implemented first in medicine during the 1960s and then in a variety of domains such as economics, law, and social work. The basic idea underlying this approach is to let students learn by solving authentic clinical problems that may stimulate students’ interest and promote acquisition of clinical knowledge and direct transfer of knowledge content to problem solving. By analyzing an authentic problem, students first find their knowledge gaps (also, learning issues), then resort to many possible resources such as books, expert coaches, classmates, computers, and the internet to elaborate their solutions, and finally evaluate their learning processes for improvement (Zimmerman & Lebeau, 2000).
Such problem-solving processes may also be supported and constrained by students' collaborative learning groups where students (a) express their understanding (correct or incorrect), (b) elicit others’ expression of understanding, (c) accept reasonable aspects of others’ opinions by integrating these aspects into their original understanding, and (d) refuse unreasonable aspects of others’ expressions by negotiating options (Fisher, Bruhn, Graser, & Andl, 2002). Through integration and negotiation, students frequently self-regulate themselves in relation to others and dynamically update their knowledge representation of a task in problem-solving competency.

Such collaborative problem-based learning processes may also be supported by computer tutors in computer-supported collaborative learning environments (CSCL). According to Lajoie (2005), computer tutors are cognitive tools designed and informed by current theories of learning sciences to provide learners: (a) examples of experts’ problem-solving through which experts’ actions and applications of principles may be observed and imitated, (b) dynamic scaffolding by evaluating learners’ learning processes, (c) a meaningful situation in which problems and tasks can be presented, and (d) interaction opportunities around cognitive states, activities, and contexts.
In this study, participants were presented an authentic one-way ANOVA statistics problem and five tasks in the McGill Statistics Tutor for them to explore their knowledge gaps, generate learning issues, and learn to carry out particular steps in applying ANOVA to a data set. They worked in pairs to solve the problem with help of the Tutor that was designed according to experts' knowledge structure and knowledge application. Prompts or hints were provided as students worked on problem examples to help them elaborate the underlying principles or concepts. Thus, this environment combined PBL and CSCL to provide an ideal platform to explore how cultural, social, and personal contexts interacted with each other to frame the meaning of self-regulatory practice.

5.1.6 Learning and Problem-Solving Tasks

Participants learned intermediate statistics in pairs by solving a statistical problem in a computer environment, which provided participants (a) a writing software (e.g. Microsoft Word 2007) for them to record processes of problem-solving; (b) the Tutor (McGill Statistics Tutor) to support learners' cognitive processes; and (c) an authentic ANOVA problem (see Appendix B for details).
Statistics tasks were chosen as the context of this study because mathematics and statistics are challenging and encourage one’s involvement in self-monitoring and self-regulation (e.g. Shoenfeld, 2002; Lan, 1996). Moreover, statistics knowledge is pivotal to many university students who hope to enter into a research community. Lack of this knowledge may close doors leading to higher education or membership in a research profession. Therefore, many students usually spend much time in learning the related course materials to succeed in the future. In addition, statistics courses are required courses for many departments at McGill University. Therefore, many students may have some knowledge in elementary statistics and are interested in updating their competency in this domain.

The problem description is shown in Appendix B. It can be seen that participants needed to solve a one-way ANOVA problem with three group levels. Sample data were provided, followed by the output of ANOVA through Statistical Analysis System (SAS, an integrated system of software products provided by the SAS Institute), which presented a standard ANOVA table, group means and their standard deviations. SAS outputs were directly given to the participants so that they did not have to learn to use SAS software. Students’ task was to interpret the output and
to jointly write a report. There were four requirements for writing a report: (a) writing score models for their data, (b) estimating parameters involved in the score models, (c) interpreting the ANOVA table that was shown in the output, and (d) drawing a conclusion about whether there were significant differences among the three groups by stating a null hypothesis and relevant F and p statistics.

Pairs of participants were encouraged to read the three-page problem description in some detail before they went to the McGill Statistics Tutor. When they read, they talked about what they already knew and what they needed to know to write their report (see Appendix B for detailed requirements of writing the report). They could write down some key points if needed.

After a pair of participants found what they needed to know (i.e. the new concepts and principles needed to write their report), they then switched to McGill Statistics Tutor general interface to learn (see Figure 5.4). As can be seen from Figure 5.4, the McGill Statistics Tutor involves twelve learning tasks, among which task 5 to task 9 were required learning tasks for solving the prescribed problem. Participants were instructed to search relevant information from the five tasks to write their report; however, they were also allowed to search information from other tasks if
they felt it was necessary to do so. Task 5 is ANOVA Score Models, which was used to scaffold the first requirement of writing a short problem-solving report. This task involves deeper-level principles of ANOVA, which illustrates ways of writing a general score model, and a score model for a specific group level. It also explains some fundamental concepts used in ANOVA such as general mean, group mean, group effect, all of which are abstract parameters from a population. These parameters are usually not directly measurable. However, these parameters can be estimated from appropriate small samples. This is the topic of task 6.

Figure 5.4: McGill Statistics Tutor general interface.
Task 6 is Estimating Parameters of ANOVA Score Models, which illustrates principles and ways of estimation of the parameters proposed in ANOVA score models. This task was used to support the second requirement of writing a problem-solving report. Participants needed to apply the principles and the methods of parameter estimation to their own data set so that the parameters in their score models could be estimated by using their sample data.

Parameterization of a model and estimation of its parameters are deeper-level principles of statistical analysis. They are usually not presented in an output of SAS software. People usually go directly to a SAS output to look for the exact probability p values to see whether their tests are significant at a prescribed alpha level because p values are usually prominent foci of research. However, these principles are also very important in data analysis; if there is a lack of understanding of these principles, learners may have difficulty in specifying a model for a SAS ANOVA procedure.

Task 7 is the topic of constructing an ANOVA table, which explains the meaning of the elements in an ANOVA table and how the table should be constructed. Task 8 is a topic of calculating and using ANOVA
statistics, which illuminates the ways of calculating all the statistics presented in an ANOVA table. Task 9 covers testing hypotheses in ANOVA, which discusses the null hypothesis, F statistic, and exact p value. These concepts are critical and prominent in interpreting output of an analysis of variance.

5.1.7 Apparatus and Materials

Apart from McGill Statistics Tutor, Microsoft Word, and a Dell desktop computer, other apparatus and materials used in the experiment included a video camera, a microphone, screen recorder software, Adobe Acrobat Pro, a pencil, and some blank paper (see Appendix A).

The McGill Statistics Tutor contained all of the information needed to solve the problems. Microsoft Word was used for participants to read the problem description in a word format, and to write their joint report just below the report requirements. The Dell desktop computer was also shared by the pair of participants with a mouse and a keyboard in front of the computer screen.

A small omni-directional Labtec microphone was hidden under the computer screen so that it would not attract the participants’ attention. Another small device, an ICatch PC Camera, was fixed on the bookshelf
on the wall near the participants so that participants’ activities such as
mouse control, typing, and writing on paper were captured by the camera.
Participants usually did not move away from the computer during the two
hours of learning.

In addition, the Tutor itself was a recording device. The Tutor not
only provided information for participants but also recorded all the events
during the use of the ANOVA tutor. Moreover, a Camtasia screen recorder
(a software developed by TechSmith Corporation) was used to record
screen activities moment by moment. Therefore, screen activities,
participants’ activities outside the screen, and their talking were
synchronized by the Camtasia software as a picture-in-picture MP4 file,
which also corresponded to the time stamped Tutor log. All MP4 files were
then used for transcription and the Tutor log files were directly transformed
to SAS data files.

Adobe Acrobat Pro was used for participants to do their pre-tests.
They could click on a check box or a radio button to answer the pretest
questions. A pencil and some paper were also given to the pairs of
participants for them to write something if needed. Although all the
recording devices worked automatically in an unobtrusive way, the
participants were always notified when the devices began recording.
5.1.8 Experimental Procedure

An experimental session lasted for 2 hours. For the first 20 minutes, each pair of participants was greeted with cups of tea when they came to the lab. They then read the informed consent forms, and signed the forms to indicate their acceptance of the requirements of the experiment and that they met the participation criteria. Next, they completed a pre-test of their prior knowledge in statistics (see Appendix C). After both participants had finished their pre-tests and saved their pre-test results, they were instructed to sit together for a 30-minute training session.

The researcher briefly read the problem description with the participants, and explained the requirements for their joint report. After that, the researcher turned to the McGill Statistics Tutor interface and explained and modeled the functions of the tools on the Tutor website. Then, the mouse was transferred to one of the participants for him to try practice. After the first participant was comfortable with the program, he transferred the mouse control to his partner. Once both participants were familiar with the Tutor environment, they were given further instruction: “This experiment is not a test. You come here to learn statistics. So you just relax as you study at home. You may need to read the problem
description again to find what you need to learn. You are asked to learn from task 5 to task 9; however, you may explore other tasks if needed. You may need to use your own words to write your joint report, but it does not have to be long. Try your best as you can to learn more in the following 70 minutes. You will learn by yourselves; however, you may ask help whenever you meet with technical problems. Do you have any questions?” When participants were ready, all the recording devices were started. At the end of the experiment, each participant was compensated $20.

5.1.9 Pre-Test

Although participants were randomly assigned to the Canadian pairs group, the Chinese pairs group, and the mixed pairs group, their prior knowledge might still make a difference between the groups if random assignment was not successful. Therefore, the pre-test was designed to verify the success of random assignment. An analysis of variance of participants’ scores on the pre-test was used to check to see if there were any significant differences between the groups. Moreover, pre-test scores were also used as an indicator of prior knowledge in statistics to control for its influence on the effect of cultural differences.
The pre-test in Appendix C was designed as a measure to estimate the prior knowledge of the participants in statistics. It can be seen that this test covered most topics of elementary statistics, ranging from mean, standard deviation, percentage, normal distribution, types of measurement scale, population mean, sample mean, correlation, random sampling, confidence intervals, probability, null hypothesis, critical alpha level, variance, and F value, all of which were needed to understand fully analysis of variance.

Furthermore, participants were classified into the category of highly experienced students if they had taken two statistics courses and the category of less experienced students if they had taken less than two statistics courses. An analysis of variance showed there was a significant difference between the two kinds of participants scores on the pre-test, \( F(1, 58) = 16.58, p < .05, R^2 = .22 \). This result showed that this test was capable of differentiating highly experienced participants from less experienced participants. In addition, Cronbach’s reliability coefficient alpha (alpha = .53) for the pretest was acceptable. By convention, a lenient cut-off of .50 is common in exploratory research (Henson, 2001).

In summary, although this test was constructed by the researcher himself,
it was satisfactory as a research tool to estimate participants’ prior knowledge in statistics.

5.1.10 The Researcher’s Role

As an important authoritative source, the researcher may play a role in participants’ learning. Therefore, it was important to keep the researcher’s interaction with the participants constant for each participant. When participants came to the lab, they all were greeted with cups of tea. Then, the entire experimental procedure was consistent for each pair of participants. The researcher’s help mainly included: (a) preparing the computer environment, (b) presenting task requirements, and (c) familiarizing participants with the tutor characteristics. Moreover, the researcher was always available during the sessions to answer any questions except task-related ones. When no questions were asked by the participants, the researcher sat at another corner of the lab to avoid intrusive behaviour. Detailed notes on participants’ behaviours were recorded during this time.
5.2 Data Collection and Data Sources

In this section, the time line of data collection, data sources, and debriefing of the participants are presented.

5.2.1 Data Collection

Before data collection started, two freshmen were recruited to simulate the 2-hour experiment to see whether any concerns needed to be addressed. Based on feedback from the two students, instructions and experimental procedures were revised. Data collection then began on March 29, 2009, and ended on May 12, 2009. It lasted 45 days.

On March 20, 2009, the blog webpage http://cssrl.blogspot.com and its associated appointment centre were open to the public. Appointments were made available starting from March 29, 2009. In the nine days before experiments began, the researcher took most of the time to publish the ads in targeted area. Thus, interested participants could book their preferred time intervals to participate. Four time intervals were made available each day from morning to evening. At the same time, all devices were tested and synchronized every day so that any problems could be solved in advance. Apparatus maintenance continued until experiments ended on May 12, 2009.
Appointment time intervals during the examination days at the university were made unavailable so that students could work on their final exams without interruption, but time intervals after their final exams were still open. Interested participants could book their preferred time intervals two weeks ahead. They were also granted the right to cancel or reschedule their appointment 12 hours ahead through the website. Within 12 hours before experiment, they had to email the researcher or call directly to make a change to their appointments. This limitation to participants was due to the consideration of the nature of paired learning. Cancellation or rescheduling of one’s own appointment could directly influence the interest of the randomly assigned partner. However, in an emergency, they could cancel by calling the researcher so that their partners could be notified in time.

5.2.2 Data Sources

Data were collected from multiple sources that include: (a) pre-test files, (b) the Tutor logs (stamped by time), (c) participants’ discourse during collaborative learning, (d) participants’ notes and the researcher’s observation notes, and (e) participants’ solutions to the problem. Pre-test files were originally saved as a PDF format by using participants’ names. They were then indexed, and gathered into one folder. The Tutor logs
were recorded by the McGill Statistics Tutor program when participants clicked on the Tutor tools to search needed information. The log files were originally web tables, which can be copied and then directly pasted into Microsoft Excel. Thus, the log files were indexed and saved as an excel format in one folder.

Participants’ discourse during learning was recorded and then saved as an MP4 format. Originally, Camtasia software synchronized information from the microphone, screen recorder and camera, and then saved it as a Camtasia file when an experiment ended. However, files in this format were very large and could not be recognized by other transcribing software. Therefore, all Camtasia files were transformed into an MP4 format, which could be recognized by Computerized Language Analysis (CLAN, developed by Leonid Spektor, Carnegie Mellon University) or other media players. These files were then indexed, and saved in one folder.

Participants’ notes and the researchers’ memos were generated during participants’ learning. Participants were offered two pieces of paper and a pencil to write down their thoughts, ideas, and etcetera. These notes and memos were then put together in a folder. Moreover, participants’ solutions to the problem came from the pairs’ joint report. These files were
originally saved in a word format by using both participants’ names, which were then indexed, and saved in one folder.

5.2.3 Ethical Issues and Debriefing of Participants

Informed consent forms (see Appendix K1) were signed when participants arrived at the lab. Private information was kept in a safe place in the Applied Cognitive Science Group Lab at McGill University. At the end of the experiment, participants were debriefed through emails, and further information was provided as needed.

5.3 Data Preparation and Analysis

There were five data sources in this study: discourse, log data, pre-test files, solutions to the problem, and notes, among which participants’ dialog during learning needed to be transcribed. Transcripts were then linked to MP4 videos for coding. Next, transcripts were coded by applying prescribed SRL codes. Participants’ pre-test files were graded, followed by grading of the pairs’ solutions to the problem. Log data were then examined for accuracy and coding reliability was investigated. Notes and memos were kept for reference without being further processed.
5.3.1 Data Transcription

Thirty sessions of dialog, learning actions, and problem solving actions of pairs of participants were integrated into thirty MP4 video files, each of which lasted about 70 minutes. CLAN software, which is widely used by discourse researchers and can be downloaded for free at http://childes.psy.cmu.edu/, was used to transcribe these video files. CLAN provides two modes of transcription for video data: F5 and walker controller. The F5 function is used to set breakpoints between dialog units (i.e. meaning units), which are represented by pauses, or turn-taking. A conversational turn can consist of several consecutive dialogue units produced by one particular speaker in the pair, which refer to main clause units (including relative clauses), clauses that are bound adjuncts, and non-clausal conversational actions. Another mode of transcription is the walker controller mode, which sets breakpoints automatically. Transcribers can set walk length, loop number, playback speed, and so on. The researcher used both of these modes.

After segmenting (i.e. setting breakpoints), transcribers need to follow a transcription convention to transcribe the data. The CLAN software has its own transcription convention, which is integrated with its error checking system, coding system, and analysis system. Because the
researcher planned to use the free CLAN software to do all the work, he followed the transcription convention defined in this software. A small collection of the rules from this software was listed in Appendix I. Interested readers can go to http://childes.psy.cmu.edu to download the CHAT manual, which describes the convention in detail. A sample of the transcripts is presented in Appendix J.

5.3.2 Linking Transcripts to Videos

When using the F5 mode to transcribe the videos, the researcher first segmented the videos by inserting bulleted breakpoints into transcripts. These bullets are actual time durations for the dialog units. They can be played by mouse clicks. Thus, a dialog unit can be transcribed by clicking and clicking again the associated bullet. Sometimes, a bullet may be clicked many times if the associated dialog unit is long. However, the advantage of this mode is that a researcher does not have to link videos to transcripts when transcription is done because linking is done already before transcription begins.

In contrast, the walker controller mode gives more freedom to a transcriber, who can set up many parameters of the walker to make it accommodate the special needs of the transcriber. However, transcripts
are not linked to the videos in this mode because playback speed, walk length, and other parameters are frequently changed by the transcriber. After transcription is done, an extra step of linking transcripts to videos is needed because the associated bullets can make the subsequent coding more accurate and convenient. Accordingly, the researcher tried the two modes of transcription and linking, and did most of his work by following the second mode: transcription first, then linking.

5.3.3 Data Coding

Data coding process was divided into three stages: development of a priori codes, implementation of these codes, and adjustment of the codes. The final coding schemes are shown in Appendix D, E, and F. The first stage of data coding was to develop an appropriate coding scheme. Many coding schemes in SRL used by other researchers were reviewed; as a result, learning strategies that were elaborated in Zimmerman’s social cognitive theory (Zimmerman, 2006, 2008a) became major parts of the coding scheme. These strategies were included mainly because they are widely accepted in the field, and they fit the data of the researcher. Azevedo and Cromley’s coding scheme (Azevedo & Cromley, 2004) was also consulted because his scheme was specifically developed in a
learning context with hypermedia, which was the case in this study.

Moreover, a strategy is usually a larger unit than a specific action; however, they were not differentiated in this study.

According to the situated discourse model of self-regulated learning, employment of these learning strategies was traditionally viewed as individually oriented. To make these strategies fit the situated discourse model of self-regulated learning, employment of each strategy was split into an individually oriented and socially oriented version. Decision rules for coding a dialog unit as individually oriented or socially oriented are listed in Appendix D. A dialog unit was coded as socially oriented if it was based on: (a) meeting the needs of others or the group, (b) shared understanding of relevant knowledge, (c) shared interest, (d) a concern about the performance of the group, (e) a concern about the benefits of others, and (f) a concern about the opinions of others. Otherwise, it could be coded as individually oriented. Concrete examples can be found in Appendix D.

To make the coding of each dialog unit more accurate, a detailed coding scheme was developed and is presented in Appendix F, which includes definitions of a specific SRL strategy, and its associated use of individual orientation or social orientation. For example, an environment
structuring strategy (code 12) was defined as “statements indicating student-initiated efforts to organize their learning context in ways that help to learn better. An environment may be physical, psychological, or social.” The associated individual orientation of the strategy use referred to, “individually articulating one’s environment structuring efforts to help improve one’s individual learning.” In contrast, socially oriented environment structuring was defined as, “help the group improve their learning through interactive discussion with one’s partner or members of a group.” Discourse examples are also provided in Appendix F.

Apart from codes that were used to code dialog units while using the McGill Statistics Tutor, problem-solving (PS) actions were also used as a PS coding scheme to code dialog units while individuals solved the statistics problem in order to study the different roles of problem-solving context and context of learning new information to frame one’s orientation. A problem-solving coding scheme that was developed by Frederiksen and his colleagues was reviewed and applied to this study (Frederiksen, Roy, & Bedard, 2010). This coding scheme is presented in Appendix E, and includes nine types of actions that may be engaged during problem solving. Again, these PS actions were divided into individually oriented
and socially oriented sub-codes, whose definitions and discourse examples are also listed in Appendix E.

Thus, the PS and SRL coding schemes were mutually exclusive; if one was accepted, the other must be rejected. The decision rules of coding a dialog unit as PS or SRL are listed in Appendix D. The PS coding scheme could apply if a dialog unit was related to solving the prescribed problem; the SRL coding scheme could apply, however, if a dialog unit was related to gaining new knowledge. No coding applied if a coding unit was irrelevant to both PS and SRL. As a result, the SRL scheme might be more appropriate when there were fewer coding units related to PS in a sequence of talking about learning issues. For example, in a sequence of dialog of learning the score model on the Tutor, one participant pointed at a number in the problem description file and said, “This is the grand mean, I think.” Clearly, the participant switched from the learning task to the problem-solving task. However, the participant came back to the learning task after this clarification, indicating that the participant did not really want to solve the problem at that time. Consequently, it is more appropriate to treat this utterance as an SRL action rather than PS action. On the other hand, the PS scheme could be more appropriate when there were fewer coding units related to SRL in a sequence of talking about problem-solving...
issues. For instance, in a sequence of dialog of problem solving, one participant pointed at a formula on the Tutor and said, “We may copy the formula and paste it to our report.” At this point, the participant switched from problem solving to learning on the Tutor. However, the participant returned to the problem solving after copying that formula, indicating that he did not really want to learn on the Tutor at this time. Therefore, it is a proper way to code this utterance as a PS action rather than SRL action.

Coding schemes were then tested to see whether they fit the data. Six transcripts were selected to do a pilot test, two transcripts for each group. Consequently, some codes were deleted because they were rarely used whereas other codes were inserted because the original coding scheme did not fully account for the data.

After a priori codes were developed, they were implemented in coding all the 30 transcripts, 10 for each group. This was the second stage of the coding process. CLAN software was then selected as a platform to apply the coding schemes, as CLAN is very easy to use when a priori codes have already been developed. In applying the codes, hierarchical coding was employed for coding each dialog unit (see Appendix D). There were four steps for the hierarchical coding: type of action, orientation of action, PS action, and SRL action. First, CLAN would ask a coder what
kind of action the dialog unit was, PS or SRL. Second, it would ask what kind of orientation the dialog unit was, individual or social. Third, it would ask what kind of PS action the dialog unit was if PS was selected in the last step. Fourth, it would ask what kind of SRL the dialog unit was if SRL was selected in the earlier step. To help make an appropriate decision in each step, decision rules were developed (see Appendix D). With more transcripts coded, other problems were further found in the coding schemes. When this happened, the researcher wrote down the concerns in order to synthesize them at the last stage of coding process.

In coding a dialog unit, linked videos were always examined as a more accurate context of the dialog. When coding a transcript, the researcher usually began by watching the video from the beginning to the end to get a sense of the whole context. He then coded each dialog unit by clicking its associated video link. The media player would play the video for a duration that was directly related to this dialog unit. If a sequence of dialog needed to be viewed, the researcher could do this by pressing the F4 function key on the keyboard.

The last stage of the coding process was adjustment of the codes. Coding memos were gathered and examined in detail. Some original events were dropped because they took place infrequently. However,
some events needed to be addressed because they happened more often than they were originally considered at the stage of developing a priori codes. For example, Tom said, “Degrees of freedom for total is N minus one, right?” Such sentences were originally classified into socially oriented clarification category because this utterance clarified Tom’s understanding about the DF concept (degree of freedom) with a concern about the opinion of his partner. However, from another perspective, this utterance should be classified into socially oriented evaluation because Tom tried to evaluate his understanding with reference to the standards of others. In this case, all the 30 transcripts were examined again for adjustment.

In the end, nine types of PS actions were accepted. They referred to the application of one’s conceptual knowledge and procedural knowledge to the completion of each component task. They included (a) *planning goals* (i.e. planning or selecting a goal related to a problem-solving procedure); (b) *planning actions* (i.e. planning an action or sequence of actions to achieve a goal); (c) *testing conditions* (i.e. testing conditions required to apply a procedure); (d) *interpreting the problem state* (i.e. interpreting the initial state before a particular action has been executed, intermediate states that arise during application of a procedure or reasoning, the state resulting from the application of a procedure or
reasoning); (e) executing an action (i.e. executing a procedure by performing its action); (f) evaluating (i.e. evaluating the result of applying a procedure or of reasoning to derive the solution, or the methods or reasoning that are used to obtain the solution); (g) explaining (i.e. explaining the theoretical rationale that underlies a method, or reasoning to derive a solution, or predict, explain or evaluate a result); (h) correcting (i.e. correcting an error or providing a missing component of the solution); (i) reasoning (i.e. reasoning to plan a goal or an action to interpret a problem state, infer or derive a solution, evaluate a method used or result obtained, or correct an error) (Frederiksen, Bedard & Roy, 2010).

Seventeen types of self-regulatory strategies (more accurately called “self-regulatory actions”) were identified. They included goal setting, planning, and motivating in the forethought phase; searching, clarifying, elaborating, summarizing, reviewing, note taking, predicting, locating, environment structuring, help seeking, and monitoring in the performance phase; evaluating, satisfying, and adapting in the self-reflection phase. Their definitions and discourse examples are provided in Appendix F.

Both PS action and SRL action were further classified into two sub-codes: individually oriented and socially oriented. Their definitions and examples are presented in Appendix F.
5.3.4 Grading of Participants' Solutions to Pre-Test Items

Participants’ responses to the pre-test items were graded in terms of the students’ accuracy and confidence in their answers. Correct answers were graded as “1” whereas wrong answers were graded as “0”. Accuracy was the proportion of correct answers out of the total of 16 items.

5.3.5 Grading of Participants' Solutions to the Problem

Participants’ solutions to the prescribed problem were graded according to a scoring rubric, which is listed in Appendix G. This rubric covered all elements that were required to answer the questions in the problem description. Solutions of a pair were classified into 12 categories. If evidence for a specific category was found in the participants’ solutions, this category was graded as “1”; otherwise, it was graded as “0.” Thus, the total numbers of participants’ correct answers were calculated. The frequencies of correct answers were then served as values of the dependent variable, which could be tested for differences between groups.
5.3.6 Measures Obtained from the Log Files of the McGill Statistics Tutor

The Tutor log files were useful in identifying characteristics of participants’ learning, and further complemented the results of discourse analysis. For example, some pairs of participants performed many actions on the Tutor without talking. In this case, Tutor logs would more accurately represent their learning trajectory than their talking.

After the logs were transformed from the Tutor software to EXCEL files, all events were indexed by a pair number and a group number. They were then checked for accuracy of recording. Events lines may be deleted if they took place before the 70-minute learning began or if they happened after the assignment was submitted. The time duration for each event was not considered in analysis of the logs data because it was inaccurate as a measure of participants’ real learning. For instance, when participants moved away from the Tutor to solve their problem, the Tutor kept recording the time duration for the event until participants came back to click another hyperlink. However, the number of events was accurate. Whenever participants clicked on a topic, the Tutor would record it. Thus, the frequencies of each topic exploration were counted and served as dependent variables in analysis.
5.3.7 Investigation of Coding Reliability

Inter-coder reliability coefficients were obtained for coding categories considered in the analyses. As discussed in subsection 5.3.3, coding for each dialog unit was hierarchical. To obtain inter-coder reliability, a 4-step coding procedure was considered. The first step of coding was to decide whether a dialog unit was problem solving or regulation of learning. The second step was to determine if a dialog unit was individually oriented or socially oriented. The third step was to consider what kind of problem-solving action a dialog unit was if the first step generated an answer for problem solving. The last step was to figure out what kind of regulation strategy a dialog unit was if it dealt with knowledge construction. Therefore, reliability coefficients for each level of coding could be calculated respectively. They included the reliability coefficients for orientation of action, type of action, phases of self-regulation, specific regulatory actions, and problem-solving actions.

To obtain these reliability coefficients, one of the researcher’s supervisors coded a transcript independently by following the 4-step coding procedure. He discussed in detail with the researcher the definitions of each category related to both regulation of learning and problem solving. He then selected one of the transcripts as training
material, and discussed the coding units with the researcher about the orientation of action, type of action, phases of regulation, and the use of kinds of strategies. Ambiguities and disagreements were further discussed. Finally, he coded another randomly selected transcript independently.

Consequently, simple inter-coder agreement percentage reached 85% for orientation of action, 86% for type of action, 71% for phases of regulation, 87% for clarification, 93% for elaboration, 97% for environment structuring, 83% for monitoring, and 97% for motivation.

5.3.8 Data Analyses

Codes of problem solving and regulation of learning were counted for their frequencies, which were then analyzed quantitatively. The data analysis plan is presented in Appendix H.

The principal dependent variables were orientation of problem-solving actions or orientation of self-regulatory actions (obtained from coding discourse units and coded as individual or social) which was the binary dependent variable (individual / social). Other dependent variables were frequencies of events for particular tutor topics (obtained from the logs data); and frequencies of correct solutions to the ANOVA problem (solutions data).
The two independent variables (factors) in the design were: (A) **groups** (corresponding to the composition of the dyads) with three levels: (a) mixed Chinese-Canadian pairs (b) Canadian-Canadian pairs, (c) Chinese-Chinese pairs; and (B) **cultural identity of partners within the mixed pairs group** with two levels: (a) Chinese or (b) Canadian. Moreover, a third independent variable can be included in the model as an additional source of variation within groups: (C) **pairs**, i.e., effects associated with individual differences associated with specific pairs of students nested within groups. Furthermore, another independent variable was (D) **type of action** with two levels: (a) SRL or (b) PS. Finally, an additional independent variable was (E) **prior knowledge**.

Analyses of effects of the above independent variables on frequencies of response variables were carried out using Generalized Linear Models (GLZ) as implemented in the SAS GENMOD Repeated procedure. Response variables were specified to have binomial distributions; hence, a logit link function was used. Maximum likelihood estimation methods are used by the GENMOD program and these estimates result in chi-square statistics that corresponds to; (a) a between-group main effects, and (b) a within-group effect of cultural identity for the mixed dyads.
Utterances (i.e., response units) of individuals in a dyad were assumed to be correlated within local sequences of discourse. Therefore, participants’ dialog was further segmented and indexed into clusters to estimate the correlations among the responses. A cluster was defined according to a focused topic and conversational boundary markers. Then, the local dependence structure was modeled by the REPEATED statement of the SAS GENMOD procedure. Due to the sequential nature of discourse, a response of a participant was influenced mostly by its immediate previous utterances, but not vice versa. Consequently, a first-order autoregressive method (i.e. AR(1)) was employed to estimate the stationary (i.e., constant) regression weight between adjacent responses within clusters. All the analyses involved in the discourse data were adjusted for this covariance structure, which is not explicitly presented for each analysis in the following presentation of the results.

The General Linear Models procedure (GLM) was used to conduct an analysis of variance of the effects of the above independent variables on participants’ pretest accuracy scores (which were treated as continuous normally distributed variables). If there were no significant differences in these variables, then the effects of random assignment were considered to have resulted in balanced groups.
At last, qualitative analyses were performed to see what the patterns were like in terms of cultural differences.

All other materials including memos and notes in all the studies served as resources for reference. Therefore, they were not specifically analyzed.
Chapter 6 - Results

Data analyses were carried out to investigate: (a) Group differences in personal and social orientation of SRL and problem solving (PS) actions, (b) differences between Chinese and Canadian partners within the mixed pairs group in the orientation of their SRL and PS actions, (c) Group differences in SRL phases and in specific types of SRL actions (SRL strategies), and (d) differences between Chinese and Canadian partners within the mixed pairs group in their SRL phases and specific types of SRL actions (SRL strategies). Moreover, participants’ performance scores on the pre-tests were analysed first to evaluate whether pre-test performance scores were balanced across groups or between partners within the mixed pairs group. An alpha level of .05 was used for all statistical tests. In addition, qualitative examples were given to illustrate the patterns of individually or socially oriented self-regulated learning in the three cultural groups (Canadian pairs, Chinese pairs, and the mixed pairs).
6.1 Participants’ Background Knowledge in Statistics

An analysis of variance using the GLM procedure was performed on the pre-test data set to test: (a) whether there were pre-existing differences among the groups in their background knowledge and experience of statistics; and (b) whether there was a difference in background knowledge and experience between the Canadian participants and Chinese participants with the mixed pairs group.

6.1.1 Participants’ Background Knowledge in Statistics

Table 6.1: Proportion of Correct Answers in Pre-Test

<table>
<thead>
<tr>
<th>Category</th>
<th>n</th>
<th>M (SD)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>Proportion of correct answers in the three groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CACA</td>
<td>20</td>
<td>.61 (.03)</td>
<td>[.55, .68]</td>
</tr>
<tr>
<td>CACN</td>
<td>20</td>
<td>.64 (.03)</td>
<td>[.58, .71]</td>
</tr>
<tr>
<td>CNCN</td>
<td>20</td>
<td>.63 (.03)</td>
<td>[.57, .70]</td>
</tr>
<tr>
<td>Proportion of correct answers in the CACN group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian</td>
<td>10</td>
<td>.65 (.04)</td>
<td>[.56, .74]</td>
</tr>
<tr>
<td>Chinese</td>
<td>10</td>
<td>.64 (.04)</td>
<td>[.55, .73]</td>
</tr>
</tbody>
</table>

Note. CI = confidence interval; CACA = two Canadian participants paired together; CACN = a Canadian participant paired with a Chinese participant; CNCN = two Chinese participants paired together.
Table 6.1 presents the sample sizes, means, standard deviations, and 95% confidence intervals for variables involved in the analyses of this data set. It can be seen in the upper part of Table 6.1 that the mean proportions of correct answers of the three groups were all close to .60 with overlapping confidence intervals. Consequently, the analysis of variance showed that there was no significant difference among the three groups, $F(2, 57) = 0.24, p = .7852, R^2 = .0084, 1-\beta = .473$.

6.1.2 Participants' Background Knowledge in Statistics in the Mixed Pairs Group

The proportion of correct answers for Canadian participants and Chinese participants in the mixed pairs group is shown in the lower part of Table 6.1. It can be seen that their mean proportions of correct answers were very close ($M = .65$ for Canadians, $M = .64$ for Chinese) with overlapping confidence intervals. Correspondingly, the analysis of variance indicated that there was no significant difference between the Canadian participants and the Chinese participants in the mixed pairs group, $F(1, 18) = 0.04, p = .8437, R^2 = .0022, 1-\beta = .083 (\alpha = .05)$. 
6.1.3 Decision on How Participants' Prior Knowledge Would Be Further Analyzed

Based on the results of the two analyses of variance, it can be concluded that participants' prior knowledge was equal across groups and between the Canadian participants and the Chinese participants within the mixed pairs group. Thus, there was evidence that the random assignment procedure was successful in balancing prior knowledge across groups. In addition, participants' prior knowledge in statistics was transformed into a categorical variable with three levels (high, medium, and low) and was then included as an additional independent variable in analyses of the response variables for the mixed pairs group.

6.2 Differences in Orientation of Actions among Chinese, Canadian, and Mixed Pairs Group

In this section, generalized linear models (GLZ) analyses were performed using the SAS GENMOD REPEATED procedure to analyze differences among the three groups (Canadian-Canadian pairs, Chinese-Chinese pairs, and mixed Chinese-Canadian pairs). First, group differences on overall orientation of action were explored with type of action (SRL action or problem solving (PS) action) added as an additional predictor so that group differences adjust for types of task. Then, separate
analyses were carried out to examine group differences in orientation of problem-solving (PS) actions as the dependent response variable, and in orientation of self-regulatory (SRL) actions as a second dependent response variable. Finally, analysis of group differences focusing on dependent variables obtained from measures taken from the computer logs were carried out. A summary of the findings pertaining to the first research question is given at the end of the section.

6.2.1 Differences among Chinese, Canadian, and Mixed Pairs Group with respect to Orientation of Actions

A generalized linear model (GLZ) analysis was performed using the SAS GENMOD procedure to analyze differences among the three groups (Canadian-Canadian pairs, Chinese-Chinese pairs, and mixed Chinese-Canadian pairs) on frequencies of discourse units in the discourse produced by pairs of students. Learning sessions were coded in terms of orientation of action (coded as individual or social), which was the binary dependent variable. In addition to group, type of action (SRL action or PS action) was added as the second predictor in analysis. Two pre-planned contrasts were made: a comparison between the mixed pairs group and the Canadian pairs group, and between the Canadian pairs group and the Chinese pairs group.
Frequencies (Row Pct) of each type of orientation of action for each group are presented in Table 6.2. The percentage of individually oriented actions (51.09%) was close to that of socially oriented actions (48.91%) in the Chinese pairs group, but in the Canadian and the mixed pairs group, the percentages of individually oriented actions (59.42% and 58.81% respectively) were larger than those of socially oriented actions (40.58% and 41.19% respectively). The GLZ analysis showed that the main effect of Group was significant, $\chi^2 (2, N = 20344) = 41.49$, $p < .0001$. Since the difference between the Canadian pairs group and the mixed pairs group, as well as that between the Canadian pairs group and the Chinese pairs group were both of interest, these two pre-planned contrasts were tested.

Table 6.3 reports the results of these contrasts: there was no significant difference between the mixed pairs group and the Canadian pairs group, $\chi^2 (1, N = 20344) = 1.03$, $p = .3095$, with an odds ratio of $OR = 0.95$. However, the difference between the Canadian pairs group and the Chinese pairs group was significant, $\chi^2 (1, N = 20344) = 44.04$, $p < .0001$. The effect size was quite high: the odds ratio was $OR = 1.42$, indicating that the odds of individually-oriented actions over socially-oriented actions in the Canadian pairs group was 1.42 times the odds in the Chinese pairs group.
The effect of the type of action was significant, $X^2 (1, N = 20344) = 27.79$, $p < .0001$, $OR = 1.24$ with more individually-oriented actions produced for problem solving (PS) than for self regulated learning (SRL) dialog units. The effect of the pairs (group) was also significant, $X^2 (27, N = 20344) = 149.11$, $p < .0001$. Thus, there were significant differences among pairs in the production of individually vs. socially-orientated actions reflected in their dialog during the learning and problem-solving sessions. Therefore, the effect of pairs (group) was included to adjust all group effects in this study.

Table 6.2: Frequencies (Row Pct) of Orientation of Action by Group Types

<table>
<thead>
<tr>
<th>Type of group</th>
<th>IND</th>
<th>SOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACN</td>
<td>4256 (58.81)</td>
<td>2981 (41.19)</td>
</tr>
<tr>
<td>CACA</td>
<td>4332 (59.42)</td>
<td>2958 (40.58)</td>
</tr>
<tr>
<td>CNCN</td>
<td>2972 (51.09)</td>
<td>2845 (48.91)</td>
</tr>
<tr>
<td>Total</td>
<td>11560 (56.82)</td>
<td>8784 (43.18)</td>
</tr>
</tbody>
</table>

Note. IND = individually oriented; SOC = socially oriented; CACA = two Canadian participants paired together; CACN = a Canadian participant paired with a Chinese participant; CNCN = two Chinese participants paired together.
Table 6.3: Effect Sizes (Odds Ratios) of Overall Orientation of Actions for
Group Comparisons

<table>
<thead>
<tr>
<th>Contrast</th>
<th>OR</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACN vs. CACA</td>
<td>0.95</td>
<td>[0.87, 1.05]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>1.42*</td>
<td>[1.28, 1.57]</td>
</tr>
<tr>
<td>PS vs. SRL</td>
<td>1.24*</td>
<td>[1.14, 1.34]</td>
</tr>
</tbody>
</table>

Note. OR = parameterized odds ratio with effect coding; CI = confidence interval; CACN = a Canadian participant paired with a Chinese participant; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together; PS = problem solving; SRL = regulation of learning. The predicted orientation of action coded as 1 for individual orientation and 0 for social orientation. Code 1 over code 0 modeled as odds. The contrasts in this table were made following the GENMOD model statement with orientation of actions as the predicted, and group, type of actions, pair nested in group as the predictors.

* p < .05.

6.2.2 Differences among Chinese, Canadian, and Mixed Pairs Group with respect to orientation of problem-solving (PS) Actions

A similar generalized linear model analysis was performed to analyze differences among the three groups (Canadian-Canadian pairs, Chinese-Chinese pairs, and mixed Chinese-Canadian pairs) on frequencies of discourse units which had been coded as problem solving (PS) actions in terms of the orientation of PS actions (coded as individual or social) which was the binary response variable in the analysis. Again, two pre-planned contrasts were made: a comparison between the mixed pairs group and
the Canadian pairs group, and between the Canadian pairs group and the Chinese pairs group. The effect of differences among pairs (group) was added to the linear model as an additional predictor.

The left panel of Table 6.4 presents the frequencies of orientation of problem-solving actions across groups. Similar to the pattern in Table 6.2, the percentage of individually oriented problem solving (PS) actions (52.75%) was close to that of socially oriented PS actions (47.25%) in the Chinese pairs group, but in the Canadian pairs and the mixed Canadian-Chinese pairs group, the percentages of individually oriented problem-solving action (63.56% and 61.21% respectively) were much higher than those of socially oriented actions (36.44% and 38.79% respectively). The generalized linear models analysis showed that the main effect of group on orientation of problem-solving actions was significant, $\chi^2 (2, N = 9326) = 14.10, p = .0009$.

Since difference between the Canadian pairs group and the mixed pairs group, as well as that between the Canadian pairs group and the Chinese pairs group were of interest, these two pre-planned contrasts were tested. The odds ratios (OR) and 95% confidence limits for these contrasts are presented in the left panel of Table 6.5. The GLZ analysis results indicated that there was no significant difference between the mixed pairs group and the Canadian pairs group, $\chi^2 (1, N = 9326) = 2.15,$
\[ p = .1426, \ OR = 0.89. \] However, the difference between the Canadian pairs group and the Chinese pairs group was significant, \[ \chi^2 (1, N = 9326) = 32.89, \ p < .0001, \ \ OR = 1.58, \] indicating that the Canadian pairs group favoured individually oriented problem-solving action much more than did the Chinese pairs group.

Table 6.4: Frequencies (Row Pct) of Orientation of PS Actions and SRL Actions by Groups

<table>
<thead>
<tr>
<th>Group type</th>
<th>Orientation of PS actions</th>
<th>Orientation of SRL actions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IND</td>
<td>SOC</td>
</tr>
<tr>
<td>CACN</td>
<td>2064</td>
<td>1308</td>
</tr>
<tr>
<td></td>
<td>(61.21)</td>
<td>(38.79)</td>
</tr>
<tr>
<td>CACA</td>
<td>2072</td>
<td>1188</td>
</tr>
<tr>
<td></td>
<td>(63.56)</td>
<td>(36.44)</td>
</tr>
<tr>
<td>CNCN</td>
<td>1421</td>
<td>1273</td>
</tr>
<tr>
<td></td>
<td>(52.75)</td>
<td>(47.25)</td>
</tr>
</tbody>
</table>

Note. PS = problem solving; SRL = regulation of learning; IND = individually oriented; SOC = socially oriented; CACA = two Canadian participants paired together; CACN = a Canadian participant paired with a Chinese participant; CNCN = two Chinese participants paired together.
Table 6.5: Effect Sizes (Odds Ratio) of Overall Orientation of Action for Group Comparisons

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Orientation of PS action</th>
<th>95% CI</th>
<th>Orientation of SRL action</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACN vs. CACA</td>
<td>0.89</td>
<td>[0.77, 1.04]</td>
<td>1.00</td>
<td>[0.88, 1.13]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>1.58*</td>
<td>[1.35, 1.84]</td>
<td>1.33*</td>
<td>[1.16, 1.53]</td>
</tr>
</tbody>
</table>

Note. PS = problem solving; SRL = regulation of learning; OR = parameterized odds ratio with effect coding; CI = confidence interval; CACN = a Canadian participant paired with a Chinese participant; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together. The predicted orientation of action coded as 1 for individual orientation and 0 for social orientation. Code 1 over code 0 modeled as odds. The contrasts in this table were made following the GENMOD model statement with orientation of PS actions or orientation of SRL actions as the predicted, and group and pair nested in group as the predictors.

*p < .05.

6.2.3 Differences among Chinese, Canadian, and Mixed Pairs Group with respect to Orientation of Self-Regulatory Learning (SRL) Actions

Finally, a GLZ analysis was performed to analyze differences among the three groups (Canadian-Canadian pairs, Chinese-Chinese pairs, and Mixed Chinese-Canadian pairs) on frequencies of discourse units that had been coded as self-regulated learning (SRL) actions in terms of the orientation of SRL action (individual or social) which was the binary dependent variable in the analysis. The same two pre-planned contrasts
were made: a comparison between the mixed pairs group and the Canadian pairs group, and between the Canadian pairs group and the Chinese pairs group. The effect of pairs (group) was added to the linear model as a second predictor.

The right panel of Table 6.4 presents the frequencies of orientation of self-regulatory learning (SRL) actions across groups. The percentage of individually oriented SRL actions (49.66%) was similar to that of socially oriented SRL actions (50.34%) in the Chinese pairs group, but in the Canadian and the mixed pairs group, the percentages of individually oriented SRL actions (56.08% and 56.71% respectively) were higher than those of socially oriented SRL actions (43.92% and 43.29% respectively). The generalized linear models analysis revealed that the main effect of group on orientation of SRL actions was significant, \(X^2 (2, N = 11018) = 18.45, p < .0001\).

Since the difference between the Canadian pairs group and the mixed pairs group, as well as that between the Canadian pairs group and the Chinese pairs group were of interest, two pre-planned contrasts again were tested. The right part of Table 6.5 presents the odds ratios (OR) and 95% confidence limits for these contrasts. The results of the GLZ analysis of these contrasts indicated that there was no significant difference between the mixed pairs group and the Canadian pairs group, \(X^2 (1, N = \)
11018) = 0, \( p = .9670, OR = 1.00 \). However, the difference between the Canadian pairs group and the Chinese pairs group was significant, \( \chi^2 (1, N = 11018) = 17.00, p < .0001, OR = 1.33 \), indicating that the Canadian pairs group preferred individually oriented SRL actions to socially oriented actions in comparison to the Chinese pairs group.

6.2.4 Differences in Frequency of Exploration of Topics: Findings from the Computer Logs

Table 6.6 presents frequencies and percentages of actions for exploring specific learning topics across the three groups. It can be seen that the required task (task56) had a lower exploration percentage in the Canadian pairs group (34.30%) than in the Chinese pairs group (43.24%); however, other optional tasks (other tasks) were explored more frequently in the Canadian pairs group (9.15%) than in the Chinese pairs group (1.35%). This pattern can be seen more clearly in Figure 6.1, where it can be seen that the Canadian pairs group was much lower at task56, but much higher at other tasks than the Chinese pairs group. The two lines overlap at task78 and task9. The mixed pairs group explored tasks56 and task78 more than the other two groups did, but explored less in task9 and other tasks.
Table 6.6: Frequencies (Row Pct) of Explored Learning Topics Categorized by Group Type

<table>
<thead>
<tr>
<th>Group configuration</th>
<th>Task56</th>
<th>Task78</th>
<th>Task9</th>
<th>Other tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACA</td>
<td>330 (34.30)</td>
<td>328 (34.10)</td>
<td>216 (22.45)</td>
<td>88 (9.15)</td>
</tr>
<tr>
<td>CACN</td>
<td>335 (45.95)</td>
<td>294 (40.33)</td>
<td>82 (11.25)</td>
<td>18 (2.47)</td>
</tr>
<tr>
<td>CNCN</td>
<td>320 (43.24)</td>
<td>262 (35.41)</td>
<td>148 (20.00)</td>
<td>10 (1.35)</td>
</tr>
</tbody>
</table>

Note. Task56 = ANOVA score models and estimation of their parameters; task78 = ANOVA table construction and ANOVA statistics; task9 = ANOVA hypothesis testing; other = other tasks; CACA = two Canadian participants paired together; CACN = a Canadian participant paired with a Chinese participant; CNCN = two Chinese participants paired together.

To analyze group differences reflected in this graph, a GLZ analysis was performed with the same pre-planned group contrasts conducted previously. Table 6.7 shows the results of the analysis of group differences. It can be seen that there were no significant differences between the Canadian pairs group and the Chinese pairs group on task78, \( \chi^2 (1, N = 1702) = 0.32, p = .5735, OR = 0.94 \), nor on task9, \( \chi^2 (1, N = 1702) = 1.50, p = .2213, OR = 1.16 \). However, the differences between these two groups were significant on task56, \( \chi^2 (1, N = 1702) = 14.11, p = .0002, OR = 0.69 \), and on other tasks, \( \chi^2 (1, N = 1702) = 27.44, p < .0001, \)
OR = 7.35. The Canadian pairs group performed significantly fewer actions on the required task 56 and more actions on other tasks than the Chinese pairs group did.

Like the Chinese pairs group, the mixed pairs group performed more actions than the Canadian pairs group on the required task 56, \( \chi^2 (1, N = 1691) = 23.45, p < .0001, OR = 1.63 \) and task 78, \( \chi^2 (1, N = 1691) = 6.92, p = .0085, OR = 1.31 \), but fewer actions on other tasks, \( \chi^2 (1, N = 1691) = 34.94, p < .0001, OR = 0.25 \).

Figure 6.1: Learning activity influenced by one's own choice and the requirements of the prescribed problem
Note. Task56, task78, and task 9 are the required learning tasks prescribed in the problem description sheet whereas other tasks are optional. task56 = ANOVA score models and estimation of their parameters; task78 = ANOVA table construction and ANOVA statistics; task9 = ANOVA hypothesis testing; other = other tasks; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together. This data set came from the Tutor logs that were recorded automatically by the Tutor when participants took actions on it.

Table 6.7: Odds Ratios (Effect Sizes) of Group Differences in Frequency of Engagement in Specific Learning Tasks

<table>
<thead>
<tr>
<th>Contrast</th>
<th>OR</th>
<th>95% CI</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task56</td>
<td></td>
<td></td>
<td>Task78</td>
<td></td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>1.63*</td>
<td>[1.34, 1.98]</td>
<td>1.31*</td>
<td>[1.07, 1.59]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>0.69*</td>
<td>[0.57, 0.84]</td>
<td>0.94</td>
<td>[0.77, 1.15]</td>
</tr>
<tr>
<td>Task9</td>
<td></td>
<td></td>
<td>Other tasks</td>
<td></td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>0.44*</td>
<td>[0.33, 0.58]</td>
<td>0.25*</td>
<td>[0.15, 0.42]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>1.16</td>
<td>[0.91, 1.47]</td>
<td>7.35*</td>
<td>[3.79, 14.24]</td>
</tr>
</tbody>
</table>

Note. OR = parameterized odds ratio with effect coding; CI = confidence interval; Task56, task78, and task 9 are the required learning tasks prescribed in the problem description sheet whereas other tasks are optional. task56 = ANOVA score models and estimation of their parameters; task78 = ANOVA table construction and ANOVA statistics; task9 = ANOVA hypothesis testing; other = other tasks; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together. Predicted variable coded as 1 for task56 and 0 for disappearance of task56; Predicted variable coded as 1 for task78 and 0 for disappearance of task78; Predicted variable coded as 1 for task9 and 0 for disappearance of task9; Predicted variable coded as 1 for other tasks and 0 for disappearance of other tasks. Code 1 over code 0 modeled as odds.

*p < .05.
6.2.5 Summary of Results Pertaining to Research Question One

In summary, compared with the Chinese pairs group, the Canadian pairs group favoured more overall individually oriented actions, engaged more with tasks of their own choice. The Chinese pairs group preferred more socially oriented actions and was involved more in tasks that were suggested by authoritative others.

Compared with the Canadian pairs group, the mixed pairs group preferred to follow the experimental instructions to learn as shown in the log file data. However, there were no differences between the two groups with respect to proportions of overall orientation of actions in their discourse. That is to say, the performance of the mixed pairs group was close to that of the Canadian pairs group in their discourse, but close to the Chinese pairs group in their actual learning activity. Moreover, the Canadian pairs group displayed a higher proportion of individually oriented PS actions over socially oriented PS actions than did the Chinese pairs group, and the Canadian pairs group also displayed a higher proportion of individually oriented SRL actions over socially oriented SRL actions than did the Chinese pairs group. Furthermore, there were no significant differences between the mixed pairs group and the Canadian pairs group in overall orientation of actions, orientation of PS actions, and orientation of SRL actions. Finally, the effect of type of actions on orientation of
actions was significant, reflecting more individually oriented actions for PS than for SRL.

6.3 Differences between Chinese Participants’ and Canadian Participants’ Orientation of Actions in the Mixed Pairs Group

In this section, the generalized linear models (GLZ) procedure was used to analyze the discourse and actions of Canadian and Chinese participants within pairs in the mixed pairs group. Differences between them with respect to their general orientation of action (individual vs. social) in their dialog were analyzed first with prior knowledge and type of task as additional predictor variables. Then an analysis of frequencies of production of individual and socially orientated actions was carried out for their problem-solving (PS) actions, followed by a similar analysis of their frequencies of production of individual or socially orientated self-regulatory learning (SRL) actions. Prior knowledge was included as an additional independent variable. Finally, a summary of the findings related to research question two is given at the end of this section.
6.3.1 Overall Differences in Orientation of Actions between Chinese Participants and Canadian Participants within the Mixed Pairs Group

Frequencies (Row Pct) of individually and socially oriented actions in the dialog produced by Canadian and Chinese members of a pair within the mixed pairs group can be seen in the upper panel of Table 6.8. The percentage of individually oriented actions (60.42%) was much higher than that of socially oriented actions (39.58%) for the Canadian participants, while the difference in the percentage of individually oriented actions and socially oriented actions was smaller for the Chinese participants (57.26% and 42.74%).

A GLZ analysis showed that there was a significant difference between the Canadian and the Chinese participants, $\chi^2 (1, N = 7237) = 7.29$, $p = .0070$. The upper left part of Table 6.9 reports the odds ratio measure of effect size for this test ($OR = 1.22$). This odds ratio indicates that it was 1.22 times more likely that the Canadian participants produced individually oriented actions than did the Chinese participants.
Table 6.8: Frequencies (Row Pct) of Overall Orientation of Actions, Orientation of PS Actions and SRL Actions by Cultural Identity of Participants in the Mixed Pairs Group

<table>
<thead>
<tr>
<th>Cultural identity</th>
<th>IND (Row Pct)</th>
<th>SOC (Row Pct)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All actions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>2139 (60.42)</td>
<td>1401 (39.58)</td>
</tr>
<tr>
<td>CN</td>
<td>2117 (57.26)</td>
<td>1580 (42.74)</td>
</tr>
<tr>
<td><strong>PS actions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>985 (61.91)</td>
<td>606 (38.09)</td>
</tr>
<tr>
<td>CN</td>
<td>1079 (60.58)</td>
<td>702 (39.42)</td>
</tr>
<tr>
<td><strong>SRL actions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>1154 (59.21)</td>
<td>795 (40.79)</td>
</tr>
<tr>
<td>CN</td>
<td>1038 (54.18)</td>
<td>878 (47.35)</td>
</tr>
</tbody>
</table>

*Note.* PS = Problem solving; SRL = regulation of learning; IND = individually oriented; SOC = socially oriented; CA = Canadian participants in the mixed pairs group; CN = Chinese participants in the mixed pairs group.

The main effect of type of action was not significant, $X^2 (1, N = 7237) = 2.68, p = .1014$. However, the effect of prior knowledge was significant, $X^2 (2, N = 7237) = 6.78, p = .0337$, with a higher proportion of individually
oriented actions for the highly experienced participants (see Figure 6.2). In addition, there was a significant interaction effect between cultural identity and prior knowledge, \( \chi^2 (2, N = 7237) = 56.65, p < .0001 \), indicating that the effect of prior knowledge depended on cultural identity.

Table 6.9: Effect Sizes (Odds Ratio) of Overall Orientation of Actions, Orientation of PS Actions, and Orientation of SRL Actions for Comparisons between the Canadian and Chinese Participants in the Mixed Pairs Group

<table>
<thead>
<tr>
<th>Contrast</th>
<th>OR</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of actions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA vs. CN</td>
<td>1.22*</td>
<td>[1.06, 1.40]</td>
</tr>
<tr>
<td>Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of PS actions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA vs. CN</td>
<td>1.21</td>
<td>[0.96, 1.52]</td>
</tr>
<tr>
<td>Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of SRL actions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA vs. CN</td>
<td>1.23*</td>
<td>[1.02, 1.48]</td>
</tr>
</tbody>
</table>

Note. OR = parameterized odds ratio with effect coding; CI = confidence interval; PS = problem-solving; SRL = regulation of learning; CA = Canadian participants in the mixed pairs group; CN = Chinese participants in the mixed pairs group. The predicted orientation of action coded as 1 for individual orientation and 0 for social orientation. Code 1 over code 0 modeled as odds. The contrasts in this table were made following the GENMOD model statement with orientation of actions, or orientation of PS actions, or orientation of SRL actions.
as the predicted, and cultural identity, prior knowledge as the predictors. Type of action was also considered as a predictor when orientation of actions was the predicted.

*p < .05.

Figure 6.2: The effect of prior knowledge on orientation of actions depends on cultural identity in the mixed pairs group

It can be seen clearly from Figure 6.2 that the percentage of individually oriented actions for the Canadian participants nearly remained the same when they had high experience, medium experience, and low experience; however, this was not the case for the Chinese participants. They generated a higher proportion of individually oriented actions when they had high experience and a lower proportion of individually oriented actions when their prior knowledge was medium and low.
6.3.2 Differences between Chinese Participants and Canadian Participants with respect to Orientation of PS Actions

The middle panel of Table 6.8 reports the frequencies (Row Pct) of orientation of problem-solving (PS) actions within the mixed pairs group. It can be seen that the frequencies of 61.91% of individually oriented actions and 38.09% of socially oriented actions for the Canadian participants were close to the frequencies of 60.58% individually oriented actions and 39.42% socially oriented actions for the Chinese participants. A GLZ analysis showed that there was no significant difference between the Canadian and the Chinese participants with respect to orientation of PS actions, $\chi^2 (1, N = 3372) = 2.59, p = .1076, OR = 1.21$. Moreover, the effect of prior knowledge on orientation of PS actions was not significant, $\chi^2 (2, N = 3372) = 1.28, p = .5273$. However, the interaction between prior knowledge and cultural identity was significant, $\chi^2 (2, N = 3372) = 22.60, p < .0001$.

6.3.3 Differences between Chinese Participants and Canadian Participants with respect to Orientation of SRL Actions

Frequencies (Row Pct) of orientation of SRL actions within the mixed pairs group can be seen in the lower panel of Table 6.8. The percentage
of individually oriented actions (59.21%) was higher than that of socially oriented actions (40.79%) for the Canadian participants, whereas the difference between the two orientations was smaller for the Chinese participants (54.18% for individually oriented actions, 47.35% for socially oriented actions). A GLZ analysis revealed a significant difference between the Canadian and the Chinese participants, $\chi^2 (1, N = 3865) = 4.50, p = .0339$. The lower part of Table 6.9 reports the effect size of the test ($OR = 1.23$), indicating that the odds of individually oriented actions over socially oriented actions for the Canadian participants was 1.23 times the odds for the Chinese participants in the mixed pairs group. Moreover, the effect of prior knowledge was significant, $\chi^2 (2, N = 3865) = 8.70, p = .0129$. The effect of the interaction between cultural identity and prior knowledge was also significant, $\chi^2 (2, N = 3865) = 35.84, p < .0001$.

### 6.3.4 Summary of Results Pertaining to Research Question Two

In summary, Canadian participants were more individually oriented than their Chinese partners were in their contributions to dialog within the mixed pairs group. The Canadian participants were highly individually oriented in solving the problem; however, their Chinese partners also demonstrated a higher proportion of individually oriented actions. The difference between them disappeared with respect to orientation of PS
actions. In contrast, the difference between them was significant in orientation of SRL actions.

Moreover, the effects of prior knowledge in the mixed pairs group was a significant predictor of overall orientation of actions and orientation of SRL actions, but was insignificant as a predictor of orientation of problem solving actions. Furthermore, the effect of type of actions (PS vs. SRL) on orientation of action was not significant in the mixed pairs group. Finally, the effect of the interaction between cultural identity and prior knowledge was significant for overall orientation of actions, orientation of problem-solving actions, and orientation of SRL actions.

6.4 Differences in Orientation of Actions among Chinese, Canadian, and Mixed Pairs Group with Respect to Self-Regulatory Phases and Specific Types of SRL Actions

In this section, generalized linear models analyses were performed to analyze differences in frequencies of self-regulatory phases and of specific SRL actions (SRL strategies) among the Canadian, Chinese, and mixed pairs group. First, overall group differences among self-regulatory phases were scrutinized, followed by an examination of group differences across the three phases of self-regulated learning. Group differences in specific SRL actions (strategies) were then investigated. Finally, a summary of the
findings as they pertain to question three is provided at the end of the section.

### 6.4.1 Overall Differences in Orientation of Actions with Respect to SRL Phases

Frequencies (Row Pct) of orientation of action in three SRL phases are presented in Table 6.10. It can be seen from the last row of total frequencies (pooled over groups) that the percentage of individually oriented actions was highest in the performance phase (64.30%), followed by that in forethought phase (57.71%). However, in the reflection phase, the percentage of individually oriented actions accounted for only 27.91% of the actions produced.

Generalized linear models (GLZ) analysis detected significant main effects of differences among SRL phases (pooling over groups), \( \chi^2 (2, N = 11018) = 343.61, p < .0001 \). To investigate these differences further, two a priori planned contrasts were performed among successive SRL phases. Table 6.11 presents the results of significance tests, effect sizes, and their 95% confidence intervals of contrasts among SRL phases. The results showed that the forethought phase accounted for a significantly lower proportion of individually oriented actions compared to the performance phase, \( \chi^2 (1, N = 11018) = 14.53, p = .0001, OR = .72 \). The performance
phase consisted of a significantly higher proportion of individually oriented SRL actions than the reflection phase, \( \chi^2 (1, N = 11018) = 767.86, p < .0001, OR = 5.68. \)

Table 6.10: Frequencies (Row Pct) of Orientation of Actions by SRL Phases among Chinese, Canadian, and Mixed Pairs Group

<table>
<thead>
<tr>
<th>SRL phases</th>
<th>Forethought</th>
<th>Performance</th>
<th>Reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IND</td>
<td>SOC</td>
<td>IND</td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CACA</td>
<td>216</td>
<td>136</td>
<td>1765</td>
</tr>
<tr>
<td></td>
<td>(61.36)</td>
<td>(38.64)</td>
<td>(66.53)</td>
</tr>
<tr>
<td>CNCN</td>
<td>137</td>
<td>147</td>
<td>1195</td>
</tr>
<tr>
<td></td>
<td>(48.24)</td>
<td>(51.76)</td>
<td>(59.04)</td>
</tr>
<tr>
<td>CACN</td>
<td>212</td>
<td>131</td>
<td>1698</td>
</tr>
<tr>
<td></td>
<td>(61.81)</td>
<td>(38.19)</td>
<td>(66.15)</td>
</tr>
<tr>
<td>Total</td>
<td>565</td>
<td>414</td>
<td>4658</td>
</tr>
<tr>
<td></td>
<td>(57.71)</td>
<td>(42.29)</td>
<td>(64.30)</td>
</tr>
</tbody>
</table>

Note. CACN = a Canadian participant paired with a Chinese participant; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together; IND = individually oriented; SOC = socially oriented.
Table 6.11: Effect Sizes of Successive Differences between SRL Phases with respect to Orientation of Actions

<table>
<thead>
<tr>
<th>Contrast</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRL phases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forethought vs. performance</td>
<td>0.72*</td>
<td>[0.60, 0.85]</td>
</tr>
<tr>
<td>Performance vs. reflection</td>
<td>5.68*</td>
<td>[5.02, 6.42]</td>
</tr>
</tbody>
</table>

*Note. OR = parameterized odds ratio with effect coding; CI = confidence interval; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together. The predicted orientation of action coded as 1 for individual orientation and 0 for social orientation. Code 1 over code 0 modeled as odds. The contrasts in this table were made following the GENMOD model statement with orientation of action as the predicted, and group, SRL phases, pair nested in group, and Interaction between group and SRL phases as the predictors.

*"p < .05.

6.4.2 Differences in Orientation of Actions among Chinese, Canadian, and Mixed Pairs Group with respect to SRL Phases

GLZ analyses were performed to detect differences among Chinese, Canadian, and mixed pairs group in frequencies of individual versus social orientation of SRL actions within each of the three SRL phases (the frequencies are given in Table 6.10), and a priori planned contrasts were conducted. The results of significance testing of contrasts between the CA-CA vs. CN-CN groups, and between the CA-CN vs. CA-CA groups
with respect to orientation of action within each SRL phase are presented in Table 6.12. The results indicated that the preference for individually oriented actions in the *forethought phase* was stronger in the Canadian pairs than in the Chinese pairs, $\chi^2 (1, N = 979) = 5.81$, $p = .0160$, $OR = 1.78$. Moreover, the Canadian pairs also demonstrated stronger preference for individually oriented actions than did the Chinese pairs in the *performance phase*, $\chi^2 (1, N = 7243) = 15.31$, $p < .0001$, $OR = 1.45$. However, the preference for individually oriented actions in the *reflection phase* between the Canadian pairs and the Chinese pairs was insignificant, $\chi^2 (1, N = 2796) = 0.55$, $p = .4574$, $OR = 0.91$.

In the contrast between the Canadian pairs and the mixed pairs, there were no significant differences in the *forethought phase*, $\chi^2 (1, N = 979) = 0.52$, $p = .4695$, $OR = 0.86$, or in the *performance phase*, $\chi^2 (1, N = 7243) = 0.87$, $p = .3515$, $OR = 0.92$. In contrast, the preference for individually oriented actions in the reflection phase was stronger in the mixed pairs than in the Canadian pairs, $\chi^2 (1, N = 2796) = 8.86$, $p = .0029$, $OR = 1.45$. 
Table 6.12: Effect Sizes of Differences in Orientation of Actions between Chinese, Canadian, and mixed pairs group with respect to Specific SRL Phases

<table>
<thead>
<tr>
<th>Contrast</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forethought</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>0.86</td>
<td>[0.56, 1.31]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>1.78*</td>
<td>[1.11, 2.85]</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>0.92</td>
<td>[0.78, 1.09]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>1.45*</td>
<td>[1.20, 1.75]</td>
</tr>
<tr>
<td><strong>Reflection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>1.45*</td>
<td>[1.13, 1.84]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>0.91</td>
<td>[0.70, 1.18]</td>
</tr>
</tbody>
</table>

*Note. OR = parameterized odds ratio with effect coding; CI = confidence interval; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together. The predicted orientation of action coded as 1 for individual orientation and 0 for social orientation. Code 1 over code 0 modeled as odds. The contrasts in this table were made following the GENMOD model statement with orientation of action in the three phases as the predicted, and group, pair nested in group as the predictors. *p < .05.
6.4.3 Differences among Chinese, Canadian, and Mixed Pairs with Respect to Orientation of Specific SRL Actions

GLZ analyses were performed to investigate differences among Chinese, Canadian, and mixed pairs with respect to orientation of specific SRL actions, and the same pre-planned contrasts among groups were conducted as in the previous analysis. Table 6.13 presents frequencies of orientation for specific SRL actions for each of the three groups. Two cells for the summarization variable were zeros; therefore, this variable was excluded from further analysis. Group differences in orientation of each specific action were tested and the significant results are presented in Table 6.14. It can be seen that there were significant differences between the Canadian pairs and the Chinese pairs on five variables: clarification, $\chi^2 (1, N = 2144) = 7.72, p = .0055, OR = 1.53$; elaboration, $\chi^2 (1, N = 1547) = 7.55, p = .0060, OR = 1.86$; environment structuring, $\chi^2 (1, N = 206) = 7.85, p = .0051, OR = 3.33$; monitoring, $\chi^2 (1, N = 1269) = 5.38, p = .0204, OR = 1.54$; and motivation (i.e. interest, efficacy, and a sense of duty), $\chi^2 (1, N = 215) = 13.83, p = .0002, OR = 4.57$. All of these variables exhibited a greater preference for individual orientation by the Canadian pairs. There were no significant differences between the Canadian pairs and the mixed pairs on any specific actions.
Table 6.13: Frequencies of Orientation of SRL Actions across the Chinese, Canadian, and Mixed Pairs Group

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>CACA</th>
<th>CNCN</th>
<th>CACN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IND</td>
<td>SOC</td>
<td>IND</td>
</tr>
<tr>
<td>ADAP</td>
<td>32</td>
<td>58</td>
<td>13</td>
</tr>
<tr>
<td>CLAR*</td>
<td>553</td>
<td>239</td>
<td>347</td>
</tr>
<tr>
<td>ELAB*</td>
<td>305</td>
<td>187</td>
<td>188</td>
</tr>
<tr>
<td>ENVI*</td>
<td>45</td>
<td>18</td>
<td>35</td>
</tr>
<tr>
<td>HELP</td>
<td>142</td>
<td>70</td>
<td>127</td>
</tr>
<tr>
<td>LOCA</td>
<td>31</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>MONI*</td>
<td>354</td>
<td>148</td>
<td>206</td>
</tr>
<tr>
<td>MOTI*</td>
<td>37</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>NOTE</td>
<td>12</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>PRED</td>
<td>62</td>
<td>39</td>
<td>25</td>
</tr>
<tr>
<td>REVW</td>
<td>37</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>SATI</td>
<td>125</td>
<td>529</td>
<td>85</td>
</tr>
<tr>
<td>SEAR</td>
<td>202</td>
<td>154</td>
<td>196</td>
</tr>
<tr>
<td>SREV</td>
<td>122</td>
<td>159</td>
<td>121</td>
</tr>
<tr>
<td>SRGO</td>
<td>44</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>SRPL</td>
<td>135</td>
<td>98</td>
<td>87</td>
</tr>
<tr>
<td>SUMM</td>
<td>22</td>
<td>0</td>
<td>13</td>
</tr>
</tbody>
</table>
Table 6.14: Effect Sizes of Differences in Orientation for Contrasts among the Canadian, Chinese and Mixed Pairs Group with respect to Orientation of Specific SRL Actions

<table>
<thead>
<tr>
<th>Contrast</th>
<th>OR</th>
<th>95% CI</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Clarification</td>
<td></td>
<td>Monitoring</td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>0.91</td>
<td>[0.70, 1.19]</td>
<td>1.16</td>
<td>[0.82, 1.65]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>1.53*</td>
<td>[1.13, 2.08]</td>
<td>1.54*</td>
<td>[1.07, 2.20]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elaboration</td>
<td></td>
<td>Motivation</td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>1.04</td>
<td>[0.71, 1.53]</td>
<td>0.48</td>
<td>[0.22, 1.05]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>1.86*</td>
<td>[1.19, 2.88]</td>
<td>4.57*</td>
<td>[2.05, 10.19]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>structuring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CACN vs. CACA</td>
<td>0.97</td>
<td>[0.36, 2.67]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>3.33*</td>
<td>[1.44, 7.73]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. OR = parameterized odds ratio with effect coding; CI = confidence interval; CACN = a Canadian participant paired with a Chinese participant; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together; IND = individually oriented; SOC = socially oriented; ADAP = adaptation; CLAR = clarification; ELAB = elaboration; ENVI = environment structuring; HELP = help seeking; LOCA = locating where participants had been; MONI = monitoring; MOTI = motivation; NOTE = note-taking; PRED = prediction; REVW = review; SATI = satisfaction; SEAR = search information; SREV = self-evaluation; SRGO = learning goal; SRPL = learning plan; SUMM = summarization.
Chinese participants paired together. The predicted orientation of action coded as 1 for individual orientation and 0 for social orientation. Clarification, elaboration, environment structuring, monitoring, and motivation predictors coded as 1 for their emergence and 0 for disappearance. Code 1 over code 0 modeled as odds. The contrasts in this table were made following the GENMOD model statement with orientation of a specific SRL action in the as the predicted, and group as the predictors.

*p < .05.

6.4.4 Summary of Results Pertaining to Research Question Three

To summarize, the performance phase of SRL accounted for a higher proportion of individually oriented actions than the forethought phase, and the forethought phase accounted for a higher proportion of individually oriented actions than the reflection phase. There were significant differences in orientation of action between the Canadian pairs and the Chinese pairs in the forethought phase and the performance phase. No significant difference in orientation of action was found between the Canadian pairs and the Chinese pairs in the reflection phase.

However, there was a significant difference between the Canadian pairs and the mixed pairs in the reflection phase in which the mixed pairs showed a higher proportion of individual orientation than did the Canadian pairs. Analysis of differences between the Chinese and the Canadian participants in the mixed pairs group is the topic of the next section.

With respect to orientation of specific SRL actions, a large difference was found in orientation for motivation between the Canadian pairs and
the Chinese pairs (within the forethought phase). Significant differences also were found between the Canadian pairs and the Chinese pairs in: orientation of clarification, orientation of elaboration, orientation of environment structuring, and orientation of monitoring (within the performance phase). No significant differences between the Canadian pairs and the Chinese pairs were found in orientation of specific actions in the reflection phase.

6.5 Differences in Orientation of Actions in SRL Phases and Specific SRL Actions between Chinese Participants and Canadian Participants within the Mixed Pairs Group

In this section, generalized linear model analyses were performed to compare differences between Canadian and Chinese participants within the mixed pairs group. Differences between them with respect to orientation of action in SRL phases were first investigated, followed by an examination of cultural differences in specific SRL actions. A summary of the findings is provided at the end of this section.
6.5.1 Differences in SRL Phases between Canadian Participants and Chinese Participants in the Mixed Pairs Group

Table 6.15 shows the frequencies of orientation of action in three SRL phases for the Canadian and Chinese participants in the mixed pairs group.

Table 6.15: Frequencies (Row Pct) of Orientation of Actions by SRL Phases between Canadian and Chinese Participants in the Mixed Pairs Group

<table>
<thead>
<tr>
<th></th>
<th>Canadian</th>
<th></th>
<th>Chinese</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IND</td>
<td>SOC</td>
<td>IND</td>
<td>SOC</td>
</tr>
<tr>
<td>Forethought</td>
<td>131 (70.81)</td>
<td>54 (29.19)</td>
<td>81 (51.27)</td>
<td>77 (48.73)</td>
</tr>
<tr>
<td>Performance</td>
<td>882 (69.78)</td>
<td>382 (30.22)</td>
<td>816 (62.62)</td>
<td>487 (37.38)</td>
</tr>
<tr>
<td>Reflection</td>
<td>141 (28.20)</td>
<td>359 (71.80)</td>
<td>141 (30.99)</td>
<td>314 (69.01)</td>
</tr>
</tbody>
</table>

Note. IND = individually oriented; SOC = socially oriented.

It can be seen that the percentage of individually oriented actions in the reflection phase for Canadian participants (28.20%) was close to that for Chinese participants (30.99%); however, the percentages of individually oriented actions in the forethought phase (70.81%) and in the performance phase (69.78%) for Canadian participants were much higher.
than that for Chinese participants (51.27% and 62.62% respectively).

Analysis of variance results are presented in Table 6.16, where two significant effects between Canadian and Chinese participants can be seen in the forethought phase, $\chi^2 (1, N = 343) = 7.16, p = .0074, OR = 1.99$, and in the performance phase, $\chi^2 (1, N = 2567) = 4.01, p = .0453, OR = 1.27$. No difference was found between Canadian participants and Chinese participants in the reflection phase, $\chi^2 (1, N = 955) = 0.19, p = .6653, OR = 0.93$.

Table 6.16: Effect Sizes of Differences in Orientation between Canadians and Chinese in the Mixed Pairs Group with respect to a Specific SRL Phase

<table>
<thead>
<tr>
<th>Phase</th>
<th>Contrast: CA vs. CN</th>
<th>$OR$</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forethought</td>
<td></td>
<td>1.99*</td>
<td>[1.25, 3.16]</td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td>1.27*</td>
<td>[1.00, 1.61]</td>
</tr>
<tr>
<td>Reflection</td>
<td></td>
<td>0.93</td>
<td>[0.67, 1.29]</td>
</tr>
</tbody>
</table>

*Note. $OR =$ parameterized odds ratio with effect coding; CI = confidence interval; CA = Canadian participants in a pair; CN = Chinese participants in a pair. The contrasts in this table were made following the GENMOD model statement with orientation of action as the predicted, and cultural identity, prior knowledge, and their interaction as the predictors.

*p < .05.
Moreover, the effect of prior knowledge on orientation of action was significant in the reflection phase, $\chi^2 (1, N = 955) = 15.06, p = .0005$. The effect of interaction between cultural identity and prior knowledge was significant in the performance phase, $\chi^2 (2, N = 2567) = 11.96, p = .0025$, and in the reflection phase, $\chi^2 (2, N = 955) = 39.48, p < .0001$.

6.5.2 Differences Between Chinese and Canadian Participants within the Mixed Pairs Group in terms of Specific SRL Actions

Table 6.17 presents frequencies and percentages of individual and social orientation of specific SRL actions for both Canadian participants and Chinese participants in the mixed pairs group. The percentages of individual orientation were higher for most of the variables for the Canadian participants than they were for the Chinese participants; however, GLZ analyses showed significant effects only in monitoring. The proportion of individually oriented monitoring over socially oriented monitoring was much higher for Canadian participants than for Chinese participants, $\chi^2 (1, N = 435) = 4.00, p = .0454, OR = 1.91$.
Table 6.17: Frequencies (Row Pct) of Orientation by Specific SRL Actions between Canadians and Chinese in the Mixed Pairs Group

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Canadian IND</th>
<th>Canadian SOC</th>
<th>Chinese IND</th>
<th>Chinese SOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADAP</td>
<td>13 (33.33)</td>
<td>26 (66.67)</td>
<td>15 (48.39)</td>
<td>16 (51.46)</td>
</tr>
<tr>
<td>CLAR</td>
<td>287 (69.16)</td>
<td>128 (30.84)</td>
<td>240 (65.93)</td>
<td>124 (34.07)</td>
</tr>
<tr>
<td>ELAB</td>
<td>221 (67.79)</td>
<td>105 (32.21)</td>
<td>203 (56.86)</td>
<td>154 (43.14)</td>
</tr>
<tr>
<td>ENVI</td>
<td>18 (78.26)</td>
<td>5 (21.74)</td>
<td>17 (65.38)</td>
<td>9 (34.62)</td>
</tr>
<tr>
<td>HELP</td>
<td>58 (73.42)</td>
<td>21 (26.58)</td>
<td>67 (77.01)</td>
<td>20 (22.99)</td>
</tr>
<tr>
<td>LOCA</td>
<td>8 (61.54)</td>
<td>5 (38.46)</td>
<td>14 (60.87)</td>
<td>9 (39.13)</td>
</tr>
<tr>
<td>MONI</td>
<td>175 (77.78)</td>
<td>50 (22.22)</td>
<td>141 (67.14)</td>
<td>69 (32.86)</td>
</tr>
<tr>
<td>MOTI</td>
<td>31 (75.61)</td>
<td>10 (24.39)</td>
<td>10 (25.64)</td>
<td>29 (74.36)</td>
</tr>
<tr>
<td>NOTE</td>
<td>5 (55.56)</td>
<td>4 (44.44)</td>
<td>9 (60.00)</td>
<td>6 (40.00)</td>
</tr>
<tr>
<td>PRED</td>
<td>11 (68.75)</td>
<td>5 (31.25)</td>
<td>19 (70.37)</td>
<td>8 (29.63)</td>
</tr>
<tr>
<td>REVW</td>
<td>23 (82.14)</td>
<td>5 (17.86)</td>
<td>12 (75.00)</td>
<td>4 (25.00)</td>
</tr>
<tr>
<td>SATI</td>
<td>60 (19.74)</td>
<td>244 (80.26)</td>
<td>52 (18.91)</td>
<td>223 (81.09)</td>
</tr>
<tr>
<td>SEAR</td>
<td>58 (51.79)</td>
<td>54 (48.21)</td>
<td>89 (51.45)</td>
<td>84 (48.55)</td>
</tr>
<tr>
<td>SREV</td>
<td>68 (43.31)</td>
<td>89 (56.69)</td>
<td>74 (49.66)</td>
<td>75 (50.34)</td>
</tr>
</tbody>
</table>
CULTURALLY SITUATED SELF-REGULATION

<table>
<thead>
<tr>
<th>SRGO</th>
<th>20 (74.07)</th>
<th>7 (25.93)</th>
<th>17 (60.71)</th>
<th>11 (39.29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRPL</td>
<td>80 (68.38)</td>
<td>37 (31.62)</td>
<td>54 (59.34)</td>
<td>37 (40.66)</td>
</tr>
<tr>
<td>SUMM</td>
<td>18 (100.00)</td>
<td>0 (0.00)</td>
<td>5 (100.00)</td>
<td>0 (0.00)</td>
</tr>
</tbody>
</table>

Note. IND = individually oriented; SOC = socially oriented; CA = Canadian participant in a pair; CN = Chinese participant in a pair; ADAP = adaptation; CLAR = clarification; ELAB = elaboration; ENVI = environment structuring; HELP = help seeking; LOCA = locating where participants had been; MONI = monitoring; MOTI = motivation; NOTE = note-taking; PRED = prediction; REVW = review; SATI = satisfaction; SEAR = search information; SREV = self-evaluation; SRGO = learning goal; SRPL = learning plan; SUMM = summarization.

6.5.3 Summary of Results to Research Question Four

In summary, comparisons between Canadian and Chinese participants in the mixed pairs group demonstrated that there were significant differences in orientation of action in the forethought phase and in the performance phase with a higher proportion of individually oriented actions for Canadian participants. In addition, Canadian participants revealed preference to individual orientation in Monitoring in comparison to Chinese participants.
6.6 Qualitative Evidence of Individually and Socially Oriented Self-Regulated Learning in the Canadian Pairs Group, Chinese Pairs Group, and Mixed Pairs Group

In this section, we provide qualitative evidence of cultural differences in terms of individually oriented and socially oriented self-regulated learning. Differences between the Canadian pairs group and Chinese pairs group will be explored first, followed by an investigation of the differences between Canadian participants and Chinese participants in the mixed pairs group. We present a summary of the qualitative evidence at the end.

6.6.1 Differences between the Canadian Pairs Group and the Chinese Pairs Group with regard to Orientation of Self-Regulated Learning

To illustrate the different interaction patterns found in self-regulated learning actions between the Canadian pairs group and the Chinese pairs group, one Canadian pair (VIC and JON) and one Chinese pair (JAC and TIN) were selected from the thirty pairs for further investigation. Examples of dialog between the students are given for self-regulatory actions in the forethought phase and the performance phase, but examples in the reflection phase were omitted because no significant differences were
found between the two cultural groups in terms of the phase or specific SRL actions.

In the forethought phase, Canadian pairs appeared to prefer to express freely their own unique feelings, ideas, or opinions when they wanted to do something, even if these ideas were incorrect or were against the wishes of their partners. The following is an episode in the forethought phase selected from the pair of VIC and JON.

**VIC:** *I hope to read the introduction first.*

**JON:** *I don’t know what the score model is.*

**JON:** *It’s interesting to read this first.*

**JON:** *Let’s look at the score model.*

**VIC:** *Ok.*

In this episode, VIC set up his own plan to obtain an overview of the learning material and assumed that his partner would accept his motion. The real goal of his partner was unknown. Therefore, this was an individually oriented planning action. However, his partner, JON, did not agree with this plan. In fact, JON was concerned about the theory of score models at this point in time. Therefore, instead of accepting his partner’s motion, JON expressed his own concern “I don’t know what the score model is” and assumed that VIC would understand his situation. This was an individually oriented self-monitoring action. Then, he expressed his
feeling of interest to further persuade his partner. This was an individually oriented motivating action. Next, he suggested reading the score model first according to his interest and choice. This was an individually oriented planning action.

In contrast, when the Chinese participants set their goals and made their plans in the forethought phase, they appeared to have supposed that the opinions of their partners may be equally or more important than their own, or that it would not be easy to persuade others to follow their own goals or actions. Therefore, it was important for them to seek their partners’ opinions when they wanted to do something even if their partner thought it was unnecessary. The following is an example of dialog in the forethought phase selected from the Chinese pair, JAC and TIN.

JAC: *Ok, so, is there any time constraint for our learning?*

TIN: *Eighty minutes.*

JAC: *So we have a task to do.*

JAC: *Do you want to make this clear?*

TIN: *Ok.*

TIN: *Let's go through this first.*

In this episode, JAC and TIN started their planning by investigating the affordance and constraints first. Instead of proposing a motion directly, JAC asked whether there was a time constraint so that they could
accommodate the demands of the learning task designed by the researcher. This was a socially oriented self-monitoring action. Then, TIN clarified the situation by answering: "eighty minutes" to respond to JAC's request. This was a socially oriented clarification action. Next, JAC express his feeling of duty: "we have a task to do". This was an action of socially oriented motivation. To fulfill the duty, JAC asked whether his partner intended to make the problem description clearer. In fact, JAC wanted to read the problem description again. However, he did not propose this motion directly because he assumed that this might be against TIN's will. Therefore, TIN's opinion should be asked first before he tried to do so. This was a socially oriented planning action. TIN recognized JAC's intent and proposed a motion: "let's go through this first" to address JAC's concern. This was a socially oriented planning action.

In the performance phase, conflicts between participants may become serious if one participant wants to continue reading while his partner is not interested in it at all. In such cases, individually oriented actions would be more likely. This especially was the case in the Canadian pairs group. The following is an example selected from the dialog of the Canadian pair consisting of JON and VIC.

VIC: This is the definition of mean square.
VIC: *This is sum of square divided by degree of freedom, I learned in my class.*

JON: *We don’t have to know this because we don’t have it in our problem.*

VIC: *Ok, so, I mean this is very helpful to answer our questions.*

VIC: *We now copy these things.*

JON: *Click the next topic.*

VIC: *Wait a minute.*

In this episode, VIC began by clarifying and elaborating his understanding of the concept of mean square on the Tutor. These two utterances are individually oriented actions of clarification and elaboration because they mainly relied on his own interest or his prior knowledge.

JON monitored his memory and found no need to know the concept. This monitoring focused on his own internal mental activity, and thus, it was individually oriented. However, VIC monitored his own knowledge and believed that this was helpful. Again, VIC monitored his learning activity based on his own understanding and interest. Therefore, it was an individually oriented monitoring action. Then, VIC suggested copying the definition of the concept that he believed helpful. This was individually oriented note-taking. Next, JON was uninterested in reading this part and suggested changing to a new topic. This was an individually oriented
information searching action because JON mainly depended on his own interest to make the decision. Finally, VIC said, "Wait a minute." This was an action of individually oriented environment structuring because VIC could focus on improvement of his own understanding in doing so.

Although conflicts also occurred frequently for the Chinese pair in the performance phase, they were more likely to accommodate each other in solving their problems. The following is an example selected from the dialog of a Chinese pair, JAC and TIN.

JAC: I can't remember the number (p value) should be a bigger one or a smaller one.

TIN: Oh, I can't remember too.

TIN: So let's check it.

TIN: Specifying ANOVA, right?

JAC: Hm.

TIN: Show task help, right?

In this episode, JAC stated his difficulty in understanding the concept of p value and felt that this may be a barrier to write their joint report. Instead of directly asking for help, he chose to express his concern. Therefore, this was a socially oriented help-seeking action. Next, TIN monitored his memory to address JAC’s concern, but he did not remember either. This was a socially oriented action of self-monitoring. Then, TIN put
forward a motion to check it on the Tutor to make clear the concept that they did not understand. This was a socially oriented planning action. When they needed to select a topic to search for the relevant information, TIN assumed that his click on a topic might be against JAC’s desire. Therefore, he chose to ask JAC for his opinion first. This was a socially oriented searching action. After JAC responded, Tin continued to ask opinions from his partner to maintain his searching activity.

6.6.2 Differences in Orientation of Self-Regulated Learning between Chinese Participants and Canadian Participants within the Mixed Pairs Group

In the mixed pairs group, the Canadian participants also appeared to demonstrate stronger preference for individually oriented self-regulated learning actions, even if they had less knowledge than their partners did about the topic. In contrast, the Chinese partners maintained a profile of socially oriented self-regulated learning even if they had more knowledge about the topic than their partners did. The following excerpt (see Appendices E and F for the codes) is selected from the dialog of a mixed pair in which both participants had taken statistics courses before, but PAK, the Canadian partner, had taken a statistics course several years
ago whereas YUW, the Chinese partner, had taken a statistics course recently.

PAK: *So the degree of freedom is two, here.* [ICLAR]

PAK: *So the number of groups minus one?* [SSREV]

YUW: *The number of independent terms is that one so.* [SCLAR]

PAK: *So three minus one, yeh?* [SSREV]

YUW: *No, ten.* [ISREV]

PAK: *Ten?* [ISREV]

PAK: *But I saw the degree of freedom here was two.* [ISREV]

YUW: *Oh, that's fine.* [SADAP]

YUW: *Oh, yeh, we groups, we have three groups.* [SCLAR]

PAK: *The number of groups, ok.* [SCLAR]

PAK: *Reads: the number of independent terms +...* 

PAK: *Reads: a mean square is a variance +...* 

PAK: *Reads: a large F ratio indicates a large effect +...* 

PAK: *The larger is good or bad?* [IHELP]

YUW: *I think it's good.* [SELAB]

YUW: *I mean, I think a larger F indicates that the factor was effective.* [SELAB]

YUW: *So the larger F indicates the material was good, was important.* [SELAB]
CULTURALLY SITUATED SELF-REGULATION

YUW: *That's what we know about this topic.* [SELAB]

PAK: *Ok, so.* [SSATI]

In this episode, PAK started the dialog by clarifying his understanding of the concept of degrees of freedom. This was an individually oriented action of clarification because this action did not address any of his partner’s concerns. Then he evaluated his understanding by inviting opinions from his partner. This was a socially oriented evaluation. Then, YUW responded to the invitation and clarified the concept further. This was a socially oriented clarification action. After he had received a positive response from YUW, PAK continued his socially oriented evaluation by saying “*So three minus one, yeh?*” At this time, YUW responded negatively on the basis of his own understanding. This was an individually oriented evaluation action. “*Ten?*” PAK questioned. Obviously, PAK doubted the feedback from his partner, and began to evaluate the situation on the basis of his own standard. This was also an individually oriented evaluation action. Next, he provided evidence for his own evaluation. Then, YUW acknowledged his mistake and adapted himself to PAK’s perspective. This was a socially oriented adaptation action.

Moreover, YUW also clarified the reason why such an adaptation action was needed. This was a socially oriented clarification because this action tried to fit PAK’s perspective. This was confirmed by PAK’s further
clarification, which was also socially oriented. PAK then read the text until
he was confused by another concept (i.e. the F statistic). Instead of asking
whether his partner knew this concept, PAK directly sought help from
YUW: *The larger F value was good or bad?* to address his concern.
Therefore, it was an individually oriented help-seeking action. This was
responded to with a sequence of socially oriented elaboration actions from
YUW, who provided some useful information from his prior knowledge to
help PAK out.

As can be seen from this episode, PAK focused more on his own
understanding and expressed himself more freely, whereas YUW
performed more attempts to fit the needs and perspectives of his partner.

### 6.6.3 Summary of the Qualitative Evidence

In summary, participants in the Canadian pairs group demonstrated a
profile of individually oriented self-regulated learning whereas participants
in the Chinese pairs group revealed stronger preference for socially
oriented self-regulated learning. This pattern was largely replicated in the
mixed pairs group, where Canadian participants were more likely to
express themselves freely and directly than were their Chinese partners.
6.7 Group Differences with respect to Quality of Solutions

In the last section of this chapter, we explore whether significant differences occur among Canadian pairs group, Chinese pairs group, and the mixed pairs group with respect to quality of solutions. A generalized linear models analysis was performed on the total correct answers generated during problem solving by the pairs in the mixed pairs group, the Canadian pairs group, and the Chinese pairs group. As shown in Table 6.18, frequencies in the three groups were approximately equal. A GLZ analysis showed that there were no significant differences among the three groups, \( X^2 (2, N = 159) = 3.43, p = .1803 \), \( R^2 = .001 \), \( 1-\beta = .07 \). Effect sizes of group contrasts are given in Table 6.19.

Table 6.18: Frequencies (Pct) of Correct Answers in Each Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACN</td>
<td>54</td>
<td>33.96</td>
</tr>
<tr>
<td>CACA</td>
<td>52</td>
<td>32.70</td>
</tr>
<tr>
<td>CNCN</td>
<td>53</td>
<td>33.33</td>
</tr>
</tbody>
</table>

Note. CACN = a Canadian participant paired with a Chinese participant; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together. The predicted orientation of action coded as 1 for individual orientation and 0 for social orientation. Code 1 over code 0 modeled as odds.

*p < .05.
Table 6.19: Effect Sizes of Differences in Solutions to the Prescribed Problem between the Canadian Pairs Group, the Chinese Pairs Group and the Mixed Pairs Group

<table>
<thead>
<tr>
<th>Contrast</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACN vs. CACA</td>
<td>1.13</td>
<td>[0.97, 1.31]</td>
</tr>
<tr>
<td>CACA vs. CNCN</td>
<td>0.99</td>
<td>[0.86, 1.16]</td>
</tr>
</tbody>
</table>

*Note. OR = parameterized odds ratio with effect coding; CI = confidence interval; CACN = a Canadian participant paired with a Chinese participant; CACA = two Canadian participants paired together; CNCN = two Chinese participants paired together.

*p < .05.
Chapter 7 - Discussion

The purpose of this study was to explore how contexts, especially socio-cultural contexts, frame SRL differently. In agreement with our research design, participants learned statistics in Canadian pairs, Chinese pairs, or Canadian-Chinese mixed pairs with the help of the McGill Statistics Tutor. As a result, cultural differences between Canadian pairs and Chinese pairs largely replicated those between Canadian participants and Chinese participants in Canadian-Chinese mixed pairs. We will discuss these results in detail in this chapter. We begin by talking about the results in relation to the specific research questions that were addressed in this study. This is followed by an examination of the results from the perspective of how they reflect the effects of the particular contexts studied and the cultural backgrounds of the participants in this study. Finally, conclusions are offered with respect to the contributions and limitations of the study, and implications for future research are given.

7.1 Discussion of the Research Questions

Four research questions will be discussed in this section:
1. Are there differences in the orientation of actions among the Canadian pairs group, the Chinese pairs group, and the mixed pairs group?

2. Are there differences in the orientation of actions between Canadian and Chinese partners within the mixed pairs group?

3. Are there differences in SRL learning phases and specific SRL strategies (regulatory actions) employed between the Canadian pairs group, the Chinese pairs group, and the mixed pairs group?

4. Are there differences in SRL learning phases and specific SRL strategies between partners in the mixed pairs group?

7.1.1 Research Question One: Cultural Construal of the Self and Orientation toward Actions in Social Contexts of Learning

As many social psychologists studying cultural differences have observed (e.g. Yang, 1995; Plaut & Markus, 2005; Heine, 2007), one’s construal of self is a product of one’s culture. These psychologists (e.g. Triandis, 1972; Markus, & Kitayama, 1991; Yang, 1995; Schooler, 1990) have argued that there are roughly two distinct types of cultures: individualistic cultures and collectivistic cultures, and these are thought to frame people’s self-construal in different ways.
In their view, people who grow up in individualistic cultures are encouraged to live independent lives and to be the authors of their own destiny. As a result, they become motivated to perceive themselves as independent agents who have the power to control the contexts around them. Self-regulation, self-determination, self-motivation, and self-fulfillment come to be viewed as ideal ways of living. In contrast, people who are brought up in collectivistic cultures are encouraged to live interdependent lives and to contribute to the benefit of a harmonious society. As a result, they learn to be attentive to the perspectives and expectations of authoritative others who represent positive role models of how to contribute to the efficiency and benefits of particular concerned groups, and they come to view contribution to harmonious interpersonal relationships and to the well-being of the group as ideal ways of living.

Consistent with these differences in cultural construal of self, in this study it was expected that students in the Canadian pairs group, which were composed of pairs of students who are both representative of people from a relatively individualistic Western culture, would prefer to learn in a manner of their own choice and demonstrate a high proportion of individually oriented actions. In contrast, it was expected that students in the Chinese pairs group, which was made up of pairs of students who are representative of people from a relatively collectivistic Eastern culture,
would prefer to learn in a manner consistent with the “authoritative”
problem descriptions provided by the computer tutor and show a higher
proportion of socially oriented actions in interacting with their partners.

The results were consistent with these predictions. First, analysis of
data obtained from tutor logs that recorded the student pairs’ use of the
McGill Statistics Tutor revealed that, in comparison to students in the
Chinese pairs group, students in the Canadian pairs group investigated
significantly more topics that were optional learning tasks, and significantly
fewer topics that were required learning tasks (which were prescribed in
the problem description). This result can be interpreted as evidence that
students’ learning in the Canadian pairs group was more likely to be
guided by their individual interests and self-discovery. In contrast,
students’ learning in the Chinese pairs group was more likely to be guided
by rules and topics prescribed by the learning activity or by suggestions of
authoritative others (i.e., the authors of the computer tutor).

Second, analysis of the discourse transcripts revealed that the
student pairs in the Canadian pairs group showed a significantly higher
proportion of individually oriented actions than those in the Chinese pairs
group. This result was found both when the student pairs were engaged in
solving problems and when they were engaged in learning statistical
principles while using the McGill Statistics Tutor. These results provide
evidence that students working in pairs in the Canadian pairs group tended to favour individual modes of learning and problem solving wherein they could shape the context in which they were working and control their own individual actions. In contrast, students working in pairs in the Chinese pairs group favoured social modes of learning and problem solving in which they were more responsive to the expectations of their partners in both their collaborative and individual actions.

Potential confounding variables in the study included differences associated with gender, age, education level, and language. These variables were effectively controlled with a random assignment procedure. Analysis of group differences in these variables provided evidence that they were adequately controlled in this study. Moreover, effects of differences in participants’ prior knowledge and in two types of actions (PS or SRL), and effects of local non-independence (i.e., correlation) among individual responses (which were repeated measures) were taken into account when contrasts were made among groups. Therefore, evidence supports the conclusion that the observed group differences may be attributed to differences in the participants’ previous experiences in the culture within which they were brought up.

These results are consistent with the predictions of this study concerning the overall social or individual orientation of the students’
actions in the learning situations studied and are consistent with the research literature on cultural differences in motivation (Iyengar & Lepper, 1999; Heine, 2007; Yu & Yang, 1994), cognition (Nisbett, Peng, Choi, & Norenzayan, 2001; Norenzayan, Choi, & Peng, 2007), and metacognition (Eaton & Dembo, 1997). In this body of work, researchers have claimed that differences between ways of living and learning within collectivistic cultures (such as those in Korea, Japan, China and India) as compared to individualistic cultures (such as those in the United States and Canada) are associated with differences in types of motivation, cognition and metacognition.

In this study, comparisons also were made that focused on the mixed pairs group. It was expected that pairs of students in the mixed pairs group would be likely to function in a manner similar to those in the Canadian pairs group since the participants in both the Canadian and mixed pairs group were learning in the context of a Canadian university lab in which learning activities were implicitly guided by the norms prevalent in Canadian academic culture. Most of the Chinese participants in this study had lived in Canadian universities for at least three years, during which time they had many opportunities to learn prevailing Canadian customs and approaches to education and learning from their Canadian classmates as well as their teachers. Thus, the student pairs working in the mixed
pairs situations were expected to display orientations and actions that were similar to those found in the Canadian pairs group.

This assumption was supported by results from analysis of the discourse data, which indicated that the proportion of individually oriented actions vs. socially oriented actions in the mixed pairs group was very similar to that found in the Canadian pairs group. This result was found for overall orientation of action, for orientation of problem-solving actions, and for orientations of SRL actions.

However, analysis of the learning activities of the groups (as reflected in their records of their use of the McGill Statistics Tutor) indicated that the mixed pairs group demonstrated a pattern that was similar to that of the Chinese pairs group. Like the participants in the Chinese pairs group, the participants in the mixed pairs group revealed a higher proportion of learning actions while using the tutor that focused on the required tasks, and a lower proportion of actions in learning related to the optional tasks. That is to say, they learned in a way that was compatible with suggestions made in the problem description. One explanation of this result may be that the freedom of the Canadian participants in selecting optional topics may have been limited by the concerns of their Chinese partners (such as concern with time constraints for their learning).
Despite these differences, it is important to emphasize that more than forty percent of the actions that occurred in the Canadian pairs group in this study were socially oriented actions, although this proportion was smaller than that of students in the Chinese pairs group. The significant presence of socially oriented actions in all groups reveals that it is necessary to incorporate socially orientated actions into SRL models. Otherwise, these models will continue to explore incomplete accounts of self-regulated learning as it occurs in social situations, and will be inappropriate as guides for educational reforms that increasingly emphasize more collaborative, problem-based, and group-oriented classroom practices. For example, if SRL models do not place as much emphasis on socially oriented actions, the performance of the participants in the Canadian pairs group would not be easy to explain since it would be thought of merely as less self-regulated instances of SRL.

The consequences of the traditional view are particularly problematic in multicultural classroom situations that often include students who come from minority cultures in which interdependent ways of living are favoured. In the traditional sense of self-regulated learning, these minority students might be criticized by a teacher as less self-regulated because they tend to learn in a way that is different from what would be expected in a traditional teacher’s conception of learning and instruction. However, from
the viewpoint of a socially situated theory of self-regulated learning, both socially oriented actions and individually oriented actions are necessary within most contexts of learning and activity within people’s lives. In some contexts, such as that of the Chinese pairs group in this study, participants learn in a predominately socially oriented collaborative environment, whereas in other contexts, such as that of the mixed pairs group in our study, the participants learn in social environments that are relatively more independently oriented. What kind of orientation is favoured largely depends on participants’ perceptions of the subjective social contexts around them, which will be further discussed in the following sections of this chapter.

7.1.2 Research Question Two: Cultural Construal of Self and Orientation toward Actions in Social Contexts Involving Cross-Cultural Collaboration

People who have been brought up in individualist or collectivist cultures are likely to have acquired a dominant preference and expectation for an individual orientation or a social orientation for actions in their lives, and this preference will tend to be supported or validated by the contexts that surround them. Over time, people perform actions in ways that are unconsciously accommodated to the cultural affordances of these contexts (Yang, 1995; Nisbett, et al., 2001).
When people encounter individuals from other cultures in new situations, they may become aware of aspects of other individuals that demand adjustments in their ways of acting and interacting. However, they still may be constrained by their original habits and preferences, which usually function in an implicit way, and their performance may often remain clothed with the colour of their own home culture. Nevertheless, the framing effect of their home culture in such a new situation may not be as strong when they work with people from a similar cultural background. Thus, in the learning situations employed in the present study, one would expect the actions of the mixed pairs group as a whole to be similar to those of the Canadian pairs group; however, within the mixed pairs group cultural differences would still be likely to occur at least to some extent.

The cultural differences that might occur would greatly depend on how the conventions of the learning activity are defined. If the learning rules of an individualistic culture were greatly emphasized, one would not expect to see many cultural differences in the mixed pairs group. However, this was not the case in the present study in which all participants were given the freedom to learn in a manner of their own choice. The only constraint on their performance came from their partners with whom they needed to negotiate to accomplish their collaboration in learning and solving the problem tasks. Consequently, we would expect that different
preferences of the members of a pair defined by their home cultures could still be observed in their negotiation processes during learning over the course of the problem solving session.

This claim is supported by the results of this study. When Canadian participants and Chinese participants learned together in culturally-mixed pairs, they each maintained patterns in their own learning orientations that were associated with their respective home cultures. The Canadian participants demonstrated a significantly higher proportion of individually oriented actions as compared to their Chinese collaborators in the mixed pairs group, both in overall orientation of actions and in orientation of SRL actions, although the effect sizes of the differences were smaller than those found in the comparisons between the Canadian and Chinese pairs group.

The results showed that there was no significant difference in orientation of problem-solving actions between the Canadian and Chinese participants in the mixed pairs group, although the Canadian participants showed a slightly higher proportion of individually oriented actions than did the Chinese participants. This might be due to the nature of the problem-solving task used in the experiment. When participants focused on problem solving, they may have tended to try their best to express their own unique ideas in writing the group report. Thus, the participants
needed to debate the contents of their report with their partner. Moreover, they were more likely to be constrained by such debates in writing their report, than in learning using the Tutor because an inappropriate answer in their report would decrease the score of the group.

It may be that as their debates became more intense, more individually oriented actions would be produced. Therefore, we might expect that both partners in the mixed pairs group would produce more individually oriented actions, and the difference between them would be less in their problem solving. However, this pattern was not found in the Chinese pairs group, in which two Chinese participants routinely built on each other’s contributions in solving problem tasks, and both Chinese participants showed a higher proportion of socially oriented actions.

7.1.3 Research Question Three: Cultural Construal of the Self and Differences in Learning Strategies between Cultural Groups

The two kinds of self-construal may also be reflected differently in the different phases of self-regulated learning and in the employment of specific social or individual learning strategies (i.e., SRL actions). This issue will be examined in this section, beginning with a discussion of the phases of SRL that were defined by Zimmerman in his social cognitive theory (Zimmerman, 2008a). Zimmerman’s theory is important in this
context because it helps to understand the potential demands imposed by particular phases of self-regulation during learning on the orientation of participants’ actions. Next, results pertaining to the overall performance of the participants in the three phases of SRL will be discussed. Group differences in specific phases of SRL will be explored in the context of differences in the cultural construal of the self, and group differences in the employment of specific learning strategies will be considered. Finally, the issue of how to interpret group differences from the perspectives of other theoretical approaches will be addressed at the end of this section.

According to Zimmerman (2006), a forethought phase in SRL is a phase in which people prepare to perform at a desired level. In this phase, people analyze the learning tasks, set goals, make plans, and motivate themselves to succeed in learning. Interest, self-efficacy, and mastery goals are believed to be the major driving factors in learning. Such motivational beliefs and strategic planning then lead to self-observed and self-controlled implementation of strategies in a performance phase. Finally, people adjust their strategies in a reflection phase in which a feeling of satisfaction or dissatisfaction leads to increases or decreases of future applications of a specific strategy.

In social settings, a feeling of satisfaction, attribution, and evaluation during the reflection phase is likely to be influenced by feedback from
others. People often need to validate or invalidate their thinking by resorting to responses of others. For example, when a participant Lee clarified his understanding of the text or performed an action, his partner often said, “Ok,” “Good,” or “Fantastic.” Thus, both of them generate a feeling of satisfaction. When Lee tried to evaluate his work, he usually said, “Can I write like this?” or “Does ANOVA mean analysis of variance?” In this way, Lee invited evaluation of his work by others. These examples illustrate how reflection is a phase in which a large number of socially oriented actions may be likely to occur.

However, in a forethought or performance phase, an action such as setting a goal, making a plan, or searching for new information may be greatly influenced by one’s own interest or intention. For example, when setting his learning goal, the participant Tom said, “I learned significance test in my class. So I want to learn more knowledge for the score model task.” Thus, individually oriented actions may be prevalent in these two phases. These predictions were supported in the current study when differences between SRL phases in frequencies of participants’ responses were tested statistically. The proportions of individually oriented actions in the forethought and performance phases were four to five times that found in the reflection phase.
It was also observed that participants produced significantly higher proportions of individually oriented actions in the performance phase than in the forethought phase. In the forethought phase, employment of strategies such as goal setting, planning, or motivating may be negotiable between participants; in the performance phase, however, conflicts between participants have the potential to become serious if one participant wants to shift away from the current topic whereas the partner prefers to stay, or one participant elaborates his/her understanding through retrieving information from his/her prior knowledge whereas the partner does not. In such cases, individually oriented actions would be more likely.

Although students generated large numbers of individually oriented actions in both cultural groups in the forethought and performance phases, the extent of individual orientation of action in self-regulatory phases may also be moderated by cultural groups. Such an effect would show up as an interaction between cultural groups and SRL phases. This assumption was supported in this study by the finding that the interaction between groups and self-regulatory phases was statistically significant. The results showed that the proportions of individually oriented actions in the forethought and performance phases of the Canadian pairs group were much larger than those in the Chinese pairs group. This difference may
indicate that in these two phases of self-regulation, differences in cultural construal of self may play a significant role in differentiating participants’ orientation of actions.

Five specific learning strategies (i.e. clarification, elaboration, monitoring, motivation, and environment structuring) were significant in differentiating cultural groups in agreement with research hypotheses. For the use of many other learning strategies, the proportions of individually oriented actions were higher in the Canadian pairs group than in the Chinese pairs group; however, there were no statistically significant differences found in these strategies between the two groups. This result might be due to low frequencies of some specific strategies. If participants had learned over a longer period, or if more pairs were included in the samples, frequencies in these cells might increase to the extent to which statistical power would be large enough to detect small differences.

Traditionally, socially oriented self-regulatory strategies are not considered in SRL research. Thus, only individually oriented strategies are considered as promoting one’s learning performance. If the results of this study were interpreted according to this tradition, one would say that the Chinese participants in this study were less self-regulated across most learning strategies and in all phases of self-regulation. Such a conclusion also would be in agreement with the results of most cross-cultural studies.
CULTURALLY SITUATED SELF-REGULATION

in SRL in which researchers have claimed that students in collectivistic cultures are less self-regulated in the use of most learning strategies except memorization (e.g. Purdie & Hattie, 1996; Salili, Tong, & Tabatabai, 2001).

As commented previously in subsection 2.3.1, this characterization of self-regulation is likely to be an effect of the narrow definition of SRL. If this limited view continues to dominate our thinking in SRL research, researchers might confine themselves to individual action rather than including the many kinds of situated, collaborative and interactive social activity that occurs within the more complex socio-cultural contexts.

7.1.4 Research Question Four: Self-Construal and Learning Strategies in Situations of Collaboration with Individuals from Other Cultures

The two kinds of self-construal in individualistic and collectivistic cultures may also be generalized to see how they apply to a situation in which people from two cultures learn together. In such mixed cultural situations, a student may produce learning actions and learning strategies in ways that are unconsciously accommodated or adapted to the respective cultural preferences of their partners. Moreover, awareness of the different cultural identity of their partners also may change their conventional way of learning to some extent.
It was expected that the Canadian participants would display a higher proportion of individually oriented actions in distinct phases of self-regulated learning than the Chinese participants when they learned together in pairs in the mixed pairs group condition. This assumption was supported by the results of the study. Significantly higher proportions of individually oriented actions were found in the forethought and performance phases for the Canadian participants than for their Chinese partners. However, as was found when comparisons were made between the Canadian pairs group and the Chinese pairs group, the comparison between Canadian participants and Chinese participants within the mixed pairs group generated no significant effect in the reflection phase of SRL.

Students’ use of specific learning strategies (SRL actions) also showed evidence that the Canadian participants produced a higher proportion of individually orientated actions in monitoring than did Chinese participants when they learned together in the mixed pairs group. The Canadian participants monitored themselves frequently, whereas Chinese participants monitored their Canadian partners more frequently than themselves.

In the analysis at the group level, frequencies of orientation of four strategy variables (i.e. clarification, elaboration, environment structuring, and motivation) were statistically significant in differentiating the Canadian
pairs group from the Chinese pairs group. However, frequencies of orientation were not statistically significant in distinguishing Canadian participants from Chinese participants within the mixed pairs group (although Canadian participants still generated a higher proportion of individually oriented strategies).

This lack of significance may have been caused by lack of power due to the smaller samples in the second analysis. There were only ten pairs in the mixed pairs group and these pairs learned for only one hour in the experiment; as a result, lower frequencies were observed for these four variables, as well as other variables. Including more participants or observing a longer period of learning might enable the detection of statistically significant differences in orientation for specific learning strategies. Generally, the findings within the mixed pairs group largely replicated those found in the comparison of the Canadian pairs group to the Chinese pairs group, lending support to the conclusion that the experimental hypotheses have been validated by the results found in this study.

In addition, if socially oriented actions are not considered self-regulated, then conflicts between the self and context will be very difficult to resolve under the traditional framework of self-regulated learning. Researchers will grapple over whether socio-cultural situations should be
considered in their research because such situations often place important constraints on individually oriented self-regulation. However, if socially oriented actions are considered an important mode of self-regulation, these difficulties will be easy to resolve. Socio-cultural constraints help students develop socially oriented self-regulatory competency, whereas more individually oriented contexts help students develop individually oriented self-regulatory competency, both of which are fundamental requirements for effective learning and situated activity in many contexts of learning and work. What kind of action one should perform depends on the context that frames one’s activity. What kind of action should be encouraged depends on what kind of competency one wants to develop at a particular time.

7.2 General Discussion of the Role of Social Contexts and Cultural Backgrounds

In the previous section, cultural differences between Canadian and Chinese participants were discussed in terms of their preference for individually or socially oriented self-regulatory actions within social contexts of collaborative learning and problem solving. Results obtained in the present study were discussed in terms how such culturally-based
preferences were expressed in the discourse and learning actions of pairs of Chinese and Canadian participants in the specific contexts studied.

In this section, we examine the role of four aspects of social contexts in framing the expression of self-regulatory actions. First, the role of *cultural identity* is discussed. Second, the role of *interpersonal relationships* is considered. Third, an *authority* aspect of context is discussed, and finally, the role of *type of task* is considered. A summary of how these four factors combine to influence how social and task contexts function to frame discourse and action is presented at the end of the section.

### 7.2.1 Contexts of Cultural Identity

According to McInerney (2008), cultural identity refers to one’s incorporation of the cultural values, beliefs, and practices of one’s ethnic group into one’s personal identity (i.e., conception of oneself). It is a product of the overall influence of one’s culture over the course of a lifetime. If one lives in the same society all one’s life, one might develop a kind of cultural identity that is in agreement with the expectations of this culture. If one moves from one culture to another, one may develop a bi-cultural identity if the time spent in the new culture is sufficient for acculturation to occur.
In this study, the parents and grandparents of the Canadian participants were born in Canada or the United states, and speak English at home. As a result, cultural identity of these participants was assumed consistent to the mainstream culture of Canada although many Canadian participants in this study had some experience working with people from other cultures. In contrast, Chinese participants in this study were sampled from visa students who had recently come from mainland China. They could speak English fluently but mainly spoke Chinese at home. Although all Chinese participants had at least one year of experience in learning with other Canadian students, it was expected that they maintained a cultural identity that was in agreement with residents of mainland China.

Consequently, the cultural identity of the two groups of participants was expected to function differently in implicitly framing their expression of individually oriented actions or socially oriented actions in the learning contexts. When two Canadian participants learned together, their shared cultural identity with the mainstream culture of Canada framed their functioning at the group level, and when two Chinese participants learned together, their shared cultural identity with the mainstream culture of mainland China framed their functioning at the group level as well. Thus, it was expected that as a result of their different cultural identities, the two cultural groups would function differently at the group level.
In the mixed pairs situation, in which a Canadian participant learned together with a Chinese participant as partner, the difference in their cultural identities necessarily worked at the within-group (i.e., within-pair) level. Their cultural identities in this case framed how they contributed to their collaborative work. The difference between Canadian participants and Chinese participants in the mixed pairs group, therefore, reflected the different contributions of their cultural identities to their interaction and group learning.

Accordingly, the significant differences in action orientation between the Chinese pairs group and the Canadian pairs group, as well as the significant differences in action orientation between the Canadian participants and the Chinese participants in the mixed pairs group, both represent the important role of cultural identity in framing self-regulated learning. Cultural identity, however, usually does not work alone. It is often combined with other aspects of social contexts in contributing to framing one’s actions or strategies in a collaborative learning activity, which will be further discussed in subsequent sections.

7.2.2 Contexts of Interpersonal Relationships

As reviewed previously (subsection 2.2.2), collectivistic cultures, such as those in China, India, Japan, and Korea, usually emphasize the
role of interpersonal relationship in shaping a healthy and orderly life. They encourage a very delicate network of interpersonal relationships in which people function very differently when they deal with an in-group member or when they interact with an out-group member. A group may refer to a family, a department, a learning group, a society, or any configurations in which people with shared intentions or goals interact with each other. Members within a group have shared interests that require each member’s contribution. Partners’ contributions usually help the growth of the whole group. Therefore, a member within a group, i.e., an in-group member, has a high stake in interacting with other in-group members to achieve their shared objectives. They need to help each other and to work to meet the expectations of others in the group. Consequently, socially oriented actions are prevalent within such a group.

In contrast, a member outside a group, i.e., an out-group member, may have few common interests that are shared with members of the in-group. Success of an out-group member may be viewed as in competition with the success of the in-group members. Therefore, out-group members may need to take actions that contribute to their ability to succeed in such situations, and individually oriented actions are likely to occur (Yang, 1995).
It should be noted that the differentiation between an in-group member and an out-group member is not always clear-cut in many situations; on the contrary, it is relative. In two of the learning conditions in this study, the Canadian pairs group and the Chinese pairs group, two Canadian participants or two Chinese participants learned as pairs. In each situation, the two members of each pair shared the same mother tongue and cultural background, that is, they were in-group members of the same cultural group. They also shared common tools for learning (provided by the computer tutor), a problem to resolve, and the task of writing a report. Therefore, participants in both the groups also were qualified as in-group members in a certain task-oriented group consisting of their student pair.

However, in this study members of pairs in the Canadian pairs group generated higher proportions of individually oriented actions than did members in the Chinese pairs group, indicating that in the Canadian pairs group the in-group relationship played a weaker role than it played in the Chinese pairs group. In contrast, the mixed pairs group in this study consisted of Canadian and Chinese participants learning in pairs. Although, like the Chinese and Canadian pairs group, the participants in the mixed pairs group shared the same tools and goals for learning and problem solving and were required to write a common report, they also
had a different mother tongue and different cultural experiences and were more likely to be strangers before coming to the experimental lab. Therefore, they were relatively out-group members with respect to the cultural group of their partners, unlike the situation with the Canadian pairs group and the Chinese pairs group.

It was expected that the out-group members in the mixed pairs group would generate higher proportions of individually oriented actions in comparison with members of the Canadian pairs group and the Chinese pairs group, if the in-group interpersonal relationship was working well in the Canadian and Chinese pairs group. This hypothesis was supported by the results of this study in which a significantly higher proportion of individually oriented actions were produced in the mixed pairs group than in the Chinese pairs group. However, there was no significant difference between the Canadian and the mixed pairs group, indicating that participants in the Canadian pairs group may have thought of each other as out-group members (with respect to each other), just as was the case for the participants in the mixed pairs group. That is to say, the Canadian participants were less sensitive to differentiating their interpersonal relationships in performing their actions. This result provides evidence of a significant interaction between cultural identity and interpersonal relationship in framing orientation of self-regulated learning.
However, even though the mixed pairs group functioned with a configuration of out-group membership, the results still indicated significant differences between the Canadian participants and the Chinese participants. Both of them were expected to create higher proportions of individually oriented actions in the mixed pairs group, but in fact, the proportion of individually oriented actions for Chinese participants was still significantly lower than that of the Canadian participants. Therefore, interpersonal relationship can be ruled out as an explanation of the effects of cultural identity when both between-group effects and within-group effects were considered.

7.2.3 Contexts of Authority

As discussed in subsection 2.2.2, collectivistic cultures such as those in China, India, Japan, and Korea usually stress the importance of following expectations of others, especially authoritative others because authoritative parents, teachers, and other professionals are seen as providing safety and efficiency for people’s activity. Thus, their suggestions and expectations should be respected and followed. Consequently, less experienced individuals are expected and encouraged to be attentive to the perspectives of authoritative others in situations in which socially oriented actions are likely to occur.
However, when individuals are authorities in a specific situation, they are expected to function differently. Parents, teachers, and other professionals should take the major responsibility for solving a problem, and it is their responsibility to instruct less experienced individuals in what to do and how to do it. Therefore, authoritative members of a group are more likely to produce individually oriented actions than other members of a group in such situations. However, it is important to realize that authoritativeness is relative to its context. Parents are authorities to their children but may be novices to their family doctor. It is the attribute of having relatively higher knowledge and experience that governs who is an authority and what kind of actions should be produced.

In this study, prior knowledge of participants provided an indicator of authoritativeness. The important role of authoritativeness in shaping one’s self-regulated actions was observed in the discourse data corpus. When a participant was a relative authority in comparison to his partner, a higher proportion of individually oriented actions was produced. When a participant was a relative novice, a larger proportion of socially oriented actions were produced. This was the case for Chinese participants but not for Canadian participants (see Figure 6.2).

Another piece of evidence related to the role of authority pertains to differences in students’ adherence to authority, which can be seen in the
results of analysis of the Tutor log data. The problem description itself included instructions or suggestions about how to learn and how to solve the problem, which was prescribed by experienced researchers (i.e. the author and his supervisors). Although participants were instructed to follow this expectation to learn, they were given the freedom to learn in any way they chose. As a result, analysis of the Tutor log data showed a higher proportion of learning according to their own choices in the Canadian pairs group than in the Chinese pairs group, indicating that the Chinese participants were more sensitive to the authority of others. Thus, there is some evidence consistent with adherence to a context of authority as an aspect that influences the orientation of Chinese students’ actions.

7.2.4 Contexts of Task

Many SRL researchers include type of task as an important aspect of context in their models (e.g. Zimmerman, 2008a; Winne & Hadwin, 2008). For example, a mathematics task and a sociology task place different demands on self-regulated learning. Consequently, conclusions based on a study conducted in a single domain of knowledge and problem-solving expertise, and with a focus on completing a specific task are limited to the specific task domain used in the study.
In this study, participants learned intermediate statistics in a problem-based collaborative environment. They had a statistics problem to solve, and they had a body of statistics knowledge and methods to learn. Thus the task demands of the situations studied included two interrelated tasks: (a) solving a problem involving interpreting results and writing a scripted report, and (b) using the tutor as source for acquiring statistical domain knowledge needed to understand the methods and models they were using, and to interpret the results and write a short scripted report. Both of these activities framed the participants’ activities and dialog in the experimental situations as they worked together to learn and solve the problem. Thus, a comparison of results obtained when they were solving the problem (usually while working on their report) vs. when they were learning using the tutor can provide one way of examining the effect of tasks in framing SRL activities.

In this study, problem solving was a high-stakes task in comparison to statistics learning. When participants focused on solving the problems, they usually had to compete with each other to put a right answer in their shared report. Competition led to emergence of individually oriented action. In contrast, when participants learned statistics using the Tutor website, they had more room to manoeuvre; a substantial concession to one’s partner would not necessarily lead to a poor score on their report.
Therefore, the learning task might allow more socially oriented actions to occur. The results showed that a higher proportion of individually oriented actions occurred when participants worked on solving the problems in comparison to those which occurred when participants focused on their learning. Thus, the tasks functioned to frame the extent of the participants’ social vs. individual actions in the experimental situations.

Thus, task context might provide an alternative interpretation for the results involving comparison of the Canadian, Chinese and mixed pairs group. To exclude the effect of type of task when comparisons were made between cultural groups, type of task was introduced as another independent variable. Effects of targeted comparisons were thus adjusted for the effect of the task variable, resulting in a better interpretation of cultural differences.

7.2.5 Knowledge Construction as a Product of Learning Activity and Contexts

In the problem-based learning situation employed in this research, self-regulated actions were influenced by all of these aspects: cultural identity of the participants, interpersonal relationship, prior knowledge, and type of task (problem solving and acquiring domain knowledge), although the context of cultural identity was the main focus of this study. Thus, to
some extent, participants’ production of self-regulated actions was
influenced by all of these contexts as they worked to acquire knowledge of
statistics and solve the problem. In other words, students’ knowledge
construction was a product of their learning activity within a specific
learning context.

Self-regulated learning without contextual constraints is impossible.
Moreover, to understand of effects of context without considering
individuals’ activity is also impossible. Context emerges with the start of
one’s learning activity, and disappears with the termination of the activity.
One cannot find context without seeing a sequence of events; and
equivalently, one cannot understand a learning event without fully
interpreting its context.

Socially oriented SRL is a mode of living, and is a response of people
to their socio-cultural context. Without socio-cultural context, one cannot
expect to find a trace of socially oriented self-regulated action. Similarly,
socially oriented self-regulated action is meaningful and important only
when expectations of its context are considered. This is the essence
suggested in Mead’s social self theory (Mead, 1932) and was evidenced in
this study. From the perspective of learning efficiency, socially oriented
self-regulation is not inferior to individually oriented self-regulation, which
was evidenced in the quality of the solutions to the prescribed problem
among the cultural groups. Both of them have advantages and disadvantages; therefore, they need to be considered in any context.

7.3 Conclusions

In this section, conclusions based on the findings of the study will be reviewed corresponding to each hypothesis. Then, contributions of this study to the theoretical development of SRL and implications for classroom practice are addressed. Finally, we consider limitations of the current study and offer suggestions concerning implications for future research.

7.3.1 Summary of Conclusions

Based on the results of this study, we conclude that the research hypotheses were positively supported by the results obtained in the contexts investigated in this study. First, hypothesis 1 predicted (a) that since individuals from relatively collectivistic cultures are likely to prefer social norms in which the individual (self) fits into the social environment, as representatives of individuals who grew up in collectivistic cultures, the Chinese students participating in this study would engage in more socially oriented SRL actions in their learning activities and interaction with their
partners in a situation of collaborative learning in pairs; and (b) that since individuals from relatively individualistic cultures are likely to prefer social norms in which the individual dominates the social environment, as representatives of individuals who grew up in a relatively individualistic culture, the English Canadian students participating in this study would engage in more individually oriented SRL actions in their learning activities and interactions with their partners.

This hypothesis was supported by the results of the study. The Canadian students engaged in more individually oriented actions in their learning activities consistent with a cultural norm of thinking of others in relation to a created context that is centered around the individual. In contrast, the Chinese students engaged in more socially oriented actions in their learning activities consistent with a cultural norm of considering others as participants in a social context that demands negotiation with others.

Hypothesis 2 predicted that individuals who grow up in collectivistic or individualistic home cultures are likely to generalize their construal of the self differently within situations in which they encounter people from other cultures, so that their original self-construal may play a significant role in governing their interactions with individuals from a different home
culture. Consequently, the Chinese participants in the study were expected to engage in more socially oriented SRL actions when learning in the mixed pairs than their English Canadian partners, and the English Canadian participants were expected to engage in more individually oriented SRL actions than their Chinese partners in the mixed pairs.

This hypothesis was also supported by the results of this study. The students’ cultural construal of self tended to generalize to a situation in which they encounter people from other cultures. In the mixed pairs situation, the Canadian participants demonstrated a stronger preference for individual orientation in their interactions with their Chinese partners, and the Chinese participants revealed a greater preference for a social orientation in their interactions with their Canadian partners.

Hypothesis 3 predicted that individuals’ construal of the self is likely to be reflected in their preference for an individual orientation or a social orientation in their self-regulatory phases and use of specific SRL strategies. It was expected that the Chinese students and the English Canadian students would display different patterns of SRL strategy use reflected in: (a) differences in their self-regulatory phases, and (b) differences in their patterns of specific SRL strategy use when learning in
the language-matched groups, i.e., the Chinese pairs group and the English Canadian pairs group.

This hypothesis was also supported by the results. Students’ cultural construal of self was reflected in their preference for an individual orientation or a social orientation in their self-regulatory phases and use of specific SRL strategies. Canadian pairs demonstrated a stronger preference for the employment of individually oriented self-regulatory strategies in the forethought and performance phases of self-regulated learning than the Chinese pairs. There were significant differences between Canadian pairs and Chinese pairs in motivation, clarification, elaboration, environment structuring, and note taking, all of which involved a stronger individual orientation for the Canadian pairs.

Hypothesis 4 predicted that an individual’s culture-specific preference for particular types of SRL strategies and for particular SRL learning phases would be expected to persist in situations of learning in a mixed pairs group. It was expected that in the mixed pairs condition the Chinese and English Canadian students in our sample would display differences in their patterns of use of specific SRL strategies and SRL learning phases and that these patterns would be similar to those they exhibited in their respective language-matched pairs conditions.
The results were consistent with this hypothesis. In the mixed pairs group, the Canadian participants demonstrated a stronger preference for an individual orientation in both the forethought phase and in the performance phase than did the Chinese participants. In addition, the Canadian participants revealed a significant preference for an individual orientation in monitoring in comparison to their Chinese partners. Thus, students’ cultural construal of self was also reflected in their preference for an individual orientation or a social orientation in their self-regulatory phases and use of specific SRL strategies in the mixed pairs condition.

Finally, self-regulated learning was also significantly influenced by the contexts of type of task (learning vs. problem solving), prior knowledge, interpersonal relationship, and their interactions with participants’ cultural experience. Chinese participants performed fewer individually oriented actions when they had lower experience or when they worked with people who had different background, whereas Canadian participants did not.

7.3.2 Implications for Culturally-Situated SRL Theory and for Education in a Culturally Pluralistic Society

The study of the relationship between the self and its environment is a long-term concern in the history of human development. In the late
1800s, a group of educational scientists in the United States such as William James, John Dewey, and George Herbert Mead, proposed a dual construal of self: the agentic “I” and the environmental “me.” The transaction between “I” and “me” represents a negotiating relationship between a human being and its environment.

Nevertheless, the influence of this theory diminished with time. With the rise of the cognitive revolution in the last century, researchers began to focus more on what happens inside the brain. Later, when self-regulation theory was presented, researchers shifted away from the dual construal of self. The “me” was dropped out of the self that originally included both the “I” and “me.” Thus, the position of “me” was degraded from an object of negotiation to an object of control. Human beings originally needed to negotiate with their environment in Mead’s theory, but today, the environment has become an object that can be omitted or that needs to be controlled.

This conception of the self meets the needs of the mainstream culture (i.e. individualism) of North America. However, it clearly cannot address well the socio-cultural configuration of human beings, and confines our current self-regulation research in a pure self (i.e. “I”) of
imagination that can function independently from the functioning of the
“me.”

Today, when cultural pluralism is emphasized and is gradually accepted in North American society, the transactional dual construal of self and its related self-regulation should be emphasized in self-regulation research. It is time for such conceptions to come back to the forefront and expand self-regulation research to involve the more socio-culturally bound individuals.

From the perspective of the dual construal of self, negotiation is a key concept that deals with the relationship between individuals and their environment. Perspectives of others (i.e. environment or context) are interpreted and emphasized at the first step of self-regulation. Based on this interpretation or perception, individuals balance the benefits and risks of these perspectives to decide what kind of action is needed to respond to the environment appropriately. Finally, they validate or invalidate their tactics or strategies through feedback from their context.

It is clear that this construal of self does no harm to the agentic “I” at all. The “I” still has choice to omit, refuse or refute the perspectives of others. In addition, this theory also gives individuals choice to accept the perspectives of others. Both types of choices are the normal responses of
individuals to their perceived context, representing two ways of living in a cultural sense. One choice does not devalue the other choice, but rather they complement each other. Therefore, both individually oriented self-regulation and socially oriented self-regulation are supported under this theoretical framework.

Under the individually oriented self-regulation framework, teachers and students often meet with great tension between the self and their environment. When students learn, they always have to ask themselves: “Shall we follow the expectations of our teacher or do by the choice of ourselves?” If they follow the expectations of their teacher, they might be labelled as other-regulated, externally-regulated, or less self-regulated students. If they choose a unique way to learn, however, they may not focus precisely on the teacher’s expectations, which may result in a lower grade. Alternatively, they may discover what works well for them and obtain a higher grade through use of effortful strategies.

What should they do? From the perspective of the dual construal of self, both ways are plausible depending on their interpretation of the perspectives of others and their own preference. If students believe they have the potential and time to explore a unique way to fulfill the requirements of their homework, they could do so. If they do it well, they
get a higher mark. Otherwise, they are also encouraged to follow the expectations of the teacher to learn. This is not only acceptable but also a representation of a good learner.

For the same reason, classroom teachers also often meet with such dilemmas. When they design a course or lesson, they usually have to ask themselves: “Shall we give students more choice of self-discovery or tell them our expectations?” If students are given choice of self-discovery, students might wallow in aimless struggles of their time-consuming work. If students are given concrete expectations, however, there may be a risk of scaffolding students too much.

What should they do? From the perspective of the dual-self theory, both ways are reasonable depending on what kind of self-regulatory competency teachers want to foster. If the training of individually oriented self-regulatory competency is the educational target of the class, self-discovery with less scaffolding is reasonable even if more time is needed. If teaching socially oriented self-regulatory competency is the aim of a class, then concrete examples and expectations may be provided to promote efficiency and accuracy.

In addition, this theory also has implications on differential treatment of students who may have diverse self-regulatory competency.
When a student focuses too much on one’s own interest and choice in an imposed context, attentiveness to expectations of others is needed to reduce the risk of inefficiency. When a student concentrates too much on expectations of others in a created context, however, independent thinking is required to promote initiatives.

7.3.3 Limitations of the Study

In spite of the advantages of this study, limitations still exist. First, the sample included only sixty participants, leading to ten pairs in each group. This resulted in a smaller power to detect effects. Second, learning time given to participants was relatively short. Participants were required to learn a whole semester course on the Tutor in just one hour and they simultaneously had to solve a problem and write a report. The short time may also be the reason that too many low-frequency cells were observed in data analysis. However, more participants and longer learning time went beyond the researcher’s ability to manage at the time of study.

Third, only male participants were recruited in this study to avoid confounding variables (i.e. gender). If female participants were involved in this study, more than two hundred participants may be needed to maintain
the current effect size levels of comparisons. Neither time nor funds allowed the researcher to do such a big project.

Fourth, all of the participants claimed that they met the requirements of participation in the research and signed the informed consent forms when they came to the learning site. However, the researcher found that some of them might not completely meet the requirements of sampling. For example, the researcher needed Anglo-Canadian participants in this study, but one participant was identified as a visa student from the UK. One student claimed he was an Anglo-Canadian, but he could speak Chinese fluently with the researcher. Another student claimed that he was a Chinese, but finally admitted that he lived in Japan most of his life. These students roughly met the requirements of the study; therefore, they were allowed to participate and were included in data analysis.

Fifth, the age of the participants was another factor that needed further control. Although most participants were upper level undergraduates, some participants were actually graduate students; still others were freshmen in the university. This problem was resolved by the random assignment sampling procedure.
Sixth, the coding process was not blind in that it might cause bias, although the researcher tried to be consistent when coding all transcripts. However, a larger bias might have resulted if the video context was missing. Therefore, the current coding procedure was a trade-off between the two.

Finally, this study was comprised of a naturalistic experimental design, which may influence the generalizability of this study. Participants were selectively sampled and were randomly assigned to different group configurations. They came to the university lab and were videotaped through a camera fixed on the wall beside them, with a microphone placed under the computer screen. These devices were intentionally arranged to avoid attention, but participants were indeed informed of the existence of these devices.

7.3.4 Suggestions for Future Research

Generally, this study represents a first attempt to validate the assumptions derived from the newly proposed theory. To firmly establish the theory in educational research and practice, much more work needs to be done. First, large samples and longer learning times may be needed to further explore the various patterns. Second, gender differences should be considered to validate the assumptions. Third, younger and older aged-
students may be investigated to see how the context of age frames various kinds of self-regulatory competency. Fourth, this study only investigated the role of four kinds of contexts in framing self-regulatory action. Numerous other contexts may be examined to see how they frame students' learning differently.

Other future directions may include cross-national research to further validate this new theoretical framework. This study only sampled Chinese students studying at McGill University. Can this theoretical framework be applied to other minority cultures in North America? Although this theory is specifically designed to involve all socio-cultural realities, different minority cultures in North America may have some peculiarities in framing students' learning.

Relations between problem-solving and self-regulated learning also need to be explored in more depth. For example, how does a problem confine and drive students’ learning? It would also be meaningful to clarify how the sequential structure of discourse interacts with cyclic sequences of self-regulation. This investigation may provide evidence for existence of self-regulatory cycles and further elaborate this theory. Finally, the relationship between this theory and other relevant socially oriented
theories needs to be further scrutinized. If they focus on a similar socio-cultural configuration, further synergy is possible.
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Appendix A: The Project from a Technical Perspective

Primary Data Recording Devices:

1. Camtasia Studio 6: Screen Recording
3. A camera and an omnidirectional microphone: Video recording of talk during sessions of use of the ANOVA Tutor
4. Microsoft Word: for participants to write a joint report

Transcription Software:

CLANXu - (Carnegie Mellon University) http://childes.psy.cmu.edu/

Coding Software:

CLANXu - (Carnegie Mellon University) http://childes.psy.cmu.edu/

Pre-Test Software:

Adobe Acrobat Pro

Data Analysis:

SAS - GENMOD, FREQ
Appendix B: Problem Description

Are there any differences among three kinds of learning?

1) Description of the Study and Data:

This study experimented with the use of different learning types of “cognitive organizers” to see how well they supported students’ learning of instructional content in a mathematics course. Cognitive "organizers" provide information that structures material for the learner.

A group of thirty undergraduate students was randomly split into three groups of ten each:

- Group 1 received organizing material before studying instructional materials on a topic in mathematics (the "Preorganizer Condition").
- Group 2 received the same organizing material after studying the mathematics materials (the "Postorganizer Condition").
- Group 3 received the instructional materials but no organizing material (the "No Organizer Condition").

On a ten-item test covering the mathematics materials that were studied, the following scores were obtained.

2) Sample data:
3) You will be given the results of an Analysis of Variance (ANOVA) that was carried out for these data to test the null hypothesis of equality of group mean scores. The criterion (level of significance) for rejecting the null hypothesis is an alpha level of 0.05.
4) The output from SAS ANOVA software is:

The ANOVA Procedure

Class Level Information

Class            Levels     Values
Cond               3          1 2 3

Number of Observations Read          30
Number of Observations Used          30

Dependent Variable: Score

Sum of

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>2</td>
<td>18.20000000</td>
<td>9.10000000</td>
<td>4.01</td>
<td>0.0299</td>
</tr>
<tr>
<td>Error</td>
<td>27</td>
<td>61.30000000</td>
<td>2.27037037</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>29</td>
<td>79.50000000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R-Square  Coeff Var   Root MSE   Score Mean
0.228931  33.48388   1.506775  4.500000

Level of Score
5) Working together with the help of the ANOVA Tutor, your task will be to write a joint report on how and why the results of this Analysis of Variance provide the information needed to answer the following research question:

**Are there any significant differences among the groups due to their different learning methods?**

Your report should include:

1. Your conclusion based on the results of the Analysis of Variance of the data (given in the output provided).

2. An explanation of how using the statistical method and results of Analysis of Variance (ANOVA) enabled you to reach this conclusion, that is:
• How does ANOVA represent each individual participant’s score in terms of a grand mean and group effect (in an ANOVA score model) based on the group to which the subject was assigned?

• How does ANOVA estimate the components of each participant’s score?

• What statistics are calculated in carrying out the ANOVA (presented in the ANOVA table)? What are they?

• What hypothesis is being tested in the ANOVA? How do you base your conclusion on the ANOVA statistics?

The ANOVA Tutor provides complete information needed to understand and carry out an Analysis of Variance. This information is comparable to the content of a good course on Analysis of Variance for researchers.

You should use the ANOVA Tutor as a resource, searching for relevant information from task 5 to task 9 to help you write your report; however, you may explore other tasks if you really feel needed.
Appendix C: Pre-test

Prior Statistics Knowledge Test

What courses in statistics have you taken before?

For the following 16 statements, please indicate whether the statement is true or false by checking the box in the True column or the box in the False column in answering each question. If you do not know the answer, make your best guess.

Then, for your True or False answer, select your rating of how sure you are that your answer is correct by clicking the corresponding radio button. Use this rating scale:

5 = absolutely sure about my answer
4 = highly sure that the answer is correct
3 = sure that my answer is correct
2 = somewhat sure that my answer is correct
1 = no idea at all about my answer, I guessed

<table>
<thead>
<tr>
<th>Answer</th>
<th>Confidence</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>True</td>
<td>False</td>
<td></td>
</tr>
<tr>
<td>--</td>
<td>------------</td>
<td>-----------</td>
</tr>
<tr>
<td>1. If all entries of a data set are increased by 20, then the standard deviation and the mean will also be increased by 20.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>2. Mike’s percentile rank on a science test was 67. This means that John answered 67% of the items correctly.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>3. A distribution that is mound-shaped with a higher mound (mound—a term for pile of earth, sand, or gravel) will have a smaller standard deviation than a distribution that is mound-shaped with a lower mound.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>4. For a data set having only negative values, both the mean and standard deviation will be negative.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>5. The winter temperature in Montreal is -20°C while the temperature in Beijing at the same time is -10°C. Therefore, the former is 3 times colder than the latter.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>6. If the claim says that the population mean μ = 200 and the sample mean is 215, we can say that the claim is true because it is obvious even without a formal test.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>7. A value of r = -0.851 shows that there is very little relationship between the two variables being compared.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>8. You bought 11 lottery tickets. One of them won a prize. That means that the probability of winning a prize is 1/11.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>9. Surveying every fifth person who walks through the door is an example of simple random sampling.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>10. If the level of confidence is increased from 90% to 95% then the margin of error will be increased.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>11. If a researcher wants to test the claim that more than 10% of all students purchased their textbook online, then the null and alternative hypotheses are H0: p = 0.10 and H1: p &gt; 0.10.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>12. A pre-election survey showed that Candidate A got 51%, and Candidate B got 48%. The margin of error is 5%. There is not enough reason for Candidate A to rejoice (to be happy).</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>13. Exactly 50% of the area under the normal curve (curve—a line of which no part is straight) lies to the right of the mean.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>14. F &gt; 8 is evidence that ( \sigma_1^2 \neq \sigma_2^2 ).</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>15. How many pairs of shoes do you own? This question variable is at the ratio level.</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>16. If A and B are independent events and P(A) = 0.37, then P(A/B) = 0.37.</td>
<td>4.00</td>
<td></td>
</tr>
</tbody>
</table>
Appendix D: Four-Step Coding Guide

Four-Step Coding Guide:

1: Problem Solving (PS) or Regulation of Learning (SRL)?

2: Social or Individual?

3: Select one of the PS codes
4: Select one of the SRL codes

Step 1: PS or SRL?

Decision rules:

1. “PS” can apply if a coding unit is related to the problem-solving itself;

2. “SRL” can apply if a coding unit is related to gaining new information;

3. No coding can apply if a coding unit is irrelevant to both “PS” and “SRL” (e.g. going to washroom, writing, reading);
4. The rule of integrity can apply if both “PS” and “SRL” are appropriate in some special cases. As a result, “SRL” is more appropriate when there are much fewer coding units related to “PS” in a sequence of talking about learning issues. On the other hand, “PS” may be more appropriate when there are much fewer coding units related to “SRL” in a sequence of talking about problem-solving issues.

**Step 2: Social or Individual?**

Decision rules:

1. “Social” can apply if a coding unit tries to meet the needs of others or the group; otherwise, “individual” may apply.

Examples:

A: I don’t know F. (Needs created)

B: F is the ratio of MSA over MSE. (SCLAR)

2. “Social” can apply if a coding unit is based on shared understanding of the same concept, formula, or a principle as that of the previous speaker; otherwise, “individual” may apply.

Examples:

A: SST measures the deviation from the grand mean. (Initial clarification)
B: The deviation of group means from the grand mean. (SCLAR)

A: The total for deviation. (SCLAR)

B: We decompose it to two parts. (SCLAR)

3. “Social” can apply if a coding unit is based on shared interests; otherwise, “individual” may apply.

Examples:

A: Do you want to see part four? (SSEAR)

B: Yes, go. (SSEAR)

4. “Social” can apply if a coding unit is clearly based on a concern about the performance of the group; otherwise, “individual” may apply.

Examples:

I don’t know the group effect. (SHELP)

Score mean is? (SHELP)

We couldn’t finish in time if we learn in this way. (SMOTI)

5. “Social” can apply if a coding unit is clearly based on a concern about the interests of others; otherwise, “individual” may apply.

Examples:

Are you done? (SENV)

Have you finished reading? (SENV)

Tell me if I go too fast. (SENV)
6. “Social” can apply if a coding unit is clearly based on a concern about others’ opinion; otherwise, “individual” may apply.

Examples:

Can I say that? (SSREV)

Do you think just to read? (SSREV)

Score mean is the same thing as grand mean, right? (SSREV)

**Step 3: select one of the PS codes**

Decision rules: see the definitions of the PS codes in Appendix E.

Extra notes: how to code “yes, yeh, ok, hm”?

1. GAOL, PLAN, INTE, EXPL, COND, REAS or CORR may apply if one of these coding units is an answer to a previous question, and tries to build shared understanding with the questioner.

2. EVAL may apply if the speaker understands the previous statement, and tries to make a decision on whether one should continue.

3. No coding can apply if these coding units are just boundary markers, or acknowledgment statements indicating one is listening.

**Step 4: select one of the SRL codes**

Decision rules: see the definitions of the SRL codes in Appendix F.
Extra notes:

**Question 1:** how do I code a motivational unit, an evaluating unit, or an adapting unit when other codes may also apply?

Answer: motivation, evaluation, or adaptation has priority over others.

**Question 2:** how do I code “yes, yeh, ok, hm”?

Decision rules:

1. ADAP can apply if evidence shows a change in learning strategies even if other codes may also apply.

2. The same code as that of the previous question apart from the help seeking question can apply if “yeh”, “ok”, or “hm” is an answer.

3. SATI can apply if the speaker understands the previous statement and tries to encourage the previous speaker to continue.

4. No coding can apply if these coding units are just boundary markers, or acknowledgment statements indicating one is listening.

**Question 3:** how do I differentiate SSREV, SHELP, and other social actions?

Decision rules:

1. SSREV has priority over other social actions.
2. SHELP may be an incomplete question (e.g. pr is?) while SSREV is a complete question (e.g. pr is 0.05?)

3. SHELP may be an incomplete question followed by a complete statement while a social action may be a complete question followed by a choice yes/no answer.

**Question 4**: how do I differentiate MONI and other SRL actions?

Answer: all other actions have priority over MONI.

**Question 5**: how do I code clarification questions?

An example:

A: (ISEAR) Part one.

B: (SMONI) Part one?

A: (SCLAR) Part one.

**Question 6**: how do I code “I don’t know”?

Decision rules:

1. It may be coded as a monitoring action (IMONI) if it is an answer or a statement in a sequence of talking.

Examples:

What is F? (IHELP)
I don’t know. (IMONI)

2. It may be coded as a help seeking action (SHELP) if it is the last statement in a turn followed by a statement to help.

   Examples:

   A: I don’t know F. (SHELP)
   B: F is the ratio of MSA over MSE. (SCLAR)

3. It may occasionally be coded as an evaluating action (ISREV) if it elicits a change to a learning direction.

   Examples:

   A: Let’s search task five, the score model. (ISEAR)
   B: No, I don’t know how to do the test. (ISREV)
   A: Ok, let’s search task nine, the test. (SADAP)
Appendix E: Problem Solving (PS) Codes

Adapted from Frederiksen, Roy, & Bedard (2010)

**Code 1: Planning Goals**

Definition: Planning or selecting a goal or goals to be achieved by applying a particular problem-solving procedure or procedures.

**Subcode 1a: IGOAL**

Name: planning an individual problem-solving goal

Definition: planning a goal to meet one’s own needs

Examples:

1. We want to test the difference between the three groups.
2. We have to write a concise report at last.
3. What is the goal in solving the problem?

Note: Example 1 and 2 are individually oriented because they stated a goal of their respective concern. Example 3 is also individually oriented because it tried to establish a goal of one’s own concern.

**Subcode 1b: SGOAL**

Name: planning a shared problem-solving goal
Definition: contributing to a shared goal through interactive discussion with one’s partner or members of a group

Examples:

1. Do you think we have to calculate the p value?
2. I hope we can answer most of the questions at last, ok?
3. Yeh, we need a reasonable conclusion.

Note: Example 1 and 2 are either a simple question or a tag question coded as socially oriented goal setting actions because they tried to seek opinions and expectations of others. Example 3 is a positive answer coded as socially oriented goal setting action because the positive answer tried to fit the expectation of others.

**Code 2: Planning Actions**

Definition: Planning an action or a sequence of actions to be carried out to achieve a problem-solving goal or goals.

**Subcode 2a: IPLAN**

Name: planning an individual problem-solving action

Definition: planning an action to achieve one’s own goal

Examples:

A: How should we answer these questions?
A: I think we should finish writing the first question, and then do the others.

Note: The two dialog units are individually oriented planning actions because the first one expressed a concern of one’s own and the second one expressed one’s own plan without considering the partner’s opinion.

Subcode 2b: SPLAN

Name: planning a shared problem-solving action

Definition: contributing to a shared plan through interactive discussion with one’s partner or members of a group

Examples:

   A: Shall we answer the last question first because it seems easy?
   B: Yeh, we can write our conclusion first, and then talk about why.

Note: The two dialog units are socially oriented planning actions because the first one tried to seek expectations from the partner and the second one was a positive answer to fit the partner’s motion.

Code 3: Testing Conditions

Definition: Testing conditions required to apply a procedure and decide whether the conditions required to apply a procedure have been met.
Subcode 3a: ICOND

Name: individual condition testing

Definition: testing based on one’s own understanding of the conditions

Examples:

1. If p is less than zero point zero five, we can say experiment is successful.

2. When we do the test, we need to know what statistic we use.

Note: The two dialog units are individually oriented condition testing actions because both of them tested conditions required to apply a procedure of one’s own interest without considering the partner’s opinion.

Subcode 3b: SCOND

Name: shared condition testing

Definition: contributing to testing based on shared understanding of the conditions through interactive discussion with one’s partner or members of a group

Examples:

A: The F value will be significant. (IINTE)

B: Yeh, if the p value is less than zero point zero five (SCOND).

Note: The first dialog unit is an individually oriented interpreting action. The second one was a socially oriented condition testing action
because it tested the condition required to apply a procedure to fit the interpretation of the partner.

**Code 4: Executing an Action**

Definition: Executing a procedure by performing its action.

**Subcode 4a: IEXEC**

Name: individually executing an action

Definition: executing an action based on one’s own goal and plan.

Examples:

1. Undo.
2. Go down.

Note: The two dialog units are individually oriented executing actions because both of them executed actions of their own interest without considering the partner’s opinion.

**Subcode 4b: SEXEC**

Name: communally executing an action

Definition: contributing to the executing of an action on which group members agree with each other through interactive discussion with one’s partner or members of a group
Examples:

A: So check the next one?

B: Yeh, task two.

Note: The two dialog units are socially oriented executing actions because the first one tried to seek expectations from the partner and the second one was a positive answer to fit the partner's motion.

**Code 5: Reasoning**

Definition: Reasoning to plan a goal or an action, interpret a problem state, infer or derive a solution, evaluate a method used or result obtained, or correct an error

**Subcode 5a: IREAS**

Name: individual reasoning process

Definition: reasoning for one’s own purpose, such as one’s own planning, goal setting, explaining, interpreting, evaluating, or correcting

Examples:

A: We need an F table. (IGOAL)

B: Why do you say we need an F table? (IREAS)

Note: Dialog unit A was an individually oriented goal setting action.

Dialog unit B is an individually oriented reasoning action because it did not
seek expectation from others. On the contrary, it expressed a concern and tried to challenge others.

Subcode 5b: SREAS

Name: shared reasoning process

Definition: contributing to a shared reasoning process through participation in an interactive discussion with one’s partner or members of a group

Examples:

A: Because this is the estimation? (SREAS)

B: Estimation of the grand mean. (SREAS)

Note: The two dialog units are socially oriented reasoning actions because the first one tried to seek shared understanding with the partner and the second one was a positive answer to fit the partner’s motion.

Code 6: Evaluating

Definition: Evaluating the result of applying a procedure or of reasoning to derive the solution, or evaluating the methods or reasoning that were used to obtain the results.

Subcode 6a: IEVAL

Name: evaluating to carry out further one’s own problem-solving actions
Definition: evaluating to facilitate one’s own expression of problem-solving ideas.

Examples:

A: The score mean is the grand mean. (IEXPL)
A: It makes sense (IEVAL).

Note: The first dialog unit is an individually oriented explaining action. The second is an individually oriented evaluating action because it evaluated one’s own explaining positively to maintain one’s own problem-solving direction.

Subcode 6b: SEVAL

Name: evaluating to maintain problem-solving actions performed by others

Definition: contributing to shared understanding of a problem solving action by evaluating it through participation in an interactive discussion with one’s partner or members of a group

Examples:

A: Does this answer look ok to you?
B: Yeh, great.

Note: Both the dialog units are coded as socially oriented because the first one tried to seek opinions from the partner and the second one
was to evaluate the performance of the partner to encourage him to continue his speaking.

**Code 7: Correcting**

Definition: Correcting an error or providing a missing component of the solution

**Subcode 7a: ICORR**

Name: correcting a PS action to make it fit well with one’s own understanding

Definition: correcting a PS action based on one’s own understanding to satisfy oneself

Examples:

1. We should say “difference in mean” instead of “mean difference”.
2. We should say “among the three groups”, not the “between”.

Note: Both the dialog units are individually oriented correcting actions because they corrected others’ statements to fit well with one’s own.

**Subcode 7b: SCORR**

Name: correcting a PS action to make it fit well with shared understanding
Definition: contributing to the correcting of an action on which group members agree with each other through interactive discussion with one’s partner or members of a group

Examples:

A: It should be bulleted, right?

B: Yeh, you are right, bullet the answers.

Note: Both the dialog units are coded as socially oriented correcting actions because the first one tried to seek opinions from the partner and the second one was a positive answer to fit the partner’s expectation.

**Code 8: Explaining**

Definition: Explaining the theoretical or conceptual rationale or knowledge that underlies a method, or reasoning processes that are used to derive a solution, or predict, explain or evaluate the significance of a result

**Subcode 8a: IEXPL**

Name: explaining to elucidate one’s own understanding of the theoretical rationale

Definition: explaining to elucidate one’s own understanding of the theoretical rationale based on one’s own knowledge and interest

Examples:
1. All the scores make up a population mean.

2. We should reject the null hypothesis if the p value is less than zero point five.

3. What is the null hypothesis?

   Note: All the three dialog units are individually oriented because they explained the understanding of one’s own concern.

**Subcode 8b: SEXPL**

Name: explaining to elucidate shared understanding of the theoretical rationale

Definition: contributing to shared understanding of the theoretical rationale through interactive discussion with one’s partner or members of a group

Examples:

   A: Do you think the null hypothesis is all the three group means are same?

   B: Yeh, mu one equals mu two equals mu three equals zero.

   Note: The two dialog units are socially oriented explaining actions because the first one tried to seek expectations from the partner and the second one was a positive answer to fit the partner’s motion.

**Code 9: Interpreting**
Definition: Interpreting the initial problem state before a particular action has been executed, intermediate states that arise during application of a procedure or reasoning, or the state resulting from the application of a procedure or reasoning.

**Subcode 9a: IINTE**

Name: interpreting to elucidate one’s own understanding of the problem states.

Definition: interpreting to elucidate one’s own understanding of the problem states based on one’s own knowledge and interest.

Examples:

1. Where is the grand mean?
2. I don’t quite understand the question.

Note: Both the dialog units are individually oriented because they tried to interpret the problem state of one’s own concern.

**Subcode 9b: SINTE**

Name: interpreting to elucidate shared understanding of the problem states.

Definition: contributing to shared understanding of the problem states through interactive discussion with one’s partner or members of a group.
Examples:

A: Here is the ANOVA table, right?

B: Yes, I think it is.

Note: The two dialog units are socially oriented interpreting actions because the first one tried to seek expectations from the partner and the second one was a positive answer to fit the partner's motion.
Appendix F: Self-Regulated Learning (SRL) Codes

**Code 1: Goal Setting**

Definition: A learning goal is an intended outcome for learning related to obtaining declarative or procedural knowledge in a domain, and developing skill or competency in reasoning, solving problems, and/or performing tasks in the domain.

**Subcode 1a: ISRGO**

Name: setting an individual learning goal

Definition: articulating one’s learning goal of interest

Examples:

1. We need to find what kind of information is needed to solve the problem.
2. We should figure out the new concepts in the problem description.
3. I want to make sure I understand this.

Note: All the three dialog units are individually oriented because they stated a goal of one’s own interest.

**Subcode 1b: SSRGO**

Name: setting a shared learning goal
Definition: contributing to the development of a shared learning goal through interactive discussion with one’s partner or members of a group

Examples:

A: So the first thing we have to do is to find information about the score model, right?

B: Yeh, we need to figure out what a score model means.

Note: The two dialog units are socially oriented goal setting actions because the first one tried to seek expectations from the partner and the second one was a positive answer to fit the partner’s motion.

**Code 2: Planning**

Definition: A learning plan is the choice of an action or a sequence of actions to achieve a learning goal.

**Subcode 2a: ISRPL**

Name: creating an individual learning plan

Definition: articulating one’s learning plan of interest

Examples:

1. I think we can calculate the smc and then check whether it is the same thing as r square.

2. I think we should go to task nine later after this.
I think we just go with the one-way model now, then two-way if we have time at the end.

Note: All the three dialog units are individually oriented because they stated a plan of one’s own interest.

**Subcode 2b: SSRPL**

Name: developing a shared learning plan

Definition: contributing to the development of a shared learning plan through interactive discussion with one’s partner or members of a group

Examples:

A: Do you want to go through all the topics?

B: Yeh, we try our best.

Note: The two dialog units are socially oriented planning actions because the first one tried to seek expectations from the partner and the second one was a positive answer to fit the partner’s motion.

**Code 3: Motivational Beliefs**

Definition: A motivational belief is a kind of desire to succeed in learning in a specific domain.

**Subcode 3a: IMOTI**
Name: articulating an individual motivational belief

Definition: articulating one’s own personal reason in participation in a learning activity, such as one’s interest in a task, confidence in performing a task, or expectation of the ultimate ends of learning

Examples:

1. I think we could do it now.
2. It’s interesting to know.
3. We will be an expert in anova.

Note: All the three dialog units are individually oriented because they demonstrated one’s own reason in doing something.

**Subcode 3b: SMOTI**

Name: articulating a shared motivational belief

Definition: contributing to the articulation of a shared motivational belief, such as aspiration for success or fear of failure in the group’s learning performance through interactive discussion with one’s partner or members of a group

Examples:

1. A: The score model is interesting, right?
   B: Yeh, it’s really great.

2. It will take long time if we do in this way.
Note: Both the dialog units in Example 1 are coded as socially oriented motivation actions because the first one tried to elicit shared feeling and the second one was a positive statement to share the feeling.

The dialog unit in Example 2 is also coded as socially oriented because it demonstrated a concern (fear of failure) about the performance of the group although it was neither a positive answer nor a simple question.

**Code 4: Searching for New Information**

Definition: Information is a kind of knowledge needed to solve a problem or improve understanding to contribute to one’s learning.

**Subcode 4a: ISEAR**

Name: searching for new information of individual interest

Definition: individually searching for new information related to one’s own learning goals expressed in the previous learning period

Examples:

1. Task five.
2. Part one.
3. Coaching.

Note: All the three dialog units are individually oriented because they stated a searching action of one’s own interest.
Subcode 4b: SSEAR

Name: searching for new information of shared interest

Definition: contributing to the search for new information related to the group’s shared goals through interactive discussion with one’s partner or members of a group

Examples:

1. Do you want to go to part two?
2. Yeh, part two.

Note: The two dialog units are socially oriented searching actions because the first one tried to seek expectations from the partner and the second one was a positive answer to fit the partner’s motion.

Code 5: Clarifying the Meaning of What Was Learned

Definition: A clarification is to articulate one’s understanding of the knowledge that was gained through learning from sources used (e.g. text, internet etc.) in ways that make it clearer.

Subcode 5a: ICLAR

Name: individual clarification of what was learned
Definition: individually articulating one’s understanding of the knowledge that was gained through learning from sources used (e.g. text, internet etc.)

Examples:

1. A mean square is a kind of variance.
2. Mu refers to the population mean.
3. This is the formula for factor a sum of squares.

Note: All the three dialog units are individually oriented because they stated a clarification action of one’s own interest.

**Subcode 5b: SCLAR**

**Name:** shared clarification of what was learned

**Definition:** contributing to the clarification of the knowledge and understanding that was gained through learning from sources used (e.g. text, internet etc.) through participation in an interactive discussion with one’s partner or members of a group

**Examples:**

A: What are least square means? (IHELP)

B: Just the optimal estimation of the means. (SCLAR)
Note: The first dialog unit is an individually oriented help seeking action. The second one is a socially oriented clarification action because it met the needs of the partner A.

**Code 6: Elaborating on What Was Learned**

Definition: An elaboration is an explanation that details the knowledge and understanding that was gained through learning from sources used (e.g. text, internet etc.) that integrates it with prior knowledge and experience. It is a kind of explanation that goes beyond the focused learning task.

**Subcode 6a: IELAB**

Name: individual elaboration on what was learned

Definition: individually elaborating the knowledge and understanding that was gained through learning from sources used (e.g. text, internet etc.)

Examples:

1. I remembered the null hypothesis is that all group means are equal.

2. I guess we have a balanced design because I remember the three groups in our case are of equal size.

Note: Both the dialog units are individually oriented because they elaborated a concept of one’s own concern.
Subcode 6b: SELAB

Name: shared elaboration on what was learned

Definition: contributing to the elaboration of the knowledge and understanding that was gained through learning from sources used (e.g. text, internet etc.) through participation in an interactive discussion with one’s partner or members of a group

Examples:

A: What is the difference between statistical significance and practical significance? (IHELP)

B: For example, small classrooms improve learning statistically but for many other students, it doesn’t matter. (SELAB)

Note: The first dialog unit is an individually oriented help seeking action. The second one is a socially oriented elaboration action because it met the needs of the partner A.

Code 7: Summarizing What Was Learned

Definition: A summary is a brief account giving the main points of what was learned from sources used (e.g. text, internet etc.)

Subcode 7a: ISUMM

Name: individual summarization of what was learned
Definition: individually summarizing the knowledge and understanding that was gained through learning from sources used (e.g. text, internet etc.)

Examples:

1. Basically this page says which part of score is due to the group, and which is due to the deviation from the group.

2. Basically this formula is describing how to estimate the group effect.

Note: Both the dialog units are individually oriented because they summarized one’s own understanding.

**Subcode 7b: SSUMM**

Name: shared summarization on what was learned

Definition: contributing to the summarization of the knowledge and understanding that was gained through learning from sources used (e.g. text, internet etc.) through participation in an interactive discussion with one’s partner or members of a group

Examples:

A: Do you understand this page? (SHELP)

B: Yeh, basically it talks about how to calculate the overall mean. (SSUM)
Note: The first dialog unit is a socially oriented help seeking action. The second one is a socially oriented summarization action because it met the needs of the partner A.

**Code 8: Reviewing Records**

Definition: Reviewing records refers to statements indicating student-initiated efforts to re-examine relevant work, such as notes, learning requirements, and texts.

**Subcode 8a: IREVW**

Name: reviewing records based on personal interest

Definition: individually reviewing records according to one’s own learning goals

Examples:

1. Let me see the notes.
2. Please go back to the questions again.

Note: Both the dialog units are individually oriented because they tried to review records based on personal interest.

**Subcode 8b: SREVW**

Name: reviewing records based on shared interest
Definition: contributing to the review of records according to the group’s shared goals through interactive discussion with one’s partner or members of a group

Examples:

A: Review the questions again?

B: Ok, we go back to the problem description.

Note: Both the dialog units are socially oriented review actions because the first one tried to elicit expectations from the partner and the second one was a positive answer to fit the partner’s motion.

**Code 9: Note-taking**

Definition: Note-taking is the practice of writing or copying pieces of information, often in an informal or unstructured manner.

**Subcode 9a: INOTE**

Name: taking notes for a personal purpose

Definition: individually engaging in and/or articulating one’s notetaking efforts

Examples:

1. Copy and paste the Definition of F.

2. Let me write down the formula.
Note: Both the dialog units are individually oriented because they were based on personal interest.

**Subcode 9b: SNOTE**

Name: taking notes for a shared purpose

Definition: contributing to note-taking for the group through one’s contribution to note-taking or interactive discussion with one’s partner or members of a group

Examples:

A: Copy it?

B: Oh, you may highlight it and copy it.

Note: Both the dialog units are socially oriented note-taking actions because the first one tried to elicit expectations from the partner and the second one was a positive answer to fit the partner’s motion.

**Code 10: Predicting What May Be Found**

Definition: A prediction is a statement or claim of whether concerned information will be found through learning from sources used (e.g. text, internet etc.) in the future.

**Subcode 10a: IPRED**
Name: individual prediction of what will be found

Definition: individually predicting the knowledge that one will gain from sources used (e.g. text, internet)

Examples:

1. I guess I can find an example in the coaching area.

2. We might see how the F is calculated in this topic.

Note: Both the dialog units are individually oriented because they were based on personal interest.

Subcode 10b: SPRED

Name: shared prediction on what will be found

Definition: contributing to the prediction on the knowledge that will be gained by the group from sources used (e.g. text, internet etc.) through participation in interactive discussion with one’s partner or members of a group

Examples:

A: The critical value may be in the last theory part?

B: Yeh, it would be.

Note: Both the dialog units are socially oriented prediction actions because the first one tried to elicit expectations from the partner and the second one was a positive answer to fit the partner’s motion.
Code 11: Locating the Place Where Learning Had Happened

Definition: A locating effort refers to trying to find the exact place where learning happened for a review purpose. This is usually important in a complex hypermedia-learning environment.

Subcode 11a: ILOCA

Name: locating the place where one’s individual learning happened for a personal purpose

Definition: individually articulating one’s place-locating efforts

Examples:

1. That’s where we were.

2. It seems that we saw the F formula in part two.

   Note: Both the dialog units are individually oriented because they were based on personal interest.

Subcode 11b: SLOCA

Name: locating the place where the group's learning happened for a shared purpose

Definition: contributing to the place-locating efforts through interactive discussion with one’s partner or members of a group
Examples:

1. We were in part seven just now?

2. Yeh, maybe.

Note: Both the dialog units are socially oriented locating actions because the first one tried to elicit expectations from the partner and the second one was a positive answer to fit the partner's expectation.

**Code 12: Environmental Structuring**

Definition: Environmental structuring refers to statements indicating student-initiated efforts to organize the learning context in ways that help to learn better. An environment may be physical (e.g. a computer environment), psychological (e.g. readiness, anxiety etc.), or social (e.g. relationship between participants).

**Subcode 12a: IENVI**

Name: structuring an environment to help oneself learn better

Definition: individually articulating one’s environment structuring efforts to help improve one’s individual learning

Examples:

1. I slept early last night to learn better today.

2. Wait a minute, I didn’t finish yet.
Note: Both the dialog units are individually oriented environment-structuring actions because they were aimed at structuring an environment to help oneself learn better.

**Subcode 12b: SENVI**

Name: structuring an environment to help the group perform better

Definition: contributing to the efforts of environment structuring to help the group improve their learning through interactive discussion with one’s partner or members of a group

Examples:

1. A: Are you finished?
   
   B: Yeh, go ahead.

2. Just say it if you have anything in mind.

   Note: Both the dialog units in Example 1 are coded as socially oriented environment-structuring actions because the first one tried to elicit expectations from the partner B and the second one was a positive statement to fit the benefit of the partner A. The dialog unit in Example 2 is also coded as socially oriented because it demonstrated an intention to benefit the partner or the group although it was neither a positive answer nor a simple question.
Code 13: Help Seeking

Definition: Help seeking refers to statements indicating student-initiated efforts to solicit unknown information from other people.

Subcode 13a: IHELP

Name: seeking help based on one’s own needs

Definition: articulating one’s specific personal needs when seeking help from others

Examples:

1. What’s the R square?
2. What should I do?

Note: Both the dialog units are individually oriented because they were based on personal interest.

Subcode 13b: SHELP

Name: seeking help based on the needs of the group

Definition: contributing to the clarification of the group’s needs through interactive discussion with one’s partner or members of a group when seeking help

Examples:
1. A: I don’t understand the R square. (SHELP)

   B: The R square is the ratio of the sum of squares explained by independent variables over the total sum of squares as you see here. (SCLAR)

2. Do you know the R square? (SHELP)

   Note: The dialog unit A in Example 1 and the dialog unit in Example 2 are socially oriented help-seeking actions because they were based on the benefits of the partner or the group.

**Code 14: Metacognitive Monitoring**

Definition: Monitoring refers to tracking one’s own or the group’s cognitive activities during learning, such as: judgments of what has been done or learned already (e.g. already read), feeling of knowing (e.g. sure of the null hypothesis), self-questioning (e.g. questioning but leaving no time for an answer), content evaluation (e.g. easy, difficult), adequacy evaluation (e.g. useful, important), progress evaluation (e.g. two questions unanswered), environmental evaluation (e.g. slow computer), as well as recall of the knowledge background related to learning (e.g. remember the null hypothesis for t-test)

**Subcode 14a: IMONI**
Name: monitoring one’s own learning activity

Definition: articulating one’s self-monitoring process during learning

Examples:

1. easy, difficult, simple, confused, lost, complicated, too much, crappy, no good.

2. useful, helpful, important, helps, pretty much we have to know

3. slow, freezing, mess.

Note: All these words can be used to track one’s own cognitive activities during learning because they were based on personal feeling or interest.

Subcode 14b: SMONI

Name: monitoring shared learning activity

Definition: contributing to the process of monitoring the group’s shared understanding of the learning activities such as their own knowledge background, intentions and expectations, or inferences about others’ understanding

Examples:

A: What’s your background?

B: I am a U2 student majoring in mechanical engineering.
Note: Both the dialog units are socially oriented monitoring actions because the first one monitored the partner's background knowledge and the second one monitored oneself to meet the needs of the partner.

**Code 15: Learning Evaluation**

Definition: Learning evaluation refers to statements articulated to indicate student-initiated critical evaluation of (and dissatisfaction with) the effectiveness of one's individual learning or the group’s learning by comparing it to either one’s best previous practice effort (self-improvement criteria), or to the learning performance of other members of the group or of the group as a whole (social comparison criteria).

**Subcode 15a: ISREV**

Name: individual evaluation of learning

Definition: articulating an evaluation of one's individual learning performance in relation to a self-improvement criterion.

Examples:

1. Sure? (a tone of doubt) (ISREV)

2. A: Larger F is an indicator of statistical significance. (ICLAR)
   
   B: No. I don’t think so. (ISREV)
Note: “Sure?” (p.308) is a simple question. However, it is an individually oriented SRL self-evaluation action because it did not seek expectation from others. On the contrary, it expressed a concern and tried to challenge others. The dialog unit B in Example 2 is also an individually oriented self-evaluation because the negative statement indicated that the evaluation was related to one’s own criteria.

Subcode 15b: SSREV

Name: shared evaluation of learning

Definition: contributing to a shared evaluation of one’s own or the group’s learning through interactive discussion with one’s partner or members of a group of one’s own learning performance or that of the group against a social comparison criterion.

Examples:

A: M is the estimated value of mu? (SSREV)

B: Yes, it is. (SSREV)

Note: The first sentence is a socially oriented self-evaluation action because it elicited evaluation from the partner (SSREV code has priority over SCLAR and SELAB). The second sentence is also a socially oriented evaluation action because it evaluated the first sentence to meet the needs of the partner.
Code 16: Feeling of Satisfaction

Definition: A feeling of satisfaction is a positive reaction to the effectiveness of one’s own or the group’s learning which contributes to the sustainment of the current learning activity, direction or strategy.

Subcode 16a: ISATI

Name: individual feeling of satisfaction

Definition: individually articulating one’s feeling of satisfaction with the effectiveness of one’s learning performance or knowledge in order to sustain one’s current learning strategy.

Examples:

1. A1: MSE is SSE divided by its degree of freedom. (ICLAR)
   A2: Great. (ISATI)

2. A: The grand mean mu is estimated by the sample mean m.
   (ICLAR)
   B1: It makes sense. (ISATI)
   B2: But what’s the cell mean? (IHELP)

Note: A2 in Example 1 is an individually oriented satisfaction action because it demonstrated a feeling of satisfaction about one’s own action (A1) in order to sustain the current learning strategy. B1 in Example 2 is also an individually oriented satisfaction action because it demonstrated
one’s own feeling of satisfaction with an intention of expressing one’s own concern (B2).

**Subcode 16b: SSATI**

Name: shared feeling of satisfaction

Definition: contributing to a shared feeling of satisfaction by the group with the effectiveness of the group’s learning performance or knowledge through interactive discussion with one’s partner or members of a group to maintain the group’s current learning strategy.

Examples:

A: A smaller p value than zero point zero five indicates a significant effect. (ICLAR)

B: Correct. (SSATI)

A: We go to the next section. (ISEAR)

Note: Unit B is coded as a socially oriented satisfaction action because it tended to encourage the partner to maintain this clarification action.

**Code 17: Adaptive Reaction**

Definition: A feeling of dissatisfaction with oneself or others may elicit a need to change from dissatisfaction (critical evaluation) to satisfaction.
Such a change is called an adaptive reaction. With more knowledge gained, a feeling of dissatisfaction may occur again, and lead to another wave of adaptation toward learning.

**Subcode 17a: IADAP**

Name: individual adaptive reaction

Definition: individually adapting one’s own learning strategy based on dissatisfaction with previous learning experiences (evaluation) so that one may change from a state of dissatisfaction to satisfaction.

Examples:

A1: So far we have read a lot but we don’t know whether we could answer the questions. (IMONI)

A2: We may read our question again and then look for the answer on the Tutor (IADAP).

Note: A2 is an individually oriented adaptive action because it was based on one’s own unsatisfied learning experience.

**Subcode 17b: SADAP**

Name: shared adaptive reaction

Definition: contributing to the group’s adaptation by changing one’s own or contributing to changing the group’s learning strategy through interactive
discussion with one’s partner or members of a group so that the group may change from a state of dissatisfaction to satisfaction with their collective learning performance.

Examples:

A: Go to task five. (ISEAR)

B: No, task zero. (ISEAR)

A: We may not have enough time to read the needed knowledge if we do in this way. (SMOTI)

B: Ok, task five (SADAP).

Note: The last dialog unit is coded as a socially oriented adaptive action because it was based on meeting the expectation of the partner (SADAP has priority over other social actions).

Footnote:

1. Action solicitations will be classified into one of the following categories: searching (i.e. 4a), reviewing (i.e. 8a), note-taking (i.e. 9a), locating (i.e. 11a), or environment structuring (i.e. 12a) based on the nature of the action.
2. Questions that ask others to judge whether a claim of one’s understanding about learning is correct will be classified into the social evaluation (i.e. 15b) category.

3. Questions that request information about others’ background, intention, or expectation will be classified into the social monitoring (i.e. 14b) category.

4. Questions that are used to check one’s understanding about others will be classified into the social clarification, social elaboration, social summarization, and social prediction categories as appropriate.
Appendix G: Scoring Rubrics

You recognized the general score model $x_{i(j)} = \mu + \alpha_j + e_{i(j)}$ for one-way ANOVA.

You identified the specific score models for your data:

$x_{i(1)} = \mu + \alpha_1 + e_{i(1)}$; $x_{i(2)} = \mu + \alpha_2 + e_{i(2)}$; $x_{i(3)} = \mu + \alpha_3 + e_{i(3)}$.

You estimate the grand mean $\mu$ by using $M_\cdot = 1/3 \left[ M_{1.} + M_{2.} + M_{3.} \right]$.

You estimate the group effect by using $\text{est} (\alpha_1) = M_{1.} - M_\cdot$; $\text{est} (\alpha_2) = M_{2.} - M_\cdot$; $\text{est} (\alpha_3) = M_{3.} - M_\cdot$.

You estimate the error scores by $\text{est} (e_{i(j)}) = x_{i(j)} - M_\cdot - \text{est}(\alpha_j)$.

You estimate the factor A effect by using $\text{SS}(A) = n \sum (M_j - M_\cdot)^2$.

You estimate the overall size of error by using $\text{SS}(\text{res}) = \sum \sum (e_{i(j)})^2$.

You estimate total sum of squares $\text{SS (total)} = \sum \sum (x_{i(j)} - M_\cdot)^2$.

You identify the null hypothesis such as $H_0: \alpha_j = 0$ for $j = 1... J$.

You are aware that the F ratio is a ratio of mean squares:

$F = \frac{\text{MS (between)}}{\text{MS (error)}}$.

You draw your conclusion based on the F ratio at the 0.05 level.

You draw your conclusion based on additional statistics such as $r$ square, or group means.

Note. One point is earned for a correct answer, zero for an incorrect or missing solution. Total score is 12 for a pair.
Appendix H: Data Analysis Plan

**Dependent variables** included orientation of types of problem-solving actions and self-regulatory actions (based on coding the discourse data), frequencies of events for topics of learning (logs data), frequencies of correct solutions to the prescribed problem (solutions data), and accuracy proportion (pre-test data).

**Independent variables** involved group (composition of dyads: mixed pairs, Canadian pairs, and Chinese pairs), cultural identity of students (Chinese or Canadian) within the mixed pairs group, prior knowledge in statistics (high, medium, and low), type of action (PS and SRL), pair (group) – the nested effect of pairs in group.

A. Between group effects:

<table>
<thead>
<tr>
<th>Group</th>
<th>Composition of dyad</th>
<th>Comments: 3 levels, df = 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>CA-CN</td>
<td>Mixed pairs group</td>
</tr>
<tr>
<td>Group 2</td>
<td>CA-CA</td>
<td>Canadian pairs group</td>
</tr>
<tr>
<td>Group 3</td>
<td>CN-CN</td>
<td>Chinese pairs group</td>
</tr>
</tbody>
</table>
B. Planned contrasts between groups:

<table>
<thead>
<tr>
<th>Preplanned contrast</th>
<th>Contrast description</th>
<th>Contrasted levels of group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast 1</td>
<td>Mixed (CA - CN) vs. Canadian (CA - CA)</td>
<td>(1) - (2)</td>
</tr>
<tr>
<td>Contrast 2</td>
<td>Canadian (CA-CAN) vs. Chinese (CN-CN)</td>
<td>(2) - (3)</td>
</tr>
</tbody>
</table>

C. Cultural identity effects within the mixed pairs group:

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Contrasted levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural identity</td>
<td>Canadian (CA)-Chinese (CN)</td>
</tr>
</tbody>
</table>
Appendix I: Transcription Conventions

A CLAN transcript follows the transcription convention defined by CLAN software. It specifies three major components of a CLAN transcript: the file headers, the main tier, and the dependent tier. These tiers are used to control the function of media, identify a participant, or select specific codes for analysis. Therefore, only when this convention is followed, can one further code and analyze the transcript by using CLAN.

File headers begin with the “@” sign, telling us about things such as the date of the recording, the names of the participants, the ages of the participants, the setting of the interaction, and so forth. Many such lines can be seen in Appendix J at the beginning of the sample transcript.

A main tier of a transcript gives the basic transcription of what a speaker said. It begins with an asterisk, followed by a three-letter speaker ID, a colon, a tab, and a dialog unit. The punctuation set that is recognized by CLAN include space and nine characters such as , . ; ? ! [] < >. Other characters are not recognized. The first word of a sentence is not capitalized unless it is a proper noun. All numbers must be written in words.

Other symbols used in the main line in this study included:

unidentifiable speech: xxx.
untranscribed material: www.

actions without speech: 0.

best guess: [?].

non-completion of a text: text(text)test.

omitted word: 0word.

Intonation and utterance terminators: one of the three terminators must be used for a dialog unit. A period is used with utterances having normal falling intonation. Utterances with question intonation are followed by question marks. An exclamation point is used for an utterance with exclamatory intonation.

unfinished utterances: +...

unfinished utterances with rising intonation: +..?

reading: & = reads.

writing: & = writes.

Dependent tiers are lines typed below the main line that contain codes, comments, events, and descriptions of interest to the researcher. They are usually written on separate lines, starting with a symbol “%”.

Detailed information can be seen in the CHAT manual of CLAN.
Appendix J: A Sample of Transcript

1 @Begin

2 @Languages: en

3 @Participants: GUO Jianguo Student, YUN Yunpan Student, INV Yongchao Investigator

4 @ID:en|dialog305|GUO|30;00.0|male|CNCN|sculture|Student|lexp|

5 @ID:en|dialog305|YUN|30;00.0|male|CNCN|sculture|Student|hexp|

6 @ID:en|change_me_later|INV|||||Investigator||

7 @Media:dialog305 video

8 @Date: 15-APR-2009

9 @Location: Lab of Applied Cognitive Science Group, McGill, Montreal, QC, Canada

10 @Warning: Gestures are not transcribed

11 @Activities: Learning ANOVA through McGill Statistics Tutor

12 @Transcriber: Yongchao Shi

13 @Situation: Pair Learning
16  @Comment:  Jian in grey shirt and Pan in black and white shirt, a little more knowledge about statistics, U3. Both new to
18  anova. Both are Chinese students. Ready for coding on July the
21  *INV:  we can start with the problem. •0_6942•
22  *GUO:  wait, wait, do it together, right? •6942_12277•
23  *INV:  you do it together. •12277_14304•
24  *YUN:  so what's your opinion about the process and methodology
        of doing this research? •13988_107826•
26  *GUO:  we can look at the general questions one by one.
        •107826_113754•
27  *GUO:  we know if the answers are just right answers.
        •113754_117496•
28  *GUO:  and if we want to know the specific answers.
        •117496_121312•
29  *GUO:  just look at the tutorials. •121312_123047•
30  *YUN:  my opinion is first to go through the whole problem.
        •123047_130003•
*YUN: and think about what we need. •130003_133797*

*YUN: and go through the outline of the tutor to make sure to locate the answers. •133797_141380*

*YUN: after we locate the answers, probably just one-way anova. •141380_145260*

*YUN: and we read completely. •145260_148609*

*YUN: and pay attention to the time. •148609_151407*

*YUN: I think after we finish all the materials. •151407_156673*

*YUN: maybe just twenty minutes, we can finish the report. •156673_159952*

*GUO: ok, we can pop up the questions first. •159952_162639*

*GUO: and then do the writings then. •159952_162639*

*YUN: ok, first we do this one. •162639_165501*

*GUO: I think primarily I have an idea about what we talk about the thing. •165501_171601*

*YUN: you mean what? •171601_174407*

*GUO: ok, just the steps. •174407_176073*

*YUN: ok, first step. •176073_177231*
48 *YUN: & = reads: the solution, difference, learning, difference, cognitive organizers, how well, organizer, group, randomly split.

•177231_218231•

50 *YUN: it's a random sample. •218231_221401•

51 *GUO: hm, but it's equal sample. •221401_223421•

52 *YUN: yeh, equal sample. •223421_225884•

53 *GUO: equal size. •225884_226810•

54 *YUN: & = reads: received before, ok, before studying, yes, received the same, after, post. •226810_241275•

56 *GUO: & = reads: no organizer material. •241275_244749•

57 *YUN: so +... •244749_247609•

58 *GUO: before, after, and no. •247609_249432•

59 *GUO: I don't think it actually accounts, this calculates. •249432_255535•

60 *YUN: ok, but it's good to know. •255535_257493•

61 *GUO: yeh, ok. •257493_259606•

62 *YUN: & = reads: on a ten item test covering +... •259606_267021•
*YUN:* it's ok. •267021_267409•

*YUN:* if I go too fast or too slow. •267409_271151•

*YUN:* let me know. •271151_272003•

*YUN:* it's ok. •272003_272604•

*GUO:* ok. •272604_273366•

*YUN:* & = reads: you will be given the results of an analysis of variance +... •273366_285012•

*GUO:* I think it just tests the hypothesis that why three groups have no difference signs. •285012_294002•

*YUN:* how do you know whether there is difference? •294124_298208•

*GUO:* we need to copy this level. •298208_301096•

*YUN:* yeh, yeh, make a reference. •301096_303210•

*YUN:* ok. •303210_303829•

*GUO:* yeh. •303829_304451•

*YUN:* ok, level of significant, ninety five percent. •304451_305609•

*YUN:* & = reads: output, class, class, class variable, condition, to classify, three levels, ok, number of observation read, ok, used,
dependent score.

*YUN: so because I think because the total number is thirty.

*YUN: and because the mean is the estimated sample mean.

*YUN: so one degree of freedom is lost.

*GUO: I think they are different.

*GUO: because F value is significant.

*YUN: yeh.

*GUO: and the probability is less than five percent.

*GUO: so they are totally different.

*GUO: can I say that?

*YUN: what's the alternative hypothesis?

*YUN: because we compare the three means.

*YUN: what does it mean?

*GUO: I remembered when we deal with six two two.
CULTURALLY SITUATED SELF-REGULATION

94  *GUO:  there is the function, is the hypothesis. •366007_370407*

95  *YUN:  what's the hypothesis? •370407_373130*

96  *GUO:  h zero hypothesis. •373130_373783*

97  *YUN:  ok, anyway we can find it in the tutor. •373783_376646*

98  *YUN:  but we need to +... •376646_380494*

99  *YUN:  ok, calculated mean. •380494_381236*

100 *YUN:  this is the number divided by this number. •381236_383683*

101 *YUN:  ok. •383683_386009*

102 *YUN:  level, sample mean, sample standard deviation. •386009_389448*

103 *YUN:  ok. •389448_390654*

104 *GUO:  the last one. •390654_391828*

105 *YUN:  maybe just part of the lot of do it together to get help from the tutor, to understand those how, why. •391828_400610*

107 *YUN:  how and why, answer, significant difference due to, ok,

108  conclusion, first conclusion, yeh +... •400610_411824*

109 *GUO:  your conclusion just says what they are asking. •411824_•

1272  @End
Appendix K1: Informed Consent Form

Title of Research: Culturally Situated Self-Regulated Learning in Statistics in a Computer-Supported Collaborative Learning Environment

Researcher: Yongchao Shi, Ph.D. candidate, Educational and Counselling Psychology    Supervisor: Carl Frederiksen (tel: 514-398-3448); Krista Muis (tel: 514-398-3445)

Contact Information: Tel: 514-3984256 (office), 514-667-4835 (home), email yongchao.shi@mail.mcgill.ca

Purpose of the research: Our purpose is to find how people from different cultural backgrounds meet their challenges in learning advanced statistics knowledge in a computer-supported collaborative learning environment. You will learn in pairs for about 2 hours to solve a statistics problem with help of a computer tutor. Your performance on the learning tasks will be recorded and compared to that from other participants who have a different cultural background in order to see difference and similarity in terms of perception, feelings, and strategies when all of you learn to solve
the statistics problem. This research represents the core phase of the writing of my dissertation.

**Benefits of participation:** First, it will provide data for use in this project. Second, it will help other people who have similar learning experiences by contributing to our research knowledge base. Third, you may update your statistics knowledge that is required in many research professions. Fourth, your learning processes will be analyzed in detail so that you can get feedback on them at the end of the study, which may be useful for you to meet your future challenge in learning. Finally, you will be paid for your valuable time of participation ($10/h).

**Sampling criteria:** Each participant has to: (a) be a male graduate student in McGill; (b) speak English clearly enough to discuss problems with partners; (c) have learned elementary statistics course and be interested in updating his knowledge about statistics. Moreover, a participant should be a Chinese student or an Anglophone student. An Anglophone student in this study refers to a participant who was born in Canada, whose father or mother was born in Canada, and who mainly speaks English at home. In contrast, a Chinese student here refers to a participant who was born in Mainland China, and who mainly speaks Chinese at home. Only male
participants were selected in this study because researchers suggest female participants tend to learn differently from males.

Confidentiality: Your participation is voluntary and you can choose to withdraw from the study when you do not wish to participate further. All individual data are strictly confidential. No participants’ names will be used or identified in subsequent reports.

Participation: Research will be conducted in the lab of Applied Cognitive Science Group in Education Building of McGill University. The time for participation can be negotiated to your preference. You may contact me through email or telephone for participation or further information.

Consent: I have read the above information and I agree to participate in this study.

Signature of participants: __________________

Researcher’s signature: __________________

Date: ____________________________
Appendix K2: A Letter of Solicitation for Participation

Hello,

This is Yongchao, a PhD candidate in the Department of Educational and Counselling Psychology. We are inviting you to participate in our learning project in intermediate statistics. If you are willing to do so, you can click http://cssrl.blogspot.com/ to book your convenient time slot for participation, either before or after the final exam.

Benefits

1. Prepare for a higher-level course
2. Get permission to log in our website to learn intermediate statistics at home
3. Get feedback about your learning processes
4. $10/h compensation for the 2-hour experiment

Participation criteria:
1. Anglophone (you and parents were born in Canada or the US, mainly speak English at home); or Chinese (from mainland China and less than 5 years of experience studying overseas)

2. Male;

3. Elementary Statistics (knowledge of T-test and standard deviation)

Yongchao Shi, PhD Candidate

Department of Educational and Counselling Psychology, McGill University.

Tel: 514-398-4255 (office)

Tel: 514-907-6290 (home)

yongchao.shi@mail.mcgill.ca

Address: Room B199 Applied Cognitive Science Group, Education Building, 3700 McTavish Street, Montreal, Quebec H3A 1Y2
Appendix K3: A Website to Learn about This Project

Culturally Situated Self-Regulated Learning

Benefits
1. prepare for a high-level course
2. get permission to log in our website to learn Intermediate statistics at home
3. get feedback about your learning processes
4. $10/h compensation for the 2-hour experiment

Click the "book now" button to make an appointment

Scheduling URL
You can also click here to book online

Yongchao Shi

Blog Archive
2009 (4)
- May (1)
  Sorry, no more appointments needed!
- April (1)
- March (3)

About Me

MONDAY, MAY 11, 2009
Sorry, no more appointments needed!

POSTED BY [NAME] AT 4:31 PM 0 COMMENTS

SUNDAY, APRIL 5, 2009
Introduction to The Project 项目简介

TUESDAY, MARCH 31, 2009
Participation Criteria 帮你走向学习优势

<table>
<thead>
<tr>
<th>Participation Criteria for Canadians</th>
<th>Participation Criteria for Canadians</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Anglophone (you and parents born in Canada or US, mainly speak English at home)</td>
<td>- 来自中国大陆，海外经历少于五年</td>
</tr>
<tr>
<td>- Male</td>
<td>- 男性</td>
</tr>
<tr>
<td>- Elementary statistics (you know T-test and standard deviation)</td>
<td>- 英语流利（能清楚地用英语表达自己)</td>
</tr>
<tr>
<td></td>
<td>- 初级统计的基础 (知道 t 检验和标准差)</td>
</tr>
</tbody>
</table>
Appendix K4: A Website to Book a Time Interval for Participation