THE INFLUENCE OF TEMPERAMENT ON PEER INTERACTIONS IN A COMPUTER-SUPPORTED COLLABORATIVE LEARNING ENVIRONMENT

by

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(Under the Direction of Stacey Neuharth-Pritchett)

ABSTRACT

In recent years, computer-supported collaborative learning (CSCL) has received increased attention from teachers and educators. However, little is known about achieving effective computer-supported collaborative learning with young children. In order to discuss the components that contribute to a successful CSCL environment for children, the current study investigates the influence of the individual differences in temperament on the ways that children interact with their peers during CSCL classroom activities. Through a qualitative-based method, this research consisted of interviews and observations of a group of children from a southeastern elementary classroom. In addition, the teacher was interviewed to collect more information about children's temperamental traits as well as their interactive behaviors during the CSCL activities. Findings suggest that children exhibited different behaviors while interacting with their peers during the CSCL activities that were based on their temperament. Computer-supported learning was found to be attractive to children regardless of their temperamental dispositions. The results of this study also allow the researcher to suggest practical suggestions for teachers who expect to implement and achieve successful collaborative learning with computers.

INDEX WORDS: Temperament, Computer-Supported Collaborative Learning, Peer Interaction

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CHAPTER 1

INTRODUCTION

In recent years, *computer-supported collaborative learning* (CSCL) has received increased attention. Evidence suggests that many tasks are supported by implementing CSCL in the classroom for a variety of subjects such as science, mathematics, reading and writing skills, photography, as well as problem-solving tasks in elementary classroom settings (Clements & Nastasi, 1988; Dickinson, 1986; Erkens, Jaspers, Prangsma, & Kanselaar, 2005; Lingnau, Hoppe, & Mannhaupt, 2003; Muller & Perlmutter, 1985; Oshima, Oshima, Murayama, Inagaki, Takenaka, Nakayama, & Yamaguchi, 2004; Schiller & Tillett, 2004; Staarman, 2003).

Defined as a field of study centrally concerned with meaning and pieces of meaning-making in the context of a joint activity, and the ways in which these practices are mediated through designed artifacts, the role of CSCL warrants attention from teachers and teacher educators. Research on CSCL has demonstrated a number of positive outcomes for academic and social performance in the classroom. For example, studies indicate that CSCL promotes the quantity and quality of children's achievement in reading and writing. In these studies, children were asked to work collaboratively on a number of different writing tasks. Researchers noted that children were able to work collaboratively in editing other children's written work. In addition, the children were also perceived to be more on task and supportive of one another (Dickinson, 1985; Erkens, Jaspers, Prangsma, & Kanselaar, 2005; Lingnau, Hoppe, & Mannhaupt, 2003; Staarman, 2003).

CSCL is based on the socio-cultural learning theory (Crook, 1987; Littleton & Häkkinen, 1999; Pea, 1994; Säljö, 1999; van der Meijeden & Veenman, 2005). The socio-cultural theory of learning can be retrieved from the works of Lev Vygotsky. Vygotsky (1978) indicated that learning takes place in social contexts. Social interaction is also highly stressed in Vygotsky's theory because it can "function to promote cognitive development" (Crook, 1987, p. 47).

Children construct their own knowledge through interacting or working with others, particularly those who have advanced knowledge. Further, Vygotsky suggested that instruction should involve the following components: goal-directed learning environment, the use of mediational tools, and opportunities to interact with a more knowledgeable person. In addition, he believed that cognitive development takes place through interacting with a more skilled partner including peers.

Derived from the idea of Vygotsky, CSCL provides children two dimensions of learning opportunity. First, children learn through interacting and communicating with others rather than alone. Children's learning in CSCL is a process of joint construction (or co-construction) of knowledge, as indicated by Littleton and Häkkinen (1999) that "the child's understanding of the world is mediated by and built up through interaction with others, and meanings are negotiated and established through interaction in a wide range of social contexts" (p. 24). Second, the use of computer technologies in CSCL environment allows children to manipulate tools on their own; that is, children build up their own knowledge through using cultural tools.

Within the CSCL environment, the role computers play can be roughly classified into three categories: hardware, software, and mediational artifacts. As hardware, computers are found to be attractive to children's attention in the classroom and can generate a degree of increased interaction (Hawkins, Sheingold, Gearhart, & Berger, 1982). As software, computers provide a variety of functions to support student's group interactions and learning (Clements & Nastasi, 1988; Staarman, 2003). The latter one is usually what researchers mean when describing the role computers play in the classroom. Finally, computers are seen as mediational artifacts. The term mediation means "something happens by means of, or through the involvement of, a mediating object" that "usually determines the nature of the task itself" (Stahl, 2002, p. 66). In

terms of artifact, Stahl indicated it is “a meaningful object created by people for specific uses” that “resulted in a knowledge object that incorporated their [students’] new shared understanding” (p. 66). To describe the process that humans mediate through artifacts, Cole (1996) stated that “humans modified material objects as a means of regulating their interactions with the world and one another” (p. 108).

Säljö (1999) identified two different kinds of mediational meaning for tools: physical (or technical) tools and psychological (or mental) tools. The physical tools are utilized by people to help them complete their goals. For example, we type on the computer to write an article or a letter. The psychological tools are resources stored in the form of language or discourse that help us to think and act. Take writing a composition for example, we think in our language and follow the grammatical rules to put thoughts in words. Säljö suggested that people think and work through interacting with both tools together, people cannot think and work in isolation. The most apparent illustration in the modern society, according to Säljö, is the use of computer. As physical tools, computers are manipulated to turn abstract thoughts into concrete outcomes. For example, students can see their thoughts turn into words or pictures that display on the monitor. As psychological tools, computers offered students a place to discuss and modify each other’s ideas. Littleton (1999) supported this point of view. She argued that “our relationship with the outside world is always mediated by signs and artifacts” (p. 186). Seeing computers as mediational artifacts, Wang and Ching (2003) investigated the interactions between computers and a group of first graders. They found that the computer-related artifact had mediated in students’ social negotiating process of setting up a collective goal for the group. The computer promoted students to consider the issue of setting up a social norm of using computers for its users.

During CSCL activities, children can be seen as active learners who have more freedom to control the computer by themselves. They are allowed to have more space to plan what they want to do with the task. When collaborating together, they have more opportunities to talk to other children about the learning task as well. Research suggests that young children display high levels of learning motivation and high intensity of peer interaction when working together at the computer to achieve the goal of the task (Bergin, Ford, & Hess, 1993). Children are facilitators or collaborators for each other. Underwood and Underwood (1999) note that "students can serve as a resource for each other" (p. 12). Children come from families with versatile ethnic and cultural backgrounds; they bring different kind of knowledge with them to school and different way of interaction with people. Some children are better at manipulating computers while some have good social skills to collaborate with peers. This phenomenon has been noted by researchers who study young children's collaborative interactive patterns in the computer supported learning environment (Shahrimin & Butterworth, 2002; Wang & Ching, 2003; Yang & Liu, 2005). These scholars have found that during group work, children usually help each other or complement each other's understanding regarding the task or the use of technology.

However, Crook (1998) warned us that group work does not always equal to collaboration. This point of view was supported in a study by Yang and Liu (2005). The researchers documented four major patterns of group interactive behavior which emerged from qualitative data: individual, authoritative, argumentative, and consolidated. Members in the individual group worked separately and one or two members in the authoritative groups dominated almost all the work. In this case, an issue of inequality in learning might occur because each group member does not have an equal opportunity to share the learning resources and to participate in group work. This might cause a decrease of learning motivation and

promote limited academic outcomes. Teachers should know that by simply grouping children to learn, such placement does not faithfully guarantee true intra-group collaboration. Children need guidance in order to develop effective interaction during collaborative work because not all students come to school with enough knowledge to work with their teachers and peers. Further, individual differences need to be understood before grouping. Teachers are encouraged to recognize that individual students have different temperamental characteristics, learning styles, and cognitive abilities as well as other differences that might influence the student's interactive behaviors in group work. Without understanding one's students with regard to these differences, a teacher might wrongly group students together resulting in ineffective collaboration. For example, if a teacher put all of her students with the withdrawal pattern of temperament together, the group might not have any true collaborative interaction at all.

Children are producers or creators in the CSCL. This places the child-as-active-learner. The distinction between the two roles is that child-as-producer not only develops knowledge but also creates artifacts through utilizing the mediational tool—the computer. With the assistance of computers, students can create a variety of artifacts for different subjects. For writing skill tasks, a group of children can work together at the computer to write a composition. The composition, therefore, is seen as the artifact created by children. In this sense, for mathematics, students can create pictures to represent shapes and geometry. For science, children can create a graph to describe the relationship between time and speed.

While the research base is growing on CSCL in elementary school classrooms, there is a scarcity of research on how psychological variables such as child temperament facilitate or hinder the CSCL process. Much has been written on both peer interaction and childhood temperament as solitary constructs. The research literature is dense with the outcomes of quality

interactions between peers and how those interactions influence knowledge construction, social competence, and collaboration with others (Chiu, 2000; Pontecorvo, 1993; Ross & Lollis, 1985; Weinstein & Bearison, 1985; Williams, 2001). In addition, the childhood temperament literature, mainly based in either genetic or behavioral orientations also has an abundance of childhood outcome data associated with it. For example, researchers documented positive relationships between temperamental traits and academic performance (Bramlett, Scott, & Rowell, 2000; Lerner, Lerner, & Zabski, 1985; Martin, 1989; Martin, Drew, Gaddis, & Moseley, 1988; Martin, Nagle, & Paget, 1983; Newman, Noel, Chen, & Matsopoulos, 1998), as well as social behaviors (Calkins, Gill, Johnson, & Smith, 1999; Rothbart, Ahadi, & Hershey, 1994; Rubin, Burgess, & Hastings, 2002).

Missing from the current literature is the unique intersection of examining temperament and peer interactions in a CSCL environment. In addition, there appear to be methodological issues in the study of temperament that fail to account for contextual or environmental factors such a teacher's pedagogy, the structure of a classroom, or complicating traits of a child such as special needs or family or cultural constraints. While the majority of studies on peer interaction and on temperament have been done with large samples and with standardized assessment tools, there is little work that has been done examining the intersection of the two constructs in CSCL in a more qualitative manner. This study will attempt to expose methodological issues with the assessment of temperament and the assessment of peer interaction when situationally located in the context of a classroom.

Purpose of the Study and Research Questions

The purpose of this study is to investigate the effect of inidividual differences in temperament on the ways children interact with their peers in a computer-supported learning

classroom. Through multiple methods of looking at the construct of temperament, the study provides a rich description of how temperament may be either underestimated or overestimated when traditionally assessed. By examing children in their natural environments, this study elucidates dimensions of temperament that are influenced by the enviroment. By examining these dimensions, it is hoped that a new methodological approach to viewing temperament will be constructed. In order to begin this work, five second graders from a south-eastern elementary school were observed in their second-grade classrooms to view how their temperament influences their peer interactions in CSCL activities. This study seeks to answer the following questions:

(1) How do children's individual temperamental characteristics influence their interactive behaviors with other children?

(2) How does the computer-supported collaborative learning environment influence social interactions among children with different temperamental characteristics?

(3) How does the use of a qualitative strategy of inquiry differ from a quantitative method regarding the investigation of individual temperamental patterns in a CSCL learning environment?

Significance of the Study

This study is significant in several ways. First, the current study provides a contemporary way to investigate temperament. The majority of studies are using quantitative method to explore the relationships between temperamental patterns and other subjects. Research in using qualitative strategy to investigate the individual differences in temperament is also minimal. By using both interview and observation, more in-depth descriptions are provided regarding the influences of temperament on the way children learn and interact with others. Second, the study

provides some insights into how temperament interacts with the CSCL environment. Despite of the fact that the area temperament has been investigated within different learning environments, little research has been conducted to explore the way temperament interacts with the CSCL environment. This study provided information of how individual temperament influences and is influenced specifically by the CSCL environment. Third, the present study provided preliminary evidence for teacher education regarding a better practice for implementing CSCL in classrooms. Not all students achieve effective and successful collaboration within the CSCL learning environment. It is necessary for teachers to understand some factors that affect the way students collaborate with each other within the CSCL environment. This study may allow teachers to examine the natural behaviors of students that influence their ways of collaborating with others at the computer.

CHAPTER 2

REVIEW OF THE LITERATURE

Due to the lack of research on studying psychological variables on peer interaction specifically during the computer-supported collaborative learning environment, in this pioneer study the literature review can only emphasize the influences of temperamental traits on peer interactions. This literature review is divided into two main sections. The first section contains information regarding the definition of temperament, the theoretical models of temperament in young children, and how temperamental traits influence child developmental outcomes including social interactive behaviors among peers. The second section provides information on some perspectives of how children engage one another in classroom and the benefits as well as challenges of peer interaction among groups of children.

Temperament

Definition of Temperament

The term temperament is grounded in the Latin word *temperare*, which means to mix. This implies that temperamental traits have diverse effects on the behaviors. Although most researchers share similar intuitive definitions of temperament, they are unable to agree on a strict definition of the construct (Bates, 1989; Prior, 1992). To date, the definition of temperament has been argued by researchers from different perspectives. For example, Buss and Plomin (1984) stress the role of heredity in determining temperament. At the same time, Rothbart and Derryberry (1981) argued that temperamental characteristics are influenced over time by maturation and experience. Based on Goldsmith, Lemery, Aksan, and Buss (2000), the dimension of emotional characteristics should be considered in order to better define temperament. These controversial discussions also argue the stability of temperament through out the individual life span. Although most researchers agree that temperamental characteristics

remain consistent across time (Bates, 1989; Buss & Plomin, 1984; Thomas & Chess, 1977), some find somewhat inconsistent empirical evidence regarding this issue (Rothbart, 1989).

Bates (1994) noted two points of agreement when defining temperament. One consistent perspective is that temperament is at some level constitutionally based or biologically determined. For example, Rothbart and Derryberry (1981) defined temperament as "individual differences in reactivity and self-regulation assumed to have a constitutional basis" (p. 40). Buss and Plomin (1984) defined temperament as "a set of inherited personality traits that appear in early life" (p. 1). From the perspective of Strelau (1985), temperament is "relatively stable features of the organism, primarily biologically determined, as revealed in the formal traits of reactions which form the energy level and temporal characteristics of behavior" (p. 69). Goldsmith, Lemery, Aksan, and Buss (2000) also indicated that "genes are a fundamental underpinning of the biology of behavior" (p. 3).

The other point of agreement in defining temperament is that it can be identified in terms of patterns of behavior in early development. For example, Goldsmith and his colleagues (2000) define temperament as "early developing individual differences in tendencies to experience and express emotions, including their regulatory aspects" (p. 2). As stated earlier, Buss and Plomin (1984) also indicate that temperament can be recognized in early childhood. Bates (1989) described temperament as "a concept serving to tie together a variety of primary behavioral dispositions commonly used to distinguish one individual from another" (p. 4). Likewise, Thomas and Chess (1977) were concerned with individual differences in temperament as "the way in which an individual behaves" (p. 9).

Although the debates regarding defining temperament has not yet achieved consensus, Keogh (2003) suggests that Bates captured the general sense of temperament. For this research

study, temperament "consists of biologically rooted individual differences in behavior tendencies that are present early in life and are relatively stable across various kinds of situations and over the course of time" (Bates, 1989, p. 4). Because this definition indicates many of the conceptualizations from various models, this definition of temperament is used in this study.

Theoretical Models of Temperament

In the past five decades, a lot of models have been proposed to explain the individual differences in temperament based on different perspectives. In this paper, three major temperament models will be reviewed following the order of the behavioral style model developed by Thomas and Chess (1977), the behavior-genetic model established by Buss and Plomin (1975), and the developmental model created by Rothbart and Derryberry (1981). For each model, detailed information, such as the definition of temperament, theoretical foundation, and measurement, will be provided.

Behavioral Style Model

The New York Longitudinal Study (NYLS) conducted by Thomas and Chess (1977) is one of the major longitudinal studies in the field of temperament. The researchers defined temperament using the term "behavioral style" (Thomas & Chess, 1977, p. 9). By behavioral style, they explained that "Temperament may best be viewed as a general term referring to the *how* of behavior. It differs from ability, which is concerned with the *what* and *how well* of behaving, and from motivation, which accounts for *why* a person does what he is doing" (p. 9). In other words, "Temperament, by contrast, concerns the *way* in which an individual behaves" (Chess & Thomas, 1996, p. 32). The researchers conducted a six-year study started in 1956 and included 141 children with a median age of 55 months from middle- or upper-middle- class families. The collection of quantitative data used the parent-report *Child Temperament*

Questionnaire (CTQ) developed for children across the age period of three to seven. The CTQ consisted of 72-items using a 7-point Likert scales to measure the temperament in young children; each category of temperament contained eight questions. The collection of qualitative data was gathered either by interviewing the parents or teachers or by observing the child directly. Data analysis was particularly focused on how the child behaves. Nine categories and three constellations emerged from the inductive data analysis of the parent interview. The nine categories of temperament and their definitions are listed as follows.

a) *Activity level* means a child's general level of motility. A highly active child has "a great zest for life" and is always ready to be "revved up"; that can exhaust parents and caregivers (Kristal, 2005, p. 18). In contrast to high-activity children, low-activity children prefer quiet activities and move at a slow pace. A sample question from the CTQ illustrated as "Child seems to have difficult sitting still, may wriggle a lot or get out of seat" (Thomas & Chess, 1977).

b) *Rhythmicity (Regularity)* describes the predictability of time in a child's physical function schedule such as the sleep-wake cycle. The high rhythmicity children are very predictable in their bodily functioning schedule such as mealtime and bedtime, while the low rhythmicity children are very unpredictable regarding their biological functioning schedule. A sample question off the CTQ states as "After my child is put to bed at night it takes about the same length of time to fall asleep" (Thomas & Chess, 1977).

c) *Approach/withdrawal* examines a child's initial response to a new stimulus either by mood expression or motor activity. Approaching children are sociable and do not hold back from new stimuli such as a new place or person. On the other hand,

withdrawal children reject novel stimuli in the first place. A sample question from the CTQ reads “Child is shy with adults he/she doesn’t know” (Thomas & Chess, 1977).

d) *Adaptability* determines a child’s ease in adjusting to changes and transitions. For example, a highly adaptable child can easily to adjust him-/her-self to different settings. It is difficult for children in low adaptability to deal with changes, transitions, and intrusions. These children may need more time than others to deal with new place, people, or things. For example, the child can be measured by “If initially hesitant about entering into new games and activities, child gets over this quickly” according to CTQ (Thomas & Chess, 1977).

e) *Threshold of Responsiveness (Sensory threshold/Sensitivity)* is the intensity level of stimulation necessary to evoke a response. Children in a high sensory threshold are very sensitive to everything such as a smell or a sound in their environment. They are less tolerable to the discomfort in the environment in contrast to the insensitive children. A sample question off the CTQ reads “Child remarks if teacher or classmates wear new clothes” (Thomas & Chess, 1977).

f) *Intensity (Intensity of reaction)* delineates the energy level of a response with no relation to its quality or direction. According to Kristal (2005), children in high intensity are loud and dramatic. They usually express their emotions in an exaggerated way. On the other hand, the low-intensity children are more calm and quiet. For example, the child can be evaluated by the question “Child will show little or no reaction when another child takes his/her toy or possession away” in the CTQ (Thomas & Chess, 1977).

g) *Quality of mood* describes the child's level of pleasantness, as contrasted with unpleasantness. Children who have high quality of mood are positive and are happier, while the children in low quality of mood appear negative and irritable. An example question from the CTQ states "Child becomes easily upset when he/she loses a game" (Thomas & Chess, 1977).

h) *Distractibility* describes how easily a child can be distracted by extraneous stimulation. The highly distractible children have a short span of attention on things or people. They have difficulty in focusing on doing one thing in a busy environment. Children low in distractibility concentrate easily on things. A sample question from the CTQ reads "If other children are talking or making noise while teacher is explaining a lesson, this child remains attentive to the teacher" (Thomas & Chess, 1977).

i) *Persistence* is the length of time a child can continue on an activity particularly when it is difficult. A persistent child always finishes what they start. In contrast, a child low in persistence easily feels frustrated and gives up the task when encountering difficulties. For example, the child can be examined by asking "During free play, child will stick to any one activity for only a short time", according to the CTQ (Thomas & Chess, 1977).

At the same time, three temperamental constellations were identified by the qualitative analysis of data. The first group, comprised of 40% of the children, is labeled as easy. Easy children are described to have regularity of biological function, positive mood, high adaptability to new stimulations, and mild intensity. In contrast to the easy children category, there are about 10% of children who fell into the very difficult category. The difficult children are low in

biological function, easy to withdraw from new stimulations, slow to adapt themselves in a new place, and have high intense mood expressions that are usually negative. The third group is marked as slow-to-warm-up group. Comprising 15% of the sample in NYLS, this group of children is characterized by mild intensity of mood expression, initial withdrawal with slow adaptability to new stimuli. Although the slow-to-warm-up children usually withdraw from new things or people in the first place, they gradually adjust themselves to be more involved when given more time and opportunity to re-experience the new situation. Finally, there remained 35% of children who did not fit into any one of the three patterns. According to Thomas and Chess (1977), these children exhibited a wide range of different combinations of temperamental traits.

Based on the interactionist perspective, Thomas and Chess (1980) indicated that there is a bi-directional relationship between the individual temperament and the environment. The researchers explained that "behavioral attributes must at all times be considered in their reciprocal relationship with other characteristics of the organism, and in their interaction with environmental opportunities, demands and expectations. The consequences of this process of interaction may in turn modify or change recurrent or new environmental in-change selective features of behavior" (Thomas & Chess, 1980, p. 86). In order to describe the organism-environment interactional process, the model of goodness/poorness of fit was proposed by the researchers (Chess & Thomas, 1996; Thomas and Chess, 1980). Goodness of fit is achieved when there is consonance between the environment and the ability and characteristics of the individual. Conversely, poorness of fit is defined as dissonances between environmental demands and the individual ability. The occurrence of goodness of fit makes the optimal development possible and the poorness of fit leads to distorted development.

Behavior-Genetic Model

According to Buss and Plomin (1984), temperament is "a set of inherited personality traits that appear in early life"; it is "constitutional in origin" (p. 1). In other words, temperaments have an inherited basis. The researchers postulated four traits that describe temperament: activity, emotionality, sociability, and impulsivity. Activity examines the individual's tempo and vigor. Assuming tempo and vigor are "alternative means of expending energy" (p. 31), Buss and Plomin (1975) believed that activity can be defined by these two variables. Tempo refers to the frequency and speed of behaviors (e.g., the child is moving fast). Vigor describes the amplitude of the child's voice. A sample question for examining activity temperament reads like "Child is always on the go" (Buss & Plomin, 1984, p. 102).

The second pattern of temperament, emotionality, is "the tendency to become upset easily and intensely" (Buss & Plomin, 1984, p. 54) and has three components: the threshold of arousal, reactivity, and excitability. By arousal, the researchers mean the threshold that one needs to achieve in order to feel disturbed. Reactivity refers to the way of one reacts to new stimuli. Excitability describes the magnitude of the threshold of arousal and reactivity. An emotional person is usually described as one who is aroused easily, reacts intensely, and always is ready to explore. The child can be assessed by using questions such as "Child often fusses and cries" (Buss & Plomin, 1984, p. 102).

The third dimension of temperament, sociability, is defined as the tendency to work and play with other people in contrast to the preference to stay solitarily. Buss and Plomin (1975) defined sociability as "the only temperament that has a directional component: seeking other persons, preferring their presence, and responding to them" (p. 88). A person who is high in

sociability tends to work in a group rather than alone. A sample question that illustrates the pattern is “Child prefers playing with others rather than alone” (Buss & Plomin, 1984, p. 102).

The final trait, impulsivity, is comprised of four dimensions: inhibitory control, decision time, duration of persistence, boredom/sensation seeking. The inhibitory control means the ability to wait or delay a move. Decision time measures the time one needs to make a decision. An impulsive person feels stressed if he is pushed to make up his mind particularly in a short time. Persistence describes the duration a person can stay with a dull task. Boredom/sensation seeking tests a person’s level of tolerance to boredom. A highly impulsive person hates routines and is always finding something new to do. To measure impulsivity, the child can be evaluated by the question “Learning self-control is difficult for the child” or “Child gets bored easily” (Buss & Plomin, 1975, p. 240).

Based on the belief that temperament can affect the environment, Buss and Plomin (1975) formulated the interaction temperament model to explain the complex relationship between temperament and environment. They believed that the differences in temperament encouraged the individual to make his/her own environment. Although the environment can modify temperament at some level, the individual depends on his/her temperamental characteristics to determine which social environment is selected. In other words, temperament is more influential in changing the environment than the environment is in shaping temperament.

In order to provide empirical evidence for their theory, Buss and Plomin (1975) conducted a series of twin studies to examine the four dimensions of temperament. From their perspective, different behavioral patterns can be ascribed to environment in identical twins because they share the same set of genes. At the same time, the different behavioral traits observed in fraternal twins can be attributed to the combination of genetic and environmental

effects. If the identical twins were observed to display more similar behavioral traits than fraternal twins, it would indicate a tendency that behavioral traits were determined by genetic factors.

Therefore, Buss and Plomin (1975) developed the Emotionality, Activity, Sociability, Impulsivity (EASI) survey to examine 139 pairs of same sex twins. Mothers of twins were asked to rate both of their children. EASI is a questionnaire consisting of 20-item 5-point Likert scale with five items for each trait of temperament. The average age of the sample was 55 months with a range of one to nine years. Test-retest reliability for mother's ratings of the measurement was 0.82. The results suggested that the identical twins have a much higher intraclass correlation between each other's behavioral traits than fraternal twins. This finding led the investigators to conclude confidently that temperaments have an inherited component.

Developmental Model

Rothbart and Derryberry (1981) defined temperament as "individual differences in reactivity and self-regulation assumed to have a constitutional basis" (p. 40). The term constitutional addresses the biological development that is impacted by heredity, maturation, and experience through the individual's life span. Reactivity is referred to "the characteristics of the individual's reaction to changes in the environment, as reflected in somatic, endocrine, and autonomic nervous systems" (1981, p. 37). The dimension of reactivity was measured by both intensive and temporal response quality. In the intensive aspect of temperament, two sub-scales, threshold and intensity, were measured. The response threshold was described as the sensitivity level to new stimulation. Intensity describes the child's peak of response irrespective to its quality and direction; it also focuses on the child's "motor, vocal, and autonomic reactivity" (Rothbart & Derryberry, 1981, p. 43). The temporal quality aspect of temperament examined the

latency of reaction, rise time of a reaction, and the time needed for recovery from the emotional excitement.

Self-regulation was defined as the "approach and avoidance behavior, attentional behavior, and 'self-stimulatory' and 'self-soothing' behaviors" (Rothbart & Derryberry, 1981, p. 51). The nature of self-regulation was also observed by two dimensions: approach and avoidance behaviors and attention. By approach and avoidance behavior, the researchers mean the capacity of children to approach and avoid novel stimulations. The attentional behavior was described as "infant's deployment of attention to selectively regulate incoming information" (Rothbart & Derryberry, 1981, p. 52). In other words, the attention scale measured the child's ability to direct, maintain, or inhibit from a new stimulation. For example, a child can direct his attention to a stimulus and determine his reaction style to the stimulus. Finally, the self-stimulatory and self-soothing behaviors indicated that infants have different behavior such as thumb sucking to regulate the influence of incoming information.

To provide empirical evidence for their theory, the researchers conducted a longitudinal study to examine a total of 59 Caucasian children at age of 3, 6½, 10, and 13½ months. In a laboratory setting, the subjects were arranged to sit in an infant seat or high chair and given a series of visual, auditory and tactile stimuli in order to examine their emotional, vocal, motor, and autonomic reactions. These stimuli were presented to the infants with various levels of intensity, complexity, and novelty. For example, the infants were tested for their tendency to be startle by using a rapidly opening parasol. Every two weeks, each participant visited the laboratory 30 to 45 minutes and their reactions to stimuli were recorded on videotape. Through analyzing the data of laboratory observation, findings suggested increasingly positive change in the expression of emotion over the first year. The intensity of fear reactions was found to be

negatively connected with children's age and the intensity and tolerance of frustration were found to be positively associated with development.

According to the findings, Rothbart and her associates argued that the scale of Thomas and Chess (1977) examined limited dimensions of temperament because it was created only based on infant data. Some behaviors displayed in later childhood were not acknowledged in the questionnaire of Thomas and Chess. Take activity level for example, the movements of a toddler cannot be measured the same way as a newborn because temperamental functions undergo development through the early childhood. Therefore, Rothbart and her associates developed several questionnaires for different age groups to identify temperamental characteristics that are influenced by maturation and experience. For example, the *Infant Behavior Questionnaire* (IBQ) was established particularly for evaluating 3- to 12-month-old infants. The IBQ is a 96-item scale that contained six categories: activity, distress to limits, fear, duration of orienting, smiling and laughter, and soothability. In the 195-item *Children's Behavior Questionnaire* (CBQ), the child's temperament is identified based on fifteen dimensions (Rothbart, Ahadi, Hershey, & Fisher, 2001). According to Rothbart and her colleagues (2001), these measurements provided age-appropriate items that can better assess the temperamental characteristics for each individual age group.

In sum, there are similarities, and overlap of items found in evaluating temperamental patterns among the scales developed by these three groups of researchers. For example, activity level is a universal factor that can be seen in the CTQ (Thomas & Chess, 1977), the EASI (Buss & Plomin, 1975), the CBQ (Rothbart, Derryberry, 2001), and Martin's (1988) Temperament Assessment Battery for Children (TABC). Buss and Plomin's sociability shared a similar concept with Thomas and Chess's trait of approach/withdrawal and Rothbart's shyness.

Anger/frustration in Rothbart and Derryberry's scale has qualities of mood similar to that of Thomas and Chess's questionnaire and emotionality in Buss and Plomin's survey. Although not exactly comparable, Thomas and Chess's persistence temperament and Rothbart and Derryberry's attentional focusing share certain concepts. The idea of sensitivity threshold in Thomas and Chess's theory is close to Rothbart's perceptual sensitivity. In sum, these three models approach temperament theory from different perspectives and yet, they extend and expand on each other than contradict from one another.

The Influence of Temperament on Children's Developmental Outcomes

Not until recent decades has it been that research-based evidence supports the concept of temperament in human development. A group of studies has been conducted to investigate the correlation between temperamental characteristics and academic achievement among preschool and elementary students (Bramlett, Scott, & Rowell, 2000; Lerner, Lerner, & Zabski, 1985; Martin, 1989; Martin, Drew, Gaddis, & Moseley, 1988; Martin, Nagle, & Paget, 1983; Newman, Noel, Chen, & Matsopoulos, 1998). In most of these studies, student temperament was measured by utilizing the Teacher and Parent form, the Temperament Assessment Battery for Children (TABC), developed by Martin (1988) as a key scale. Various standardized tests were used to evaluate the students for academic performance. Pearson correlation was frequently the chosen method for analyzing the data.

In 1983, Martin et al. studied a group of 80 first-graders regarding the relationship between children's academic performance and teacher assigned grades in reading comprehension, mathematics, and social adjustment. They found that persistence, distractibility, approach/withdrawal was the three significant predictors of teacher assigned grades. According to Martin, these three temperamental patterns can be seen as a cluster and the cluster was termed

Task Orientation. In another study, Martin and his colleagues (1988) conducted a series of three studies on more than two hundred young children to find out whether preschool temperament is a predictive factor of elementary school academic performance. Standardized tests— the *Stanford Achievement Test* (SAT), *Peabody Individual Achievement Test* (PIAT), and the *Metropolitan Achievement Test* (MAT)—were used to evaluate children's mathematics and reading comprehensive performance and these scores were compared to the scores of Martin's TABC. The consistent results across the three studies suggested that distractibility, persistence, and activity were significant in predicting academic achievement.

Findings of Martin and his associates were supported by other researchers who used different achievement measurement in their studies. In recent years, Newman, Noel, Chen, and Matsopoulos (1998) investigated 397 middle-to upper-class children based on a 5-point scale parent-report questionnaire. The 15-item questionnaire was a revised version of Martin's TABC. Student achievement was assessed by using the Woodcock Reading Mastery Test-Revised (WRMT-R; Woodcock, 1987). Activity temperament was found significantly related to the reading scores at the end of first grade and no gender difference was found to be in the relationship between temperament and achievement. However, through the growth curve analysis, only persistence was found to predict the rate of reading growth from kindergarten to third grade. Thus, the researchers concluded that persistence is an important predictor of the growth rate of children's reading scores.

Bramlett, Scott, and Rowell (2000) suggested similar findings to those of Martin and his colleagues. Using Martin's TABC and the *Woodcock-Johnson Psychoeducational Battery* (Woodcock & Johnson, 1990), the researchers investigated the impact of temperament on student math and reading performance in 104 first graders. They found that both teachers' and parents'

ratings of persistence were associated with the children's reading scores, but only teachers' ratings of persistence were significant in predicting math scores. Due to this finding, the authors asserted that teacher ratings are better than parent findings because parent ratings provide limited prediction of children's school success.

Findings congruent with these early studies were found when using other forms of temperament scales and standardized tests. For example, Palisin (1986) examined temperament in fifty preschool children by using three scales: the *Behavioral Style Questionnaire* developed by McDevitt and Carey (1978), the *Parent Questionnaire* established by Thomas and Chess (1977), and the *Colorado Childhood Temperament Inventory* designed by Rowe and Plomin (1977). Children were measured on their academic achievement in a laboratory setting by using the *Wechsler Intelligence Scale-Revised* (WISC-R) and the *Peabody Individual Achievement Test* (PIAT). The findings appeared relatively consistent with the previous studies. Children's abilities to focus and to persist were found to be significantly related to all three achievement scales ($p<0.5$).

Using the temperament survey they created, Lerner, Lerner, and Zabski (1985) tested a total of 194 fourth graders. Students' general academic performance (e.g., teacher-given grades) and reading achievement were examined in order to investigate their correlation with five temperamental traits (activity, rhymthmicity, distractibility, adaptability, and reactivity). The investigators addressed two major issues in this study. First, individual temperament characteristics were found to be valid in predicting both the teacher-assigned and the standardized test scores. Second, it is noteworthy that the temperamental survey was student self-reported. According to the authors, ratings of the temperament questionnaire from an older rater might account for more variance than those from a young rater. In addition, the one-shot study

might result in limited findings. The investigators suggested a longitudinal study was needed to further explore the relationship between temperamental patterns and school achievement.

On the other hand, some studies exhibited inconsistent results on the relationship between temperament and achievement. For example, Orth and Martin (1994) suggested a contradictory finding to the previous research. Examining 81 kindergarten children with a mean age of 76.5 months, the researchers investigated how problem-solving performance co-varied with temperament differences. The findings showed no significant relationship between Task Orientation and problem-solving performance among the kindergarten children. The researchers attributed these contradicting results to the different nature and demands of the task. Compared to most of the previous studies that measured achievement by standardized tests, this study measured achievement by problem-solving performance in a one-on-one atmosphere without a time limit. The authors argued that certain temperamental characteristics (e.g., distractibility) were found to be related to the score of standardized test because the students needed to focus during the test. Thus, when students were assessed under the less intense atmosphere where certain temperamental patterns were not needed much, little relationship was found between temperament and achievement.

In summary, these studies together indicate that temperamental characteristics are found to have a significant relationship with school achievement despite of the fact that different format of standardized tests and temperament surveys were used to evaluate the participants. Because these studies all used large samples, in my opinion, the phenomenon may suggest a high consistency among these findings and their relationship to school-related outcomes.

Temperament is also found to be related to problem behavior (Andersson & Sommerfelt, 1999; Barron & Earls, 1984; Guerin, Gottfried, & Thomas, 1997; Pierrehumbert, Miljkovitch,

Plancherel, Halfon, & Ansermet, 2000; Schmitz, Fulker, Plomin, Zahn-Waxler, Emde, & DeFries, 1999). From the perspectives of these researchers, problem behavior denoted different meanings ranged from small misbehavior, such as disturbing other students in the class, to serious misconduct, such as aggression. Despite that problem behavior was seen differently by researchers, consistent research findings showed that temperamental factors are predictive of problem behavior.

To study whether temperamental characteristics can be indicators for problem behavior, Barron and Earls (1984) conducted a study in three-year-old children by comparing the results of parent-report questionnaires for problem behavior to the score of temperament scale. The results illustrated that temperament factors were positively associated with problem behavior. However, there were limitations in this research. First, children's behavioral outcomes and temperament were measured concurrently. In my opinion, children's behavioral problems need to be assessed again in later childhood. It is difficult to identify whether there is a causal relationship between behavioral problems and temperament based on the concurrent data obtained from temperament scale and behavioral problem questionnaire. The other limitation was that, according to the researchers, sample selection from a rural small setting might not be representative.

Following children from the age of 6 months to five years, Anersson and Sommerfelt (1999) assessed a total of 235 children and studied the influence of temperament on behavioral outcomes. Data on temperament in children were obtained at 6-months and 13-months using different versions of the *Infant Characteristics Questionnaire* (ICQ) (Bates, Freeland, & Lounsbury, 1979). The results exhibited a significant relationship between temperamental factors and problem behavior. At six months of age, fussy-difficult infants demonstrated higher mean problem behavior scores than others. At thirteen months of age, unsociable temperament was the

best predictor for problem behaviors at five years old. The authors attributed the inconsistent findings to that fussiness may not assess the same in two age versions.

Utilizing the same instrument to evaluate the individual differences in temperament, the conclusions of Guerin, Gottfried, and Thomas (1997) were congruent to the work of Andersson and Sommerfelt (1999). In their 10-year longitudinal study, Guerin and her associates were particularly interested in investigating young children. Difficult temperament was measured in children when they were one and half years old. Different formats of problem behavior questionnaires were completed by parents when their children were three and then annually from four to twelve. From age six to eleven, teachers were required to complete the problem behavior scales as well. Through the Pearson Correlation analysis, the Fussy/Difficult/Demanding factor had the highest correlation with the problem behavior while the unadaptability factor correlated pervasively with the results of all three problem behavior assessments. Due to these findings, the researchers concluded that difficult temperament as early as 1.5 of age was recognized to significantly correlate with problem behaviors in the later childhood. In addition, the researchers suggested parents to use the concept of the goodness-of-fit model to keep their young children from developing behavior problems.

Schmitz and her colleagues (1999) were concerned with the issue of whether genetic or environmental factors have an effect on problem behaviors in late childhood. A large scale of *monozygotic* (MZ) and *dizygotic* (DZ) same sex twins were examined at age 14, 20, 24, and 36 months based on the parent-rated temperament questionnaires. At age 4, children were assessed again with a parent-reported problem behavior checklist. Findings suggested a genetic influence in the relationship between temperament and behavioral problems because DZ twins shared lower variances than MZ twins. The results indicated that a correlation between temperament

and problem behavior for MZ twins exceeded DZ twins. Thus, the researcher argued, phenotypic variables were more able to describe problem behaviors.

An interesting study designed by Pierrehumbert, Miljkovitch, Plancherel, Halfon and Ansermet (2000) investigated whether problem behaviors could be predicted by temperamental characteristics and the quality of parent-child attachment in 5-year-old children. Temperament and attachment in this study were seen as independently affecting children's behavioral outcomes, while other research (Rothbart & Derryberry, 1981) usually explored the interrelationships and their effects for temperament and attachment. Hierarchical regression showed that insecure attachment in early childhood and temperament (e.g., approach) both had effects on behavioral problems in later childhood.

Overall, previous studies exhibited consistent findings regarding the effect of temperamental traits on behavioral problems. Evidence showed that early temperamental traits were good predictors of the problem behaviors in children. However, there was no conclusion regarding which temperamental pattern can better predict problem behaviors. Future study that investigates the specific temperament and behavioral outcomes is recommended.

Research findings also showed that temperamental patterns are associated with social behavior (Calkins, Gill, Johnson, & Smith, 1999; Rothbart, Ahadi, & Hershey, 1994; Rubin, Burgess, & Hastings, 2002). Emphasizing the emotional aspect of individual differences, Calkins, Gill, Johnson, and Smith (1999) researched the impact of emotional reactivity and regulation (Rothbart & Derryberry, 1981) on social behaviors with peers in a large group of two-year-old toddlers. In a laboratory setting, children were first assessed individually on their emotional reaction by frustrating them. During the second measurement, emotional regulation was tested by observing the individual free play and cooperation play in toddlers. At the end of the

measurement, a mother-reported data on children's temperament was collected. Pearson correlation indicated that emotional reactivity and emotional regulation were predictive of peer-directed conflict behavior and cooperation. The findings, according to the authors, suggested important relationships between emotional regulation and social skills in early childhood development.

Similar to Calkins et al., Rothbart, Ahadi, and Hershey (1994) conducted their study in the laboratory setting as well. They explored the association between temperamental traits and five patterns of social behaviors: empathy, guilt/shame, aggression, help-seeking, and negativity. Eighty children aged six and seven were assessed based on the mother ratings of *Children's Behavior Questionnaire* (CBS) and observed for their responses to the stimuli. Results documented that each category of temperamental characteristics was related to one or more of the social behaviors, but none of the temperamental characteristics were associated to all of the social behaviors as a whole.

Recently, another longitudinal study was designed to ascertain whether different patterns of behavioral inhibition can predict children's social behaviors in later childhood (Rubin, Burgess, & Hastings, 2002). A cohort of subjects was measured two times with a two-year interval in this study. For measurement one, children's data of behavioral inhibition (i.e. the amount of time the toddler spent in physical contact with his/her mom) was obtained among the two-year-olds. For measurement two, children's behaviors in different sessions (i.e., free play and speeches) were observed and coded. The results proved the hypothesis that behavioral inhibition was a predictor of social behaviors.

These studies show congruency in their findings. They all used laboratory settings and mother-report scales. It is suggested that the combination of the laboratory assessment and

questionnaires can provide valuable additional data (Prior, 1992). However, Bates (1989) argued that laboratory measures may not yield adequate normative data compared to a real life setting. In addition, Rothbart, Ahadi, and Hershey (1994) indicated that the dependence on mother ratings regarding their perceptions of children's temperamental characteristics may limit the research findings.

Temperament was found to have a connection with social competence and peer relationships (Dunn & Cutting, 1999; Eisenberg, Fabes, Bernzweig, Karbon, Poulin, & Hanish, 1993; Fabes, Eisenberg, Jones, Smith, Guthrie, Poulin, Shepard, & Friedman, 1999; Houck, 1999; Walker, Berthelsen, & Iring, 2001). Eisenberg and her colleagues (1993) highlighted the significance of self regulation and emotionality in contributing to preschoolers' social capacities in response to peer interactions. In addition, the effect of gender differences was also investigated in the relationship between temperament and social competence. The results indicated that high negative emotionality was correlated to low social capacities for both genders. High self-regulated children were more likely to have positive peer interactions. Girls were found to be more able to self-regulate, to be more expressive, and to be more socially competent than boys.

The work of Fabes and his colleagues (1999) was similar except for that they were particularly interested in understanding the correlation among the context, temperament, and social competence. Based on the data obtained from teacher- and parent-ratings of temperament and naturalistic observation, the researchers found that children with negative emotionality and low in self-regulation tended to overly react in the course of intense peer interactions. However, most children exhibited socially competent behaviors in a relaxed situation regardless of their temperamental characteristics.

Houck (1999) focused on investigating children from infancy through toddlerhood based on a total of 162 participants. Finding suggested that the relationship between temperament and social competence was not only clearly correlated but also exhibited an increasing magnitude. The researcher took this finding as evidence of an increasing stability existing between the two factors.

Walker, Berthelsen, and Iring (2001) investigated the linkage between difficult children and their peer relationships in preschool-aged boys and girls. Defining difficult children as high in activity level, high in distractibility, and negative in quality of mood. Results indicated that children who have difficult temperament tend to be rejected or neglected by their peers. Further, difficult children tend to have a higher rate of negative mood and lower level of adaptability than popular children. In contrast to girls, boys were rated by teachers as more active, more distractible, and less persistent. Different role expectation in socialization was the possible reason for different temperamental characteristics for both genders. According to the investigators, it is important for teachers and educators to be aware of the early appearance of social role stereotypes.

Similar to Walker and her associates, Dunn and Cutting (1999) were interested in exploring the connection between temperament and the interactive situation in friendship. Based on the data reported by teachers and mothers about their four-year-olds, they found that highly active children engaged less frequently in joint pretend play with their friends. In my opinion, this lower frequency of interactions between highly active children and their friends were factors that prevent the highly active children from developing close relationships with others.

In summary, the emotional dimensions of temperament were found to significantly influence social competence and peer interactions. Children who have negative emotionality and

who lack of the capacity of self-regulation tend to have negative experience during the interaction with peers. In addition, children who were highly active, easily distractible, and less persistent tend to receive negative social responses from peers. Boys were found less able to exhibit social competent behaviors than girls. Inasmuch as temperament has an effect on the course of peer interactions, it is important for teachers and educators to recognize the significance of this connection on influencing small group cooperative learning.

Peer Interactions in the Classroom

Definition

Little research was found regarding the definition of the term social interaction in the classroom. According to Webster's third international dictionary (1971), interaction is defined as "mutual or reciprocal action or influence of an individual with his social environment" (p. 1176). Laursen and Hartup (2002) indicated that developmental psychologists often use the term social exchanges when they mean social interaction. Social interaction, therefore, refers to the "exchange of resources as the social events most relevant to relationship formation and maintenance. Resources can be anything from attention and approval to food, clothing, and money" (p. 29). In addition, the term peer in this study refers to the people who are as the same age as children.

Although many researchers have shown interest in the field of social interactions among children in the classroom and have conducted many studies in it, few of them give detailed description about the process of how children interact with their peers. On the contrary, many studies jump over this process and focus on investigating the effects of social interactions on the facilitation of children's learning and preparation for children's later social lives. In the beginning of this section, I will provide general information about children's typical social

behaviors in the early childhood stage and their entry behaviors as well as concepts of friendship. This general information is important for one to understand children's initial step of approaching their peer group. Then, I will move to children's interactive behaviors based on several categories: gender similarities and differences in constructing relationships with peers, conflict resolution, and collaboration with each other during group activities. Some patterns of interaction in the group will be provided at the end of this section. In addition, the ways children interact to form peer culture will be discussed at the end of this section.

Studying young children's social competent behaviors, Howes (1987) suggested children's social interaction competence with peers in sequence from toddlerhood to preschool age period. In the early toddler period, ages 13 to 24 months, children are typically showed the ability to engage in complementary and reciprocal play. In the late toddlerhood, age 25 to 36 months, children typically demonstrated the ability to communicate meaning which is defined as "the joint understanding of the theme of the interaction" (p. 3). In the preschool stage, children typically were able to use their social knowledge to enhance their range of playmates. These findings described a preliminary idea of the way very young children interact with others. At the same time, Hatch (1988) investigated low-SES kindergartener's strategies for acquiring and protecting social power and status in peer interactions. Findings indicated that children used various active and reactive strategies to negotiate their status in their peer group. For example, threats were used as tools to dominate others and subject changing was used in response to put-down attempts. Through participating in face-to-face interactions with peers, suggested by the researcher, children learn social lessons that help prepare them to enter adult social world.

In some cases, social interactions begin when a new comer intends to participate in the group activities. In 1986, the field of group entry behaviors in children was studied by Dodge,

Pettit, McClaskey, and Brown through conducting two well-known studies. One of their purposes was to examine different entry behaviors and responses to provocations shown by teacher-rated aggressive and average children when they were seeking access to a classroom group. Through observation, the researchers found that aggressive children were more likely than average children to show disruptive behaviors when intending to participate in a classroom group. However, no significant effects were found among children for their responses to provocations. The work of Dodge and his co-workers reminds us different children display various behaviors to access a group and implies that individual differences in characteristics may have effects on the interaction strategies used with others.

Children's social interactions also start when they are making friends with their peers. Holmes (2001) suggested six basic rules children use in constructing friendships with their peers which are listed as the following: (a) friends share, (b) friends play with each other and enjoy each other's company, (c) friends show a genuine concern for each other, (d) friends barter to fulfill each other's desires, (e) friends are not bossy, and (f) friends maintain a certain level of physical contact. According to these rules, friendships do not occur spontaneously. Children need to learn the appropriate ways of interacting with others in order to build positive relationships with others.

Based on the studies of peer interactions among children, gender differences have been found to be significantly related to children's interactive behaviors. Lansford and Parker (1999) suggested girls and boys share some commonalities and exhibit differences during the interpersonal process. For example, both girls and boys were found to have no significant differences in the level of members' responsiveness to one another and the ability to stay on the task. Other researchers indicated that children tend to play with the same-sex peers (Fabes,

Martin, & Hanish, 2003; Lansford & Parker, 1999; Powlishta, 1995; Wilkinson, Lindow, & Chiang, 1985). Regarding the differences, boys were found to be more involved in group games and organized sports than girls. Girls were more likely than boys to exchange information, to show intimacy with team members, and to display less aggression to their peers (Lansford & Parker, 1999). Dodge and his colleagues (1986) indicated that boys were more likely than girls to use attention getting strategies such as raising voices for entering a classroom group. In addition, boys were more likely than girls to engage in active-forceful or rough and tumble play with same-sex peers and were more prone to choose gender stereotyped activities (Fabes, Martin, & Hanish, 2003; Hakkarainen & Palonen, 2003; Lansford & Parker, 1999; Maccoby, 1990). Within two computer-supported elementary classrooms, Hakkarainen and Palonen (2003) investigated how gender affects the language of peer interaction. In one of the classrooms, (A), contained more male students than female while the other one, (B), contained more female than male students. The researchers found that students had a tendency to communicate with same-sex peers. Findings suggested that girls showed intensive participation in classroom A where the pedagogical strategy stressed collaborative advancement of explanations. In contrast, boys dominated the classroom participation in classroom B where more traditional strategies were used. The researchers argued that boys tend to learn competitively while girls tend to learn collaboratively.

Another key group of studies focused on investigating how children manage conflicts during group activity in the classroom. It is not uncommon to see conflicts taking place during classroom activities. The term conflict has been defined as “one child’s protesting, resisting, or retaliating against the actions of another” (Ross & Lollis, 1989, p. 1084) and as “antagonism arising among the participants in the conflict situation with regard to their attitudes, values,

interests, plans, interactions, or definitions of their relationship" (Becker-Beck, 2001). The first definition focuses on conflicts occurring among children while the latter one describes a more general phenomenon among people. For the observational studies, conflicts were usually defined as a state in which two or more individuals overtly oppose one another (Shantz & Hobart, 1989). The definition proposed by Shantz and Hobart will be adopted in the current study because their definition describes a general situation of conflict.

Research on conflict has most often been explored by how children protect the integrity of peer relationships (Corsaro, 1994, 2003; Medina, Lozano, & Goudena, 2001; Verbeek & de Waal, 2001) and the strategy used by children to resolve conflicts (Eisenberg & Garvey, 1981). In the cross-cultural study designed by Medina, Lozano, and Goudena (2001), Andalusian and Dutch preschoolers were examined for how they managed conflicts during peer interactions. The purpose of this study was to find out whether cultural differences exist in children's ways of dealing with conflicts. In this study, a conflict was defined as "an interaction that takes place as a consequence of the position to a request of an action, an affirmation, or an action itself and that finalizes with its resolution" (p. 156). The researchers found that Andalusian children tended to resolve conflicts by achieving an agreement, even compromising their own perspectives to maintain the peaceful social interaction. On the other hand, Dutch children tended to articulate their own point of views even above the reconciliation of tension. These findings suggest the important role cultural factors play in children's interactive behaviors when dealing with events occurring within their groups.

Examining how dyads of young children used language to resolve conflicts, Eisenberg and Garvey (1981) found several strategies emerged from their observations. They suggested that insistence on one's desire was the most frequently used strategy among children aged 3 to

5½. The second frequently used strategy was to give a reason or justification. In addition to these strategies, children used other ways, such as suggesting an alternative, compromise, or making a deal with their peers. Except for the first strategy that could probably result in the continuity of conflict, the other strategies would lead to an end of a conflict. Like Eisenberg and Garvey (1981), Corsaro (1994, 2003) noticed some discourse patterns used by Italian young children during conflicts. He reported that debates and discussions are the integral part of their peer group. During collective work, humor was found as one important strategy used by Italian children to ease tension and restore harmonious relations with the peers.

Some researchers suggested different patterns of collaborative interactions emerged from observational data (Allen, Möller, & Stroup, 2003; Chiu, 2000; Göncü & Weber, 2000; Kumpulainen & Wary, 2002; Ogden, 2000; Yang & Liu, 2005). Compared to teacher-child interactions that involved more problem-solving activities, Göncü and Weber suggested that child-child interactions were more likely to engage in collaboration.

Ogden (2000) studied the nature of reciprocal interaction when students were working together on collective tasks in a primary classroom. Through video data, the researcher identified three major social behaviors: acknowledgements, initiation of a relevant next turn, and continued attention. The behavior of acknowledgements referred to positive gestures, such as nodding, and verbal agreements, such as saying “yes, exactly.” The initiation of a relevant next turn means that children react to the previous step in the interaction (e.g., children appropriately answer a question or respond to a request). To maintain and continually pay attention to what their partner said or how they acted, children used a variety of ways (e.g., eye contact) to show their concern. Children exhibited these behaviors during group work as evidence that they were attentive to their partners and attempted to jointly participate in the task.

Chiu (2000) indicated that different level of group member knowledge of the problem and the degree of cooperation can determine the group interaction. Based on this belief, the researcher suggested six types of social interactions among group members during the process of resolving group problems. They are: (a) piecemeal guessing, (b) joint construction, (c) lecture, (d) guided construction, (e) accepted demonstration, and (f) automatic joint solution. Members in piecemeal guessing had little knowledge of the problem and worked independently. The frequencies of interaction were relatively low. Team members ignored each other without connecting to each other's previous ideas. In joint construction group, despite the fact that group members were low in problem knowledge, more collaboration occurred and that increased the possibility of reaching correct solutions. In lecture group, most interactions occurred when members with knowledge were describing the problem-solving procedure to those without knowledge. Members who did not have knowledge of problem were only confirming and asking questions to those with knowledge. In contrast to the lecture group, team members who have knowledge of problem not only displayed information to those without knowledge but also gave practicing opportunities to them. There was more participation and interaction between team members. During accepted demonstrations, every team member knew the solution of problem but only one single person was carrying it out. Group members in the automatic joint solution group coordinated their problem-solving through using supportive requests, giving confirmations to and acknowledging each other's solutions. Although Chiu conducted this study on a group of ninth graders, I believe, the types of interactions described are still applicable to explain how children work during group activities in lower grade classrooms. Chiu's findings reflected the fact that simply grouping students does not guarantee full participation and collaboration for each member in the group (Allen, Möller, & Stroup, 2003).

Based on a series of case studies, Kumpulainen and Wary (2002) focused on investigating children's discourses in collaborative works. They found children communicate and collaborate with one another through languages with different functions. Most discourses among children were task-oriented. The most often used discourse was that of providing information to each other in order to work with each other. The second most frequently used types of discourses were the interrogative, judgmental, and organizational functions. The external thinking, responsive, and reproductional talk were the third most frequently occurred discourse types. The least discourses taking place during children's collaboration were the argumentational, expositional, hypothetical, experiential, heuristic, and imaginative talks.

In addition, Yang and Liu (2005) also examined the interactive forms during children's collaborative activities. They found four different patterns of group interactive behaviors: individual, authoritative, argumentative, and consolidated emerging from the qualitative data. In the individual type of group, members worked according to their own will without a leader. The authoritative group was dominated by a leader who directed the flow of conversation and work tasks. Members in the argumentative group quarreled frequently. In the consolidated group, students exhibited positive and collaborative interactive behaviors. Reflecting on Chiu's (2000) work which was described in the previous paragraph, the individual type of group resembles the piecemeal guessing group, the authoritative group is similar to the lecture and the guided construction group, and the consolidated group resembles the automatic joint solution group.

Social interactions in the field of children's peer culture have been investigated as well. Focusing on young children, Corsaro (2005) found that they spontaneously participate in highly sophisticated verbal communications. Peer culture, defined by Corsaro and Eder (1990), is "a stable set of activities or routines, artifacts, values, and concerns that children produce and share

in interaction with peers" (p. 197). Based on this description, the way children construct relationships with peers not only forms the basis but also influences the display of peer culture for their group. Through peer culture, indicated by Medina and Lozano (2001), we are able to "appreciate how children create their own sense of interaction, with their own norms and conditions" (p. 155).

According to Corsaro (2003, 2005), peer culture is constituted by two central themes from early childhood through adolescence: children persistently attempt to gain control of their lives and they tend to share this sense of control with other peers in their group. The attempts of gaining control from adult authority are usually seen in children's pretend play and role play. For example, children enjoy playing the authority roles such as a teacher or a mother. This imitation of adult authority figures, argued by Corsaro (2005), is an important process of gaining autonomy and learning to be independent for children. In other words, the ways children interact with their peers are similar to that of the adult world. In this sense, through interacting with their peers children learn to behave in a socially appropriate way in order to enter the adult world.

The other central theme in peer culture is the sense of the communal sharing. Communal sharing is based on children's "strong desire to do things with each other" that help them gain emotional security and excitement in the new environment (Corsaro, 1988, p. 20). When a new comer intends to join their peer group activity, Corsaro observed that young children tend to reject him/her in the first place. Corsaro (1988) attributed this phenomenon to the fact that preschool children want to protect the shared activities because of the fragility of peer interaction. Other children who want to join in the group should use various access strategies, such as imitating the behaviors of children in the playing group. During group activities, it was also found that children used sharing rituals to stress the idea of communal sharing and to engage

their partners in their group. Corsaro (1988) described that "as children develop a sense of doing things together they gain a gradual and more abstract recognition of the significance of this fact, a recognition of community" (p. 20). In my opinion, the concept of communal sharing plays an essential role in promoting effective collaborative interactions when children are working together as a group to pursue a task.

In summary, children showed different interactive behaviors according to their individual differences in gender and culture. For example, boys were found to exhibit different social behaviors from girls. Children from the independent and interdependent societies were different from each other in exhibiting behaviors of resolving the group conflicts. In addition, different patterns of interactive behaviors were found during group activities.

Theoretical Perspective

The theoretical perspectives of the studies discussed in the previous section can be classified into two major categories: the sociocultural perspective (Allen, Möller, & Stroup, 2003; Ogden, 2000; Göncü & Weber, 2000) and the interpretive production perspective (Corsaro, 2005; Medina, Lozano, & Goudena, 2001). There were two reasons that these models were selected to be discussed in the rest of this section. First, the models were optimal to explain the researcher's interests in children's group interactions. Second, Vygotsky's sociocultural perspective particularly was a widely accepted theory in examining and explaining interpersonal collaboration.

The Sociocultural Perspective

The most influential theory from the sociocultural perspective is found in the work of Lev Vygotsky. Vygotsky (1978) indicated that children's cognition is a process of social construction "with people in his environment and in cooperation with his peers" (p. 90). Social interaction

with others plays an important role in children's learning. Kumpulainen and Wary (2002) described the central theme of sociocultural perspective as "any mental activity should be investigated as an interaction between social agents and physical environment. . .The perspective emphasizes the social and situated nature of knowledge formation, with cognition being seen as including action distributed and constructed with others in cultural contexts" (p. 18).

From Vygotsky's perspective, to develop relationship with peers, language is an important tool that children need to master. He states that, "Signs and words serve children first and foremost as a means of social contact with other people" (p. 28). Through using different formats of languages, children communicate, negotiate, and further develop relationship with others. The development of engaging with others among children, according to Vygotsky (1978), can be described by using the notion of *zone of proximal development* (ZPD). The ZPD is "the distance between the [child's] actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86).

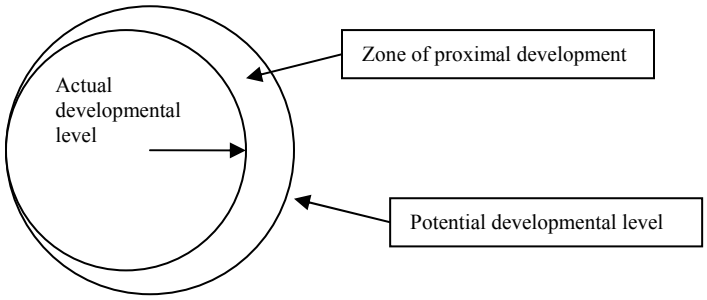

Figure 2.1. The notion of the zone of proximal development.

According to Vygotsky (1978), the theory of ZPD contains three sections: the actual developmental level, the zone of proximal development, and the potential developmental level

(see Figure 1). In the actual developmental level, children can do things alone without assistances of others. In the zone of proximal development, children participate in a wide range of socio-cultural activities in collaboration with one another by using cultural tools such as language. Vygotsky (1978) states that "Language arises initially as a means of communication between the child and the people in his environment" (p. 89). Additionally, imitation is another strategy that children use to develop intelligence with others in the ZPD. Children learn through observing and imitating other people's behaviors. In this sense, children learn to build relationships with others and adapt themselves in the group by imitating what their peers do. Finally, the potential developmental level is children's intellectual development in the future.

The Interpretive Production Perspective

For the interpretive reproduction theory, the notion which proposed by Corsaro (1988, 2005) was the theoretical foundation of peer culture research. The interpretive reproduction theory can be presented by using an orb web. In the orb web, the radii represent a wide range of cultural fields constituted by different kinds of social institutes, such as schools, where social interactions or behaviors occur. Children's family of origin is located at the center of the web and it "serves as a nexus of all cultural institutions for children" (Corsaro, 2005, p. 25). From the center of the orb web to the edge, children go through four peer cultures: preschool, preadolescent, adolescent, and adult. Although peer culture may be passed on further by older children, children construct their own peer culture with others out through their lives. As Corsaro (2005) described, "individual development is embedded in the collective production of a series of peer cultures that in turn contribute to reproduction and change in the wider adult society or culture" (p. 26).

The interpretive reproduction theory emphasizes the role of language and cultural routine play in children's social interactions. Similar to Vygotsky, language is seen as symbolic system that enables children to communicate and negotiate with others. The other key element of interpretive reproduction is children's participation in cultural routines. Participation in cultural routines not only enables children to develop the idea of communal sharing but also provides them "a framework within which a wide range of sociocultural knowledge can be produced, displayed, and interpreted" (Corsaro, 2005, p. 19). In this way, when children interact with their peers in cultural routines, they also learn to act the way that can be accepted by others.

Benefits and Challenges of Group Interactions

Research findings recognized the importance and contributions of group interactions. On the aspect of benefit, peer interactions help children in constructing knowledge (Pontecorvo, 1993; Ross & Lollis, 1985; Weinstein & Bearison, 1985; Williams, 2001). Some children are more willingly to interact with their peer groups than with an adult authority. For these children, learning may be more efficient with their partners than with the teacher. Johnson (1997) argued that students, from different cultural background which have different norms of communication may feel more comfortable interacting with peers than with an authority figure such as a teacher. For additional beneficial effects of group interaction, the study of Battistich, Solomon, and Delucchi (1993) concluded that frequent positive group experiences such as intra-group collaboration contributed for improvement of students' academic outcomes, positive classroom environment, greater intrinsic motivation, empathy, and self-esteem.

Children's knowledge of social competence may increase during the process of peer interaction (Battistich et al., 1993). However, it is a two-faced issue. On one hand, during the process of peer interaction, children construct social knowledge and competence that prepare

them for entering into the adult world (Hatch, 1988). As Corsaro (2005) described, “By interacting with playmates in play groups and preschools, children produce the first relationship in a series of peer cultures into the knowledge and skills necessary to participate in the adult world” (p. 41). Katz (1995) also indicated that “social understanding and social skills both adaptive and maladaptive are learned primarily through the give-and-take of peer play and work” (p. 8). However, on the other hand, children’s social knowledge and social competence are influential to the degree of collaboration in the group (Chiu, 2000). Children who have deficiencies in social skills are likely to be rejected by their peers and that will then hamper their learning of interacting with others appropriately.

A variety of factors were concerned by the researchers regarding the challenges and difficulties to achieve successful group interaction. In addition to the individual knowledge of social competence discussed earlier, gender differences are influential contributors to the styles of group interaction (Lansford & Parker, 1999). Comparing to their female counterparts, boys tend to participate team sports and small group activities that will enhance their conflict management skills and effective collective actions. The implication of this study was that teaching practicers should be aware arranging equal opportunities for female students to participate in the classroom group activities. Wilkinson and her associates (1985) suggested that “Teachers need to become involved in effecting cross-sex interaction by deliberately structuring situations that enhance the likelihood of achieving goals of sex equity. Teachers might also consider using same-sex small work groups, if there is indeed a tendency for girls to prolong dissension episodes in order to engage in cross-sex social interaction” (p. 205).

Children’s relative status within the group was another possible factor that influenced the group interaction process (Cohen & Lotan, 1995; Lomangino, Nicholson, & Sulzby, 1999). The

researchers argued that children's status orders within the group have effects on their opportunities and frequencies for intra-group activities. Children with high social position within the group were more likely to involve in group activities and display dominant behaviors such as arranging turn-taking orders for other members; while low status children tended to compromise. The unequal opportunities for participation during collaboration, argued by the investigators (Cohen & Lotan, 1995; Lomangino, Nicholson, & Sulzby, 1999), were resulted in negative group interaction that could lead to low developmental outcomes such as academic performance. Meanwhile, peer acceptance also played an important role on social interaction and adjustment to school, whereas antisocial behavior was predictive to peer rejection (Kemple, 1991). Students who suffered from peer rejection may be isolated during group activity that hampered their opportunity to positively connect to their peers. Among various factors that accounted for peer acceptance, temperament was one of the major factors contributed to this area (Criss, Pettit, Bates, Dodge, & Lapp, 2002; Hess & Atkins, 1998; Szewczyk-Sokolowski, Bost, & Wainwright, 2005). Furthermore, Keogh and Burstein (1988) suggested that positive temperament patterns were related to the frequency of peer interaction.

Summarizing the research findings discussed earlier, students may achieve better learning outcomes through peer interactions over than the teacher-student interaction (Pontecorvo, 1993; Ross & Lollis, 1985; Weinstein & Bearison, 1985; Williams, 2001). The development of social competence was another benefit resulted from peer interaction although children with low social competence tended to be rejected by their peers (Chiu, 2000). For the challenge of fostering effective and positive peer interaction, research investigators concerned gender differences (Landsford & Parker, 1999), children's intra-group relative status (Cohen & Lotan, 1995; Lomangino, Nicholson, & Sulzby, 1999), and peer acceptance (Kemple, 1991) as important

contributors. Furthermore, positive temperament traits were found associated with high frequency of peer interaction (Keogh & Burstein, 1988) which implies that children with intense or difficult temperament tend to interact with their peers less frequently. For future study, there are more factors to be explored regarding difficulties and challenges of promoting positive peer interactions within different classroom settings. For example, as the integration of computers in classroom activity was proved to promoting group interaction among children (Johnson, Johnson, & Stanne, 1986), future study is suggested to investigate factors associated with peer interactions within computer-supported collaborative learning environment.

CHAPTER 3

METHODOLOGY

Community Context

The current study took place in Oak County (a pseudonym) located in a community adjacent to a world class state university in the southeastern United States. According to the 2000 U.S. Census, the community population of Oak County totaled 26,225. In 2002, the Oak County per capita personal income is $30,263 which was slightly higher than the state per capita income of $29,000. The ethnic distribution of the population of Oak County was 89.6% Caucasian, 6.4% African American, 3.2% Latino, 1.4% Asian, and 1.5% identified by other races. Children under 4 years old comprised 6.95% of the total population and children between 5 and 14 years old comprised 18.15% of the total population.

The Oak County school district has been consistently ranked by the state's Department of Education in the top 5 percent on indicators of academic performance. Of the population 25 years of age and older, 23.5% had completed some college course work or an associate's degree, 22.7% had a bachelor degree, and 17.1% had a master's, professional, or doctoral degree. Of the population 3 years of age and older, 72.3% were enrolled in grades 1-12, 14.2% were enrolled in preschool or kindergarten, and 13.4% were enrolled in the college.

School Context

Carter Elementary School (a pseudonym) was built in 2002. Classes are held for children from kindergarten to fifth grade. At the time of the study, there were 485 students in the school of whom 51% were male and 49% were female. Thirty credentialed teachers were employed in this school. The teacher-student ratio was 1:16 and was equal to that of the state school average. Regarding the student ethnicity distribution, 92% were White, 4% were Latino, 2% were African American, and 2% were Asian. These figures differed from the student ethnicity ratio of the state, where 51% were White, 39% were African American, 7% were Latino, and 2% were Asian. In

this school, 17% of the students were eligible for free or reduced lunch which is less than the state ratio of 51%. The school met the Adequate Yearly Progress (AYP) criteria for test participation in 2005, Academic Performance (Math and English/Language Arts), and a second indicator which was attendance. The school was fully recognized as meeting standards under the No Child Left Behind designation. Regarding special services provision, 13.6% of the student population was enrolled in special education programs and 15.3% were in the Early Intervention Program, a program for children in grades 1-3 who are not performing at grade level.

Participants

The participants were selected purposefully to meet certain selection criteria. The school was chosen for access as the researcher and the teacher participant was classmate in the same graduate school program. Because the teacher participant was also teaching in the early childhood field, she welcomed the researcher to conduct the current study in her class. For the student participants, the researcher expected to select a group of children who presented temperament characteristics that ranged from low to high on aspects such as activity level, impulsivity, and inhibition on the temperament scale utilized in this study. This purposeful selection strategy was chosen to allow for contrasting the interactive behaviors of children in the group based on their temperament traits. In order to reduce the demographic variance between the participants and to control for other intervening or mediating variables, the researcher chose student participants who had similar demographic characteristics: ethnicity, age, and computer working experiences with peers. The group of children recommended by the teacher participant matched all the requirements described above and had parents that consented to their participation in the study. In the following paragraphs, more detailed descriptions are provided regarding the teacher and the student participants.

Description of the Teacher

The teacher, Mrs. Milton (a pseudonym), is a 41-year-old White female who had been teaching 14 years with 4 years at Carter Elementary. Her teaching experience included the teaching of all grade levels in elementary school as well as children in a variety of compensatory programs such as the gifted programs and second language assistance programs. Before she began her career as a teacher, Ms. Milton had a varied and unusual past. During her high school years, Mrs. Milton dropped out of high school and eventually completed her General Education Diploma. From encouragement from faculty and peers at an institution of higher education where she was working as a secretary, she decided to get a university degree in child development. This degree allowed her to begin a teaching career. After a few years of teaching, she ultimately ended up working on master's and doctoral degree. Mrs. Milton cherished this experience because it made her more able to be empathetic for children, particularly to those children who were considered at risk. Mrs. Milton was one of the first teachers at Carter Elementary when the school opened. Although she was not taking on any leadership roles during the course of this study, she was actively participating in groups that supported other teachers to improve each other's teaching. When questioned about her specific interests, she noted that her passions centered on children's literature and the creation of hands-on projects for children.

She had a comprehensive philosophy of education that included the basic premises that all children are able to learn and that she could teach all children if the appropriate strategies were used that matched the needs of children. On her beliefs about pedagogy, Mrs. Milton believed that teachers should always update their knowledge about teaching. This philosophy was evident in her our professional development as she had obtained a master's degree and was in the process of completing a doctoral degree.

Because the focus of this study is on the use of computer-supported learning environments, I spent some time asking Mrs. Milton about her technological skills. Mrs. Milton noted that she was very familiar with typing, using the internet, and using typical software programs for producing papers, graphs, and other documents. She also commented that although the school administration was willing to support teachers both on hardware equipment and on technology training, teachers did not get much help because of the limit of technology expertise within the school and the accompanying budget to support such innovations. Teachers who were interested in involving technology in the classroom needed to find resources outside of the school on their own. Because of the lack of computers for every student, Mrs. Milton grouped students to work together at the computer. Therefore, collaborative learning strategies were frequently used in the classroom. Mrs. Milton grouped her students in many different ways such as by academic ability, gender, and intellectual needs. Mrs. Milton noted that she found it difficult to identify the most effective way to group children because effective grouping depended on many different variables. Mrs. Milton admitted that her students were ready to use technology with one exception; children in first and second grades needed additional assistance to learn social skills to truly collaborate with each other when they were grouped.

To assess the temperament of each child who participated in the study, Mrs. Milton completed a formal standardized temperament assessment (e.g., TABC) and also provided narrative on each child's characteristics that were based on her own definition of temperament. Mrs. Milton defined temperament as each child's own unique tendency toward certain reactions or behaviors to the classroom situations and events. For example, she believed that children with intense temperaments were more likely to lose their tempers. Based on the belief that each child is unique, Mrs. Milton encouraged her students' learning to appreciate and celebrate each other's

differences. She tried to provide a warm atmosphere in the classroom where every student perceived that he or she was a member of a big family. To Mrs. Milton, the school community was also like a big family in which teachers and administrators supported each other.

Description of the Students

Four second-grade students and one first-grade student who were all enrolled in the gifted program were selected to be interviewed and observed for this study. These participants were selected because the teacher identified that the students had worked together as a group for some time before the study was conducted. Mrs. Milton perceived that these students would be cooperative with research procedures. Among the four second-graders, three were boys and one was a girl. The first-grade participant was a girl. All five participants were White and from middle-class families. All of children had computers in their homes and were allowed to play with the computers for a minimum 15 minutes every day. The children noted that they used computers to do their homework or to play games. The five students worked together as a group for approximately an hour every morning separately from the rest of the second-grade class. One of the second-grade boys, Kevin (pseudonym), had recently lost his mother to a tragic illness. However, he refused to talk about the incident and ostensibly performed as he used to be according to Mrs. Milton. Another second-grade boy, Mike (pseudonym), was diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) and was taking medication for that condition. The last second-grade boy, Andy (pseudonym), was from a single-parent family whose parents were divorced. Tina (pseudonym), the second-grade girl, was adopted by a white-middle class family. Mary (pseudonym), the only first-grader among the five, read ahead of her peers in first grade. Therefore, she joined these second-grade children for reading instruction to meet her unique academic needs. More detailed information about additional characteristics,

temperamental characteristics, and interactive behaviors of the participants will be provided in later chapters.

Measures and Protocols

This study, while predominantly qualitative, employed established and published measures of temperament and interactive behaviors. These tools were selected to provide additional information on the specific children who participated in the research study. The temperament scale was utilized to add to the description of the individual child's temperament that was developed through the interview process. By including a quantitative measure with the description of the individual children, it was hypothesized that the interview data collected from teachers would mirror the scores on the instrument. This multi-method approach strengthens the study by taking advantage of the existing literature and research tools while also using those tools to examine weaknesses in the current assessment of temperament.

The Temperament Assessment Battery for Children (TABC)

The teacher-rated scale "The Temperament Assessment Battery for Children (TABC)" developed by Martin (1984) was a theoretical driven measure of temperamental characteristics of children from 2 through 7 years of age. The questionnaire contained two forms: the Parent Form and the Teacher Form. In this study, the Teacher Form was used for assessing temperament in the participants because the instrument was designed particularly for the use in schools. The TABC contained five scales of temperament: inhibition, negative emotionality, activity, lack of task persistence, and impulsivity. The inhibition scale was established to measure children's tendency to physically withdraw or to become emotional during a social circumstance which may contain a novel person. Children with low inhibition scores indicated that they were not sensitive to cues of punishment, anxiety, and depression. It was easier for low inhibited children

to participate in public performance as well as sports. They also tended to be initiators to social interaction and the core person in the social structure of their peer group. The negative emotionality scale indicated children's tendency toward upset emotions such as temper tantrum. Children with low negative emotionality tend to be less emotional, not necessarily to be positive. The activity level measured children's tendency of engaging in energetic gross motor activity. The lack of task persistence scale assessed children's attention and ability to continue on doing a difficult task. In addition, the impulsivity was an aggregate scale composed of negative emotionality, activity level, and lack of task persistence. Using a 7-Likert scale, the Teacher Form consisted of 29 items that measured six types of children: inhibited, highly emotional, impulsive, typical, reticent, and uninhibited. The internal consistency reliability of the Teacher Form ranged from .86 to .95 and the validity coefficients ranged from .56 to .65.

In addition to using the TABC, I also interviewed the teacher and each child to gather data for this study. Observations were conducted in the classroom environment in which the computer-supported activities took place. A thorough description of the interview protocols is presented in a later section.

Interactive Behavior

The interactive behaviors which occurred when the participants worked with or without the computer were coded according in two main categories along positive and negative dimensions which emerged from the data: collaborative skills and communication skills. In addition, the type of group dynamic was identified based on the performance of collaborative skills and communication skills of the participants. These categories of interactive behaviors were modifications of methodology utilized by Yang and Liu (2005).

During computer-supported activities, the collaborative skill category examined three behaviors: how much time the child occupied the computer, the number of times the child contribute ideas, and the child's ability to compromise with a teammate's ideas. Communication skills examined the following behaviors: verbal help, non-verbal help, positive/negative verbal response, and positive/negative non-verbal response. During the class activities without computer facilitation, the collaborative skill category contained only two sub-categories of interactive behaviors: contribution of ideas and child's ability to compromise with a teammate's ideas. The communication skill category remained the same as described earlier. In order to code the number of interactive behaviors as many as possible, each subcategory was coded based on a 20-second segment. This format also allowed the author to identify the tendency of interactive behaviors for each participant during different activity time period. Finally, the total number of interactive behaviors was calculated at the end of each subcategory to allow the researcher to recognize the behavior patterns for each participant and among participants during the whole activity time period.

Both methods of interview and classroom observations were used in order to achieve more in-depth investigation regarding the research questions. A tape recorder was used to record the conversations between the researcher and each participant. A video tape recorder was used to record the observation of the participant's interactive behaviors during the CSCL activity in the classroom.

Procedures

The classroom for the study was purposefully selected because the teacher had a reputation as a highly skilled teacher as well as she incorporated CSCL in her classroom teaching. Once the site for the study was determined, a proposal was made and approved by the

institutional review board of the university. Student participations were solicited by sending home a letter to each child's parent requesting their involvement. Specifically, a recruitment flyer, a parent consent form, and a child assent form were distributed to each student prior to the beginning of the study. Students and their parents needed to sign the form in order to participate in this study. Once the parents of the children agreed to allow their child to participate, the teacher completed the TABC for all children who consented to participate.

The researcher also spent about six months in the classroom with all children so that the children would be used to her presence. Typical daily routines were noted including how CSCL activities were embedded in instruction. Once the children were selected, twelve focused observations on the group of five children for the length of the classroom activity were conducted. For three weeks, the participants were observed and videotaped twelve times for a total of 301 minutes per child. These observations chronicled the children's social behaviors with their group members when working at the computer on a CSCL activity as well as working without computer. During the computer-supported activities, the participants were assigned by their teacher to create a *PowerPoint* presentation together about introducing the wild animal and culture of Australia. Given much freedom to develop their *PowerPoint* document, the participants could add as many special effects, such as music, and slides to enrich the content of their presentation. The participants were not asked to perform any specific intervention-related tasks, but rather were observed in the course of their activities within their classroom when engaged in computer-supported collaborative learning. Specifically, social behaviors were recorded for future coding that included behaviors such as collaboration in interactions.

Once the videotaped observations were collected, observations were coded by time segments. Time segment length was determined by watching the videotape of each CSCL

activity and determined how often children on average switched their behaviors. Each videotape was coded by the time segment across the two dimensions of interactive behaviors. A narrative summary of the interactive behaviors of each of the five children was independently done. Following the specific within-case analysis, cross-case analysis was performed by examining and comparing the observational data between the five children who with different patterns of temperament and included the frequency of times that they engage in specific social behaviors within the computer-supported collaborative learning activity.

During the observation session after the research data collection has begun, interviews were conducted with the children and the teacher. The participants were interviewed about 30 minutes individually under the teacher's permission without disturbing the normal class procedure, such as a recess time. Prior to the interview, the researcher asked the participant to ensure whether he/she was ready to be interviewed. Each interview was conducted in a quiet place that the participant felt comfortable, such as the library in the elementary school. The interview questions for each of the participants follow.

Teacher Interview Protocol:

- Describe the individual differences in temperament of each child participant.
- The role computers played in children's learning.
- How does a child like to interact with their team members when using a computer to finish a task?

Interview questions for the children:

- What are some ways that you would describe yourself?
- What are some ways that your teacher would describe your behavior?
- What are some ways that your mom or dad would describe you?

- What are some ways that your friends would describe you?
- How do you feel like working on the computer to finish a task?
- How do you feel working with other children to finish a game/work by using computer?
- Do you act differently when you work with your classmates at the computer than when you work with them at your desk?

Data Analysis

A mixed method of both quantitative and qualitative inquiry was used to collect and analyze the data. Children were first identified by their general temperament rating. Within-case analyses were performed for each child and then a cross-case comparison was performed. Data from interviews were transcribed and used to code and triangulate information from observations and the rating scales. Specifically, for the qualitative analysis of interview data, the rudimentary analysis for this study was based on interviews of the children and the teacher.

Prior to coding the data, the researcher had read through all of the verbatim transcriptions several times to identify some phrases or words that the researcher thought relevant to the research topic by using a marker. Each interview was reviewed independently so that no pre-categorization was formed and used to analyze the other interviews. Then, as suggested by Patton (2002), the researcher developed some manageable coding schemes as the first step of analysis and data were sorted by using these classifications within each interview. Then, the researcher sorted the coding schemes to form several categories based on the concern of what things fit together. The internal homogeneity and external heterogeneity of the extent of data (Patton, 2002) were also taken into consideration while forming a category. Finally, a theme was

labeled according to the categories developed before. From these categories, narrative descriptions of the participants were constructed.

Data from the observations were coded by examining the videotapes multiple times and coding the child's behavior according to the behavioral categories emerged from the data. Frequencies of the behaviors were tallied as well as the overall percentage of time in which a child exhibited an interactive behavior. Two main categories of interactive behaviors were emerged from the observational data: collaborative skill, communication skill and group dynamic. The collaborative skill contained three sub-categories: the time each child used the computer, the number of times each child contributed an idea/suggestion to the team, and the frequencies each child compromised with other teammates. The behavior of contributing an idea/suggestion was defined as giving one's thoughts and/or opinions to the team about the assigned project by speaking, drawing, or other presenting ways. For example, Mary told Tina to search another website when Tina could not find information on the current one. Compromising with other teammates was defined as following the teammate's ideas without insisting on one's thoughts whether or not one agreed with his/her teammate's ideas. For example, Mike agreed to use color red although he preferred yellow because his teammate Andy wanted to use red on their project. Mike's behavior was seen as compromising.

The communication skill evaluated four sub-scales: verbal help, non-verbal help, verbal response, and non-verbal response. Verbal help denoted helping teammates by saying, reading directions, telling information. Non-verbal help was defined as non-verbal directive behaviors such as pointing out the information, helping teammates to type, and writing notes. Verbal responses were identified as either positive or negative responses. Positive verbal responses were coded when one selected polite words such as "please" to answer his/her teammates. Negative

verbal responses were coded when one chose impolite words such as stupid to answer his/her teammates. Non-verbal response was identified based on the participant's positive and negative behaviors. Positive non-verbal response was defined as using positive gestures or body languages such as one thumb up to respond to the teammate's question. Negative non-verbal response was defined as using inappropriate gestures or body languages to respond to the teammate's questions or ideas. For example, Andy pushed Mike's fingers away when Mike was typing his ideas for the project. Finally, the group dynamic was identified based on the overall performance of the participants during the computer-supported and the non-computer-supported activities.

Subjectivities

As a student who is not from the United States, my nationality and the cultural perspective it entails is inevitably connected to my subjectivity. For example, reconciliation is seen very important when people work together as a group. Individuals need to compromise in order to pursue the benefit for the group. During group work, social competence and social skills are highly valued. This social value could influence my focus of children's interaction and collaboration during the CSCL activity.

Gender might be another issue that reflects on my interpretation of student's behaviors and computer skills. I assumed male students are more likely than female students to work at the computers and learn computer skills easily and also more likely to not like working with their peers. I also assumed that the teacher tended to encourage male students to learn more advanced computer skills independently.

Finally, as a non-English native speaker, language might be a barrier for me to correctly interpret the meaning from interviewing my participants. I might not be sensitive enough to

English words that lead me to miss some moment to ask follow-up questions during the interview or did not catch the important information that my participants tried to tell me.

In order to control for my prior assumptions, I spent some time in this second-grade classroom to observe children in general, to see how the classroom functioned, and to notice typical behaviors. After this experience, I was able to see that my assumptions about gender, group work, how teachers interact with children were not supported in this environment.

CHAPTER 4

KEVIN

During the interview conversation, Kevin described himself as a little shy especially in front of a crowd, but not with his friends. He said his parents thought him to be a little clumsy. He cared about what the teacher thought about him. For example, he used to ask Mrs. Milton about the evaluations from his first-grade teacher and he would ask his third-grade teacher about how Mrs. Milton evaluated him. With his friends, Kevin said he was patient, considerate, and an easy-going person. When asked to identify his friends, Kevin picked only a few names from his class. These people were noted because they never had any arguments with each other. Friendship was seen as very important by Kevin because he grew up with his friends. He was willing to compromise with his friends when they are playing or working together. In school, Kevin liked math the best and physical education the worst. He enjoyed the process of solving the challenges of math but disliked the exercises in physical education. There were four computers in total at Kevin's home; he was allowed to use the computer after school to do his homework or to play games. He knew how to use *Word*, *PowerPoint*, and the *Internet Explorer*. Kevin preferred using computers to process his assignments rather than paper-and-pencil. In addition, he thought working with other students as a group at the computer helped him learn. Because each person knew something the others did not know, Kevin thought teammates could learn from each other. He preferred working with friends he was close to rather than just any one in the class. When encountering conflicts, Kevin usually suggested a democratic strategy such as voting until reaching an agreement within the group.

According to Mrs. Milton, Kevin was an extremely smart, sweet, and self-motivated boy who was always moderately behaved. For activity level, Kevin did not enjoy playing out in the playground because he was chubbier than children at his age. He preferred staying indoors with adults. For impulsivity level, he was seen very mild by his teacher. During a competitive game or

activity, Kevin always wanted to win or he would cry. Mrs. Milton thought Kevin was afraid of someone else in the class was smarter than he was. From every angle, Kevin was described by his teacher as a nearly perfect student in her class despite that he had some characteristics of being the youngest child in his family. In addition, Mrs. Milton also mentioned that Kevin had a strong need to be recognized by a female adult. He wanted verbal approval from women. The phenomenon became more manifested after his mother passed away around the Christmas time in 2005. Except for this particular behavior of seeking approval from a female adult, Kevin acted as normal as nothing had ever happened in his parent's house. He even acted like he had no memory about his mother when his classmates and teacher tried to talk to him. Mrs. Milton rated Kevin temperament as moderate according to the TABC. Kevin's computer skills were above the average of the class and he particularly liked to add sounds in his PowerPoint project. He enjoyed learning with the facilitation of the computer and was a quick learner of computer skills.

From my observations, Kevin behaved exactly like the teacher described. The low percentage of Kevin's share on all interactive behaviors during the computer-supported and non-computer-supported classroom activities can be attributed to the classroom setting that kept him from participating in the team work frequently. Although he was using an individual computer far away from his teammates, he occasionally came over to see the work of his teammates and tried to provide useful suggestions as well as help. He responded to his teammates with a moderately good manner, using polite words such as please and often with positive attitude. The only negative non-verbal response was identified as a distractive behavior because Kevin responded with gestures that distracted his teammates from focusing on reading.

Table 4.1

The results of teacher-rated Temperament Assessment Battery for Children (TABC)—Kevin

	Inhibition	Impulsivity	Negative Emotionality	Activity	Lack of Task Persistence
T-score	44	44-45	48-49	40	42
Standard Deviation	−0.6	−0.5 to −0.6	−0.2 to −0.1	−0.1	−0.8

Table 4.2

The Interactive Behaviors of Kevin in Different Classroom Activities

	Computer-supported (Total 218 minutes) Time (Percent)	Non-computer-supported (Total 83 minutes) Time (Percent)
Collaborative skills		
Time occupied computer	191:57 (88%)	0 (0%)
Contribute ideas/suggestions	26 (12%)	23 (28%)
Compromise to teammates	2 (0%)	4 (5%)
Communication skills		
Verbal help	32 (15%)	20 (24%)
Non-verbal help	23 (11%)	1 (1%)
Positive verbal response	7 (3%)	9 (4%)
Negative verbal response	0 (0%)	2 (2%)
Positive non-verbal response	1 (0%)	1 (1%)
Negative non-verbal response	1 (0%)	3 (4%)

The T-scores of the teacher-rated Temperament Assessment Battery for Children (TABC) exhibited that Kevin scored 44 on inhibition, 44-45 on impulsivity, 48-49 on negative emotionality, 40 on activity, and 42 on lack of task persistence. In terms of standard deviation (SD), Kevin is 0.6 SD below the mean on the inhibition, 0.6 to 0.5 SD below on the impulsivity, 0.2 to 0.1 below the mean on negativity emotionality, 1 SD below the mean on activity, 0.8 below the mean on the lack of task persistence. According to the TABC, Kevin exhibited the temperament scores at the moderate levels (45 to 55 T-score range) that he can be categorized as the typical type. Martin (1988) indicated that this group of children is expected to be more

influenced by the environment in which they find themselves. Therefore, they are very sensitive to the effects of the environments.

Regarding the session of working with teammates at the computer, Kevin occupied the computer the longest time among the five students. Due to the classroom setting, Kevin was using the computer by himself at the teacher's table and that decreased the opportunities for him to collaborate with the other teammates. Therefore, it is not surprising to find that Kevin contributed the fewest number of ideas and compromised the fewest time to his teammates among the five students. For the communication skills, Kevin provided 32 incidents of verbal help and 23 of non-verbal help to his teammates, 15% and 11%, respectively of the total session. In addition, Kevin positively responded to his teammate 7 separate times which was 3% of the total time. Pertaining to his non-verbal responses, Kevin responded to his teammates one positive and one negative time, respectively.

During the session working without the computer, Kevin ranked the highest on contributing ideas to the team, 28% of time. In his interactions with his teammates, he was the least willing to compromise among the team. On communication skills, Kevin exhibited 20 incidents of verbal help and one time of non-verbal help, 24% and 1% respectively. Kevin exhibited 9 positive responses and 2 negative responses to his teammates which accounted for 4% and 2% of time in the non-computer based session. Finally, Kevin showed one positive and three negative non-verbal responses to his teammates, 1% and 4% of time, respectively, during the session working without the computer.

CHAPTER 5

MARY

During the interview, Mary responded to me with a lot of short answers, incomplete sentences, and body language such as nodding. She did not talk much about my questions, I thought, perhaps, she preferred to share her thoughts with someone with whom she was more familiar. Mary thought her teacher described her as a nice, smart, playful, and funny child. She thought her parents described her as a nice, funny, and cute child. She thought her friends perceived her as a nice and graceful friend. In addition, she described herself as a funny and sporty child who loved basketball. Every day after school, Mary was allowed to play the computer about an hour. She usually used the computer to finish some of her homework and enjoyed searching information on the internet. She liked to play with the computer because it was fast and convenient for completing her work. Like Kevin, Mary preferred working with friends at the computer because she knew them better so that better collaboration could be reached. When encountering a disagreement, Mary thought having a talk was a good strategy to solve the problem. She would try to please her friend by making a funny faces or doing something to make the friend happy.

According to the teacher interview data, Mary was a relatively quiet child speaking in a soft voice. Mary only came to join the other four participants one hour a day because she was a first-grader. She was reading fifth-grade level readings therefore she was put to read with the second-grade gifted-students. Mary had some knowledge of operating computers; she knew how to work with *Word*, *Internet Explorer*, and *PowerPoint*. From the teacher's perspective, Mary was a self-motivated child who always followed the teacher's rule. Mary was a very hard worker and a very good student; however, she was a not creative and aggressive enough to make her a leader. Therefore, she had no problem working with other children but was more like a follower

type of child in the group's efforts. For both activity and impulsivity level, Mrs. Milton rated her as just normal.

Based on my observation and consistent with the interview with the teacher, Mary was a quiet child who spoke soft and less often than other children. There were not too many facial expressions that changed on Mary's face. It was difficult for one to read Mary's mind and emotion from her face. Mary spoke slow and walked slow; however, she did not have social problem from my observation. During the session working with computers with a teammate, Mary was less likely to actually operate the computer but was extremely high in her numbers of verbal and non-verbal help. When encountering a conflict or disagreement, Mary tended to use positive language to respond her teammates. For example, it was not unusual to hear Mary used "please" and "May I" to start her sentence. Regarding to the thirteen times of negative non-verbal responses, Mary was working with a dominant teammate who occupied the computer that made Mary absent-minded sometimes. During the session working without the computer, Mary was even quieter than in the computer-supported activities. She only talked only when it was her turn and participated in non-computer based group work less.

Table 5.1

The results of Teacher-rated Temperament Assessment Battery for Children (TABC)—Mary

	Inhibition	Impulsivity	Negative Emotionality	Activity	Lack of Task Persistence
T-score	60	40-41	33	38	55
Standard Deviation	1	−0.9 to −1	−1.7	−1.2	0.5

Table 5.2

The Interactive Behaviors of Mary in Different Classroom Activities

	Computer-supported (Total 218 minutes) Time (Percent)	Non-computer-supported (Total 83 minutes) Time (Percent)
Collaborative skill		
Time occupied computer	40 (18%)	0 (0%)
Contribute ideas/suggestions	30 (14%)	4 (5%)
Compromise to teammates	26 (12%)	5 (6%)
Communication skills		
Verbal help	78 (36%)	3 (4%)
Non-verbal help	153 (70%)	3 (4%)
Positive verbal response	21 (10%)	2 (2%)
Negative verbal response	0 (0%)	0 (0%)
Positive non-verbal response	9 (4%)	1 (1%)
Negative non-verbal response	13 (6%)	0 (0%)

The T-score results suggested Mary scored 60 on inhibition and between 40 and 41 on impulsivity. In terms of standard deviation, Mary was one deviation above the mean on inhibition and 0.9 to 1.0 below the mean on impulsivity. According to Martin (1988), Mary is identified as the inhibited type of child. The temperamental characteristics of the inhibited type of child are demonstrated by the lowest mean on the dominance rating. The inhibited children also are described as performing the lowest in athleticism and sociability. They tend to be low in motor skills and are constrained in verbal response in a group.

Regarding the interactive behaviors during the computer-supported environment, Mary occupied computers 40 minutes of the total which was equivalent to 18% of the total session. She contributed suggestions 30 times (14%) and compromised with her teammates 26 times (12%). Regarding communication skills, Mary provided 78 (36%) incidents of verbal help and 153 (70%) episodes of non-verbal help when working with her teammates. Overall, she verbally responded her teammates with 21 (10%) positive responses but no negative responses. Regarding to the non-verbal response, Mary performed 9 (4%) times of positive non-verbal responses and

13 (6%) times of negative non-verbal responses. During the non-computer-supported session, it was obvious that Mary participated in much less in the team work than in the computer-supported session. She contributed 4 (5%) suggestions and compromised 5 (6%) times with her teammates. For both verbal and non-verbal help, Mary was coded as displaying 3 (4%) incidents for each category. Mary gave 2 (2%) positive verbal responses and one (1%) non-verbal response. Neither negative verbal response nor negative non-verbal responses were provided by Mary during the non-computer-supported session.

CHAPTER 6

MIKE

Mike described himself as a handsome boy. He thought his teacher and parents thought him handsome as well. He noted that his teacher described him as someone who would do anything to help her. Mike thought his friends described him as a funny and fast friend. Mike used a computer at home every day for doing homework. He preferred to work on the computer rather than using paper and pencil because the tool was more convenient to revise his work as many times as he wanted and it also helped him learn more quickly. When working at the computer with a teammate, Mike said he could work with anybody and he would do anything to collaborate with his teammate. He noted that a teammate does not have to be a friend; he said he could even work with a stranger. The most important thing that Mike thought when working together with someone at the computer was to reach agreement that worked best for each member in the group.

Mrs. Milton described Mike as a considerate boy with a sweet personality; however, sometimes out of control without taking medicine for his diagnose of ADHD. Mike was retained for a year because the use of medication. From Mrs. Milton's observation, Mike was working well with other students in her class, as long as he took medicine. She described him as such a little helper who was willing to help with anything. Pertaining to Mike's temperament, Mrs. Milton described Mike as an easily distracted student who was very active and sensitive. With the control of medicine, Mike exhibited mild on inhibition and impulsivity level. Without the medicine, Mike was way out of control and made up stories. Mike realized the importance of the medicine for controlling his ADHD symptom; therefore, he would ask Mrs. Milton to call his parents when he forgot to bring the medicine to school. In addition, Mike was relatively persistent on the tasks and activities in the classroom. He was particularly obsessing to collecting rocks so that he enjoyed playing rock hunting game almost everyday during recess.

From my observation, Mike was a nice and sweet student who was pretty empathetic to other students. He was sensitive to people's needs and wanted to help them as much as he could. He was always the first one among the team members to get a dictionary or a reference when the group needed to look up an uncertain term. Mike was also a faithful follower of the teacher authority; he carefully followed everything the teacher required. He took on the role of reminding the group about what Mrs. Milton expected them to do. For example, when Mrs. Milton told the group the time was up Mike reminded the group to clean up over and over again until the other members stopped their work. Although Mike was diagnosed as an ADHD child, I never saw him overly react or become hyperactive during the course of the study. When working with his teammates, Mike seldom insisted on his ideas and usually compromised with his teammates' suggestions. From my perspective, Mike was trying to avoid disagreement or conflict within the group. For example, Mike never talked to Andy to let him have a try to work at the computer when Andy was dominating the operation of the computer. Mike was also easily distractible during the course of observation. His attention span was short, particularly in the non-computer-supported activities. Any new stimuli could catch his eyes from few seconds to few minutes. For example, he was frequently distracted by Mrs. Milton's lecture or a giggle in the classroom. On the other hand, he also re-directed himself back to the current activity quickly. During the computer-supported activities, Mike exhibited much longer time on persistence working on the tasks.

Table 6.1

The results of Teacher-rated Temperament Assessment Battery for Children (TABC)—Mike

	Inhibition	Impulsivity	Negative Emotionality	Activity	Lack of Task Persistence
T-score	50	58-59	50	65	61
Standard Deviation	0	0.8-0.9	0	1.5	1.1

Table 6.2

The Interactive Behaviors of Mike in Different Classroom Activities

	Computer-supported (Total 218 minutes) Time (Percent)	Non-computer-supported (Total 83 minutes) Time (Percent)
Collaborative skills		
Time occupied computer	19:00 (9%)	0 (0%)
Contribute ideas/suggestions	40 (18%)	10 (12%)
Compromise to teammates	40 (18%)	8 (10%)
Communication skills		
Verbal help	76 (35%)	4 (5%)
Non-verbal help	93 (43%)	17 (20%)
Positive verbal response	40 (18%)	18 (22%)
Negative verbal response	0 (0%)	1 (1%)
Positive non-verbal response	26 (12%)	21 (25%)
Negative non-verbal response	4 (2%)	12 (14%)

According to the results of TABC, Mike scored 50 on inhibition and negative emotionality which denoted exactly the mean compared to the norm group. For impulsivity, the T-score showed that Mike scored 58 to 59 that were 0.8 to 0.9 standard deviations below the mean. The T-score results also presented that Mike scored 65 on activity level, 1.5 standard deviations above the mean. For lack of task persistence, Mike scored 61 above the mean, 1.1 standard deviations above the mean. Based on these scores of TABC, Mike was identified as the typical type of child. The temperamental characteristics of this cluster of children were all moderate. However, Mike's score was close to the maximum for identifying impulsivity, he was

recognized higher on impulsivity. Currently, long-term prognosis was unable to be outlined by the theory. The most manifested characteristic of this cluster of children was that they were expected to be more likely to be influenced by the environment than the other clusters. In other words, this group of children was highly sensitive to effects of the environments.

During the computer-supported activities, Mike utilized the computer only 19 (9%) minutes. He contributed 40 (18%) suggestions and compromised with his teammates 40 (18%) times. Mike provided 76 incidents of verbal help and 93 incidents of non-verbal help to his teammates which were 35% and 43% of the session, respectively. For verbal responses, Mike presented 40 (18%) times of positive verbal response but no negative verbal response. For non-verbal response, Mike exhibited 26 (12%) positive non-verbal responses and 4 (2%) negative non-verbal response. During the non-computer-supported session, Mike contributed 10 suggestions and compromised with the team 8 times, which was 12% and 10% of the session, respectively. He provided 4 (5%) incidents of verbal help and 17 (20%) incidents of non-verbal help to his teammates. For verbal responses, Mike was coded as providing 18 (22%) positive verbal responses and only one negative verbal response. For non-verbal responses, Mike exhibited 21 (25%) positive non-verbal responses and 12 (14%) negative non-verbal responses.

CHAPTER 7

TINA

Tina, described herself, was the best person in the world and a good person whom everybody liked to be a friend. She thought she was a little wild but also a good student whose grades indicated good performance. She thought her parents perceived her as having some behavior and trust issues. When questioned about her friend's description of her, Tina thought she was thought of as a good friend but one involved in a cycle of breaking up and making up. There were two computers in Tina's house; one was broken she did not get to use the computer often. However, she enjoyed working with the computer and was skillful on *Microsoft PowerPoint* and the *Internet Explorer*. She preferred using the computer to finish an assignment more than the traditional way of doing homework. However, she was slow at typing and did not like reading the directions for operating the tool. Tina also liked working with friends at the computer because she thought friends could teach and share knowledge and information with each other. On the other hand, Tina realized that her friends thought of her as bossy from their complaints. If a conflict took place when working as a group, Tina thought the best strategy to make up with her teammates would have to be continually communicating with the person(s). She would apologize if she initiated the conflict. In addition, being nice to teammates and sharing were some important skills that Tina noted as essential during the group work at the computer.

In Mrs. Milton's eyes, Tina was exactly like the little girl Junie B. Jones. She was a dearly friendly and very self-motivated girl. She was very energetic and fun to work with. She and her sister were adopted at a young age by a white middle-class family because their biological mother did not want to take care of them. Although Tina knew she was adopted, she believed that her biological mother was forced to give her and her sister away because of the financial difficulties. According to Mrs. Milton, Tina was an exceptionally impulsive child. This

description was congruent with the finding in Tina's interview that her favorite class was physical education. Tina had a golden heart and loved working with anybody; she would cry when was told that she hurt someone's feeling. However, she seemed to lack skills to work with people. More than one time Mrs. Milton heard from other children as they complained how dominant Tina was during small group activities. Mrs. Milton tried several strategies with Tina to teach her social skills in order to collaborate with other children appropriately. Regarding Tina's persistence, Mrs. Milton indicated that she was an extremely persistent student on classroom activities and that occasionally she needed to be told to stop her work and to move on to another activity. Mrs. Milton concluded that Tina was a smart student with a kind heart. She was a skillful computer user but needed more direction in the area of social and communication skills.

In my observation session, the first characteristic I noticed about Tina was that she spoke her mind. She was relatively active and spoke a lot so that sometimes her teacher needed to pull her out to let her sit by herself. Tina loved participating in every classroom activity and worked with the other children. However, she seemed not to understand the appropriate way to work with people. The phenomenon was particularly obvious when she was working with her teammates at the computer. Tina dominated almost all operations of the computer and was bossy in some incidents. She did not allow her teammates to become involved in the computer-based activities. When her teammate occasionally was trying to work on the computer on tasks such as typing, Tina wiped her teammate's hands away. Tina paid full attention while working at the computer; however, she was not empathetic to her teammates' willingness to also participate in the activities. Except for the time working at the computer, Tina was a very active girl who could

hardly stay quiet for a minute. For example, during the interview she was climbing up and down the chair or walking around rather than sitting still.

Table 7.1

The results of Teacher-rated Temperament Assessment Battery for Children (TABC)—Tina

	Inhibition	Impulsivity	Negative Emotionality	Activity	Lack of Task Persistence
T-score	35	58	51	68	53-54
Standard Deviation	−1	0.8	0.1	1.8	0.3-0.4

Table 7.2

The Interactive Behaviors of Tina in Different Classroom Activities

	Computer-supported (Total 218 minutes) Time (Percent)	Non-computer-supported (Total 83 minutes) Time (Percent)
Collaborative skills		
Time occupied computer	174:40 (80%)	0 (0%)
Contribute ideas/suggestions	51 (23%)	13 (16%)
Compromise to teammates	16 (7%)	4 (5%)
Communication skills		
Verbal help	15 (7%)	11 (13%)
Non-verbal help	15 (7%)	3 (4%)
Positive verbal response	14 (6%)	5 (6%)
Negative verbal response	28 (13%)	7 (8%)
Positive non-verbal response	14 (6%)	6 (7%)
Negative non-verbal response	17 (8%)	71 (86%)

The TABC results showed that Tina scored 35 on inhibition, one standard deviation below the mean. On impulsivity, she was rated by her teacher with a score of 58 which denoted 0.8 standard deviations above the mean. Pertaining to negative emotionality, activity, and lack of task persistence, the T-score showed that Tina was rated 51, 68, and 53 to 54, which were 0.1, 1.8, and 0.3 to 0.4 standard deviations above the mean, respectively. Based on these results, Tina

was identified as the uninhibited cluster of children. With regard to the characteristics of this group, the uninhibited children were low on non-compliance and moderate on dominance. They were exceptionally self-regulated, creative, and intelligent. They were also rated to be highly positive on emotionality and sociability; therefore, this group of children had successful adjustment to schooling and peer groups.

During the computer-supported activity session, Tina was found occupying the computer 174 minutes and 40 seconds, 80% of the session. She contributed 53 suggestions, which was 23% of the sessions. Meanwhile, there were 16 (7%) incidents in which Tina compromised with her teammates. For communication skills, Tina contributed 15 (7%) incidents of both verbal and non-verbal help. Regarding verbal responses, Tina performed 14 (6%) incidents of positive and 28 (13%) incidents of negative verbal responses to her teammates. In addition, in this session there were 14 (6%) and 17 (8%) incidents of positive non-verbal and negative non-verbal responses, respectively. During the non-computer-based activities, Tina suggested her ideas 13 (16%) times and compromised to her teammate' ideas 4 (5%) times. At the same time, Tina provided 11 (13%) verbal incident of help and 3 (4%) non-verbal incidents of help to her teammates in this session. For verbal responses, Tina responded to her teammates with 5 (6%) positive and 7 (8%) negative statements. For non-verbal responses, 6 (7%) positive incidents and 71 (86%) negative incidents were found while observing Tina during this session.

CHAPTER 8

ANDY

During the interview, Andy frequently responded to me with “I don’t know”. He tended to use short answers and body language such as nodding or shaking his head. I was not sure about the possible reason that made him responded to me in this way. Andy described himself as a funny person and he thought his parents agreed with this view. He thought his teacher might describe him as lazy because he did not like doing his assignments. His favorite subject in school was science and he disliked mathematics. Lunch time was his favorite time of the day because he could eat a lot and talk as much as he wanted. When asked about his interests, he said he liked learning, playing, and talking. In Andy’s house, he was allowed to play the computer after school about half an hour although he wanted to play it for more than five hours. Andy liked using the computer for games, assignments, and classroom activities except for typing. According to Andy, he liked working with other students to finish work under the facilitation of the computer. When disagreements took place during the group work, Andy would first try to talk to the person or tell the teacher if he could not solve the problem but occasionally he suggested a democratic strategy.

Andy was from a single-parent family whose parents were divorced while he was young. His father was diagnosed with a mental health problem that made Andy’s mother wonder if Andy inherited the problem from his father’s side. When Andy first came to Mrs. Milton’s class, Mrs. Milton thought he might have some emotional problem. Andy was a little afraid of Kevin. Mrs. Milton recalled Andy’s mother once told her that she thought Andy would never perform as well as Kevin. Mrs. Milton described Andy as a truly gifted but un-self-motivated child. He did not like school or the other children in the class. He did not feel good about anything. Regarding his persistence, he showed enthusiasm and persistence only when he was interested in the assigned tasks. Mrs. Milton described Andy as a person with strong will and one who decided to act his own way in the classroom. Therefore, Mike often got in trouble in Mrs. Milton’s

classroom. Mrs. Milton sometimes needed to pull him out the class until he was ready to behave well. Andy loved working at the computer and was quite familiar with using *Microsoft Word* and *PowerPoint* as well as the skills of searching on the internet. However, he liked to work alone although other students tried to approach him.

Based on my observation, Andy was more active than was Tina. He wriggled on the chair while I was interviewing him. In both computer-based and non-computer-based sessions, Andy was usually squatting rather than "sitting his bottom" on the chair. When working at the computer with his teammates, Andy dominated almost all jobs like Tina. He also took his teammates' hands away when his teammates occasionally wanted to participate in the operation of the computer; more frequently than Tina. Andy talked a lot while using the computer; however, he was talking to himself most of the time instead of discussing with his teammates. On the other hand, Andy was willing to help his teammates on their request except for one time when Tina asked Andy's assistance for inserting pictures in her *PowerPoint* slides. Andy did not respond to her nor did he teach her the skill.

Table 8.1

The results of Teacher-rated Temperament Assessment Battery for Children (TABC)—Andy

	Inhibition	Impulsivity	Negative Emotionality	Activity	Lack of Task Persistence
T-score	61	65-66	65	70	60-61
Standard Deviation	1.1	1.5-1.6	1.5	2	1.0-1.1

Table 8.2

The Interactive Behaviors of Andy in Different Classroom Activities

	Computer-supported (Total 218 minutes) Time (Percent)	Non-computer-supported (Total 83 minutes) Time (Percent)
Collaborative skills		
Time occupied computer	189 (87%)	0 (0%)
Contribute ideas/suggestions	58 (27%)	13 (16%)
Compromise to teammates	9 (4%)	7 (3%)
Communication skills		
Verbal help	57 (26%)	68 (82%)
Non-verbal help	27 (12%)	11 (13%)
Positive verbal response	5 (2%)	10 (12%)
Negative verbal response	10 (5%)	17(20%)
Positive non-verbal response	2 (0%)	1 (1%)
Negative non-verbal response	37 (17%)	49 (59%)

The results of the TABC showed that all Andy's scores were exceedingly high. He scored 61 on inhibition level and 65 to 66 on impulsivity level, which respectively denoted 1.1 and 1.5 to 1.6 standard deviations above the mean. He was rated 65 on negative emotionality, 1.5 standard deviations above the mean. Meanwhile, Andy was rated by his teacher with a score of 70 on activity level and 60 to 61 on lack of task persistence, which accounted for 2 standard deviations and 1.0 to 1.1 standard deviations above the mean, respectively. Andy's scores were located in the highly emotional cluster. This type of child is identified as the most non-compliant in the group and the second highest on dominance among all clusters of children. They are also evaluated with the lowest developmental outcomes on positive emotionality, sociability, self-regulation, creativity, and intelligence. They are sensitive to both cues of reward and punishment. In addition, children of this cluster exhibit negative emotionality toward anxiety and impulsive behavior that may result in the greater likelihood of emotional and social conflict than the other clusters.

During the computer-supported activity session, Andy had the longest time for using the computer. He was found to occupying the computer 189 minutes, which was 87% of the total session time. He contributed 58 ideas and compromised to his teammates only 9 times, which were 27% and 4% of the session, respectively. In terms of communication skills, Andy provided 57 (26%) verbal incidents of help and 27 (12%) non-verbal incidents of help to his teammates. Five positive responses and ten negative responses were found on Andy's performance during this session, which were 2% and 5%, respectively. In addition, only 2 (0%) positive non-verbal responses and 37 (17%) negative non-verbal responses were found. During the non-computer-based session, Andy contributed 13 (16%) ideas and exhibited 7 (3%) compromises. In terms of communication skills, Andy provided as high as 68 (82%) verbal suggestions and 11 (13%) non-verbal suggestions to his teammates. For verbal responses, Andy exhibited 10 (12%) positive incidents and 17 (20%) negative incidents. For non-verbal responses, Andy performed only 1 (1%) positive incident and 49 (59%) negative incidents.

CHAPTER 9

COMPARISONS

This chapter will present a comparison of all five cases and will detail the similarities and differences among the children. Trends associated with temperament among the children will also be discussed in relation to both the computer assisted and non- computer assisted learning environments. Finally, a discussion of the merits of using qualitative and quantitative methods to examine temperament in interactive settings will be presented.

Influences of Temperament on Interactive Behaviors

The findings of this study suggested that individual differences in the children's temperament impacted on the actual interactive behaviors of the children. Children from the same temperament cluster demonstrated similar behavioral tendencies. Children who were rated by their teacher similarly on a particular temperamental trait had similar behavioral tendencies as well. Congruent with research findings that temperament was associated with problem behavior (Andersson & Sommerfelt, 1999; Barron & Earls, 1984; Guerin, Gottfried, & Thomas, 1997; Pierrehumbert, Miljkovitch, Plancherel, Halfon, & Ansermet, 2000; Schmitz, Fulker, Plomin, Zahn-Waxler, Emde, & DeFries, 1999), the current study suggested children with intense temperamental traits or those identified as highly emotional through the temperament rating scale (e.g., impulsivity and activity) tended to show more negative behaviors than positive behaviors. The actual behavior of the other children coincided with their ratings of typical, inhibited, and uninhibited temperament. Reflecting on the group dynamic, a leading by one or two dominating atmosphere was identified based on the interactive behaviors exhibited by the children. Children with intense temperamental dispositions tended be dominant on the use of the computer and expressed more opinions on the task-oriented activities.

The typical cluster of children

With moderate temperament, the typical cluster of children (i.e., Kevin and Mike) demonstrated lowest incidents of the negative verbal response both in the computer-supported and the non-computer-supported environment. Although the classroom setting prevented Kevin's easy participation in the team work, he still contributed a number of ideas and assistance both verbally and nonverbally to his teammates. With a higher rating on impulsivity than Kevin, Mike also exhibited a great number of incidents of contributing idea and verbal as well as non-verbal help than did other children. Based on my observations and those from Mrs. Milton, Kevin and Mike were able to collaborate with their teammates very well. They were sensitive to their teammates' need and were willing to provide instant favor. For example, when Andy was not sure about a term Mike immediately went to get Andy an encyclopedia without Andy's request. Kevin came over to see his teammates' work every ten minutes or so and offered as much assistance as he could. Kevin and Mike were popular candidates for grouping when the participants were asked to select a classmate with whom to work. In addition, one should notice that Mike performed highest frequency on the behavior of compromising to teammates' suggestions among the five children participants.

The Inhibited Type of Child

One tendency of the inhibited children was found to be lowest on dominating behaviors (Martin, 1988). In this case, Mary's performances on compromising behavior were congruent with this suggestion. When encountering disagreement, both Mrs. Milton and I observed that Mary tended to give in her ideas and chose to follow her teammates. In addition, the inhibited children were found to be low on athleticism and sociability (Martin, 1988). In the current study, this finding was only partially supported. Both Mrs. Milton and I perceived Mary as a neither a

creative nor lively child. According to her self-description, Mary perceived herself as a sporty and funny child who liked making friends with people. Mary's compliance with her teammates' behavior was reflected on the incidents of negative verbal and non-verbal responses. These negative behaviors were observed when Mary was absent-minded because her teammates were occupying the operation of the computer thus bored her. Once in a while Mary asked her teammates for an opportunity to operate the computer; however, she stopped after asking few times without receiving a positive response from her teammates. On the other hand, Mary's performances on verbal and non-verbal help were highest which indicated a high level of participation and collaboration with teammates during the computer-supported task.

The Uninhibited Child and the Highly Emotional Child

With regard to these two clusters of children, they tended to score high on impulsivity level. In this study, Tina was identified as the uninhibited child whereas Andy was the highly emotional type of child. Four prominent interactive behaviors were recognized for Tina and Andy based on the observational data and the interview with the teacher. First, they tended to contribute a great deal of ideas and/or suggestions during the collaborative work with other teammates. They were active participants in the computer-based activities. The incidents they performed were apparently higher than that showed by the other three members. Andy was found to exhibit high frequencies particularly on giving verbal assistance. Second, Tina and Andy exhibited very few compromising behaviors toward their teammates' suggestions in contrast to the other three members. These children ignored suggestions from their teammates or rejected those suggestions. Third, Tina and Andy tended to dominate all the operation of the computer. Their dominating behaviors were significantly highest among the five children. From my observation, neither of these two children liked to share the computer-based works with the other

members. Even if occasionally they allowed their teammates to take over the computer-based works, they got the jobs back in a short time. Tina's dominating behavior was contradicted to Martin's (1988) description that the uninhibited child was moderate on dominance. Finally, both Tina and Andy exhibited more negative verbal and non-verbal responses than the positive ones in both the computer-based and the non-computer-based environment. Most of these negative behaviors were distracting and dominating behaviors such as talking to teammates with irrelevant topics to the task and taking teammates' hands away from the keyboard while they working together at the computer. The incidents of Andy's negative behaviors were found to be the highest among the five children.

In summary, children with moderate temperament tended to collaborate well with their team members. The inhibited type of children had higher tendency to compromise with other children's ideas or decisions during group collaboration. Children with high impulsivity had the tendency to control the computer by themselves without sharing with their teammates.

Influences of Computer on Interactive Behaviors

Findings of this study also suggested that computers were attractive to students and supportive to students' group interactions (Hawkins, Sheingold, Gearhart, & Berger, 1982; Clements & Nastasi, 1988; Staarman, 2003). Even the highly impulsive children paid full attention to complete the computer-supported task. Apparently, more interactive behaviors were found during the computer-supported session than the non-computer-supported session. Regardless of the temperamental traits of the individuals, all participants in the current study tended to contribute more collaborative episodes and provided more communication in the computer-supported environment. One exception was Andy where he provided more verbal assistance and negative verbal episodes as well as non-verbal responses to his teammates during

the non-computer-based activities. The possible explanation was that Andy was helping his teammates on the reading assigned by Mrs. Milton. He helped his teammates to read more fluently when the team was reading by turns in the hallway. However, perhaps because reading a book was not as fun as controlling a computer, Andy was easily bored so that he would try to get attention from his teammates by using negative verbal or non-verbal means such as poking them or making funny faces.

Congruent with research findings, an additional role of the computer was to serve as a mediational tool during the computer-based activities (Säljö, 1999). In this study, children not only thought and worked through the computer but also collaborated with each other to pursue a shared goal. On the monitor, children were able to see each other's abstract thinking transferring into concrete words thus encouraged discussions toward the shared goal. In addition, the instant function for editing of the computer encouraged children to help each other in order to develop a better project. Unfortunately, findings did not suggest a social norm formed among children as in the study of Wang and Ching (2003). In the current study, children did not discuss the rules for fairly using the computer through out the whole observational session. Even if there was a social norm during the group interactions at the computer, it was tilted toward the dominating children. In other words, the group dynamics could be classified as leading by one or two members. From this perspective, highly impulsive children seemed to have more advantages to use the computer whereas the inhibited children had to learn to negotiate for fair opportunities of using the computer.

During the activities without the support of computer, children interacted less with each other on pursuing a shared goal. Although they set up a norm to complete an assigned task (i.e., taking turns to finish reading a book), the incidents of discussion and contributing ideas were

limited. The inhibited child was particularly found to have very few participative behaviors to the group work during this session. One possible explanation could be that the nature of the tool (i.e., the book) provided merely one-way communication. When children were reading the assigned book, they were passive receivers to the information. Further, the nature of the task was another possible reason for discouraging the interactive behaviors. Children were required by the teacher to only read the assigned book without finishing additional assignment such as a reflection. In other words, the design of the task did not encourage creativity or more in-depth learning. When children were bored by reading the book, particular to those with high activity level, they could hardly sit well to read without the presence of the teacher. In one incident, the uninhibited child and the highly emotional child were the initiators of transgressing the rules. They started playing with each other without caring to read a word; then, the typical children who easily influenced by the environment joined in the transgression. That day, children's attention was totally distracted away from the book.

In summary, this study proved what Crook (1998) warned us that simply grouping children together did not guarantee true collaboration. Although children showed more interactive behaviors during the computer-supported activities, each individual did not get fair enough opportunities to operate the computer that might lead to the inequality of learning. Group discussions and learning resources were dominated by few active children. In the environment without the computer support, children (particularly the impulsive children) not only were easily bored by the inanimate tool but also by the design of the activity.

Qualitative vs. Quantitative Inquiry

Among the research investigating the impact of temperament on children, quantitative method was a widely used strategy. Because quantitative methodology was believed to

generalize global explanations toward a specific phenomenon, large sample research related to temperament and its influences were conducted intending to find out behavioral models which could be seen on individual children (e.g., Thomas & Chess, 1977; Buss & Plomin, 1975). Through a behavioral model, these studies intended to generalize children's behaviors ethnicity by ethnicity across different environments. One issue these researchers did not concern was that children's behaviors may be influenced by a variety of variables. For example, environmental variables such as the classroom setting influences to children's group interactions (Rimm-Kaufman, La Paro, Downer, & Pianta, 2005). Little was known about the ways children with different temperament interacted with each other during different group activities. In order to look for in-depth explanations for different behaviors demonstrated by individuals with varied temperament traits within a specific learning environment, the current study adopted a qualitative inquiry to collect data in contrast to those utilized quantitative method. Through observations and interviews with the teacher as well as the children, I was able to approach what children really think and observe the real phenomena in the classroom setting. The data collected using qualitative inquiry provided me with rich information about the specific behaviors demonstrated by each individual within a particular learning environment. It allowed me to see a more complete picture about the ways children interact with each other.

On the other hand, applying qualitative strategies for the current study was not all beneficial. One challenge of adopting this method was to videotape children while they were working together. Although I have been working with them for months in order to reduce the strangeness, there were times when the participants were not be able naturally perform in the presence of the video camera. Although I tried hard not to intervene and children were told they would be recorded in advance, the video camera inevitably distracted their attention from the

classroom activities. Then, I decided to act naturally myself and provided no response to any question from the children as if I did not exist. Not long after the children lost interest in my behavior and transferred their attention to the computer. Therefore, the observation was able to continued. Another challenge was to induce data about children's interactive behaviors into meaningful categories. Each five participants exhibited many different kinds of behaviors within a total of 300 minutes. To extract collaborative and communicative behaviors within this huge number of behavior counts, specific definitions for the behaviors expected were necessary. The study of Yang and Liu (2004) was helpful for developing a template to identify the interactive behaviors; however, coding was still difficult due to the lack of precedent studies. In addition, interpreting the data was another challenge. As children created their own way to show their friendships, their behaviors could not be interpreted from ostensible performance. For example, in some occasions making faces could not be classified as a negative response but an expression of pleasant emotional status of the individual. The collected data needed to be carefully interpreted according to the status of the individual within the context.

Through utilizing a qualitative method, most findings of this study were found supportive to the previous research. The moderate cluster of children performed behaviors of mild level and the highly emotional child were dominating (Martin, 1988). The computer was attractive to children's task-oriented attention and children were supportive of one another to use the computer (Dickinson, 1985; Erkens, Jaspers, Prangsma, & Kanselaar, 2005; Lingnau, Hoppe, & Mannhaupt, 2003; Staarman, 2003). In addition, children were found automatically formed a group at the computer (Wang & Ching, 2003). However, some evidence represented contradictory conclusions. For example, the uninhibited child demonstrated highly dominating behaviors which was exactly the opposite to Martin's (1988) identifications of characteristics for

this cluster of children. However, both the uninhibited child and the highly emotional child were not found to show dominant behaviors during the non-computer-supported classroom activities. Further, children did not form their social norm although they automatically worked together at the computer (Wang & Ching, 2003). None of the participants were found to set up a democratic rule for using the computer with equal opportunities. Finally, the characteristics perceived by the inhibited child herself during the interview were very different from the observations from the teacher and me as well as Martin's (1988) identifications. Pertaining to the specific interactive behaviors within the CSCL environment under the premise of children's temperamental dispositions, no comparison was available between using qualitative and quantitative strategies in investigation due to the shortage of the precedent studies.

To summarize this section, utilizing a qualitative-based method allowed me to collect a rich amount of data with detailed information about the participants and their interactive behaviors within specific learning environment. Based on these data, knowledge about the interactions between children's psychological variables (e.g., temperament) and the environmental variables (e.g., computer-supported collaborative learning activities) could be further discussed. However, using observation as well as interview was not always beneficial for studying the current topic. Challenges regarding this qualitative-based study tool place during the events of videotaping the children, emerging meaningful categories for coding children's interactive behaviors, and correctly interpreting the interactive behaviors. From a qualitative-based perspective, most findings dictated congruence with those adopted quantitative-based method. Children with certain temperamental dispositions exhibited specific behavioral tendencies. The computer was found to draw children's attention. However, some children were found to exhibit behaviors contrary to the quantitative-based studies. In addition, comparisons

for using different research methods to investigate the range of children's interactive behaviors were not available due to the lack of precedent research.

CHAPTER 10

DISCUSSION AND CONCLUSION

Discussion

Returning to the research questions posed at the beginning of this dissertation, the current study intended to investigate the influences of temperament and computers on children's interactions during the CSCL environment as well as comparing findings resulted from different research methodologies. Pertaining to the influences of temperament on interactive behaviors among children, it was found that children with differences in temperamental dispositions exhibited different behavioral tendencies when working with their teammates. Most of these behavioral tendencies dictated congruent findings with the previous research; however, not overall supportive. Further, during the computer-supported learning activities children were found to demonstrate more interactive behaviors than in the non-computer-supported environment. Even children with intense impulsivity were able to work for long periods of time at the computer. Finally, data collected by using a qualitative strategy indicated slightly different findings from the quantitative method used by previous researchers. These findings speak volumes to the academy on knowledge of how temperamental characteristics influenced interactive behaviors during computer-supported collaborative learning environment.

This study has special implications for teachers to implement and promote computer-supported collaborative learning in the classroom. First, psychological variables of children were influential to their interactive behaviors in the classroom. Congruent with what Crook (1998) warned us earlier about the ideal conception of equating collaboration with putting into small groups, current findings suggested tilted collaborative structures within children's collaborations despite the fact that children automatically formed a group to work together at the computer (Wang & Ching, 2003). The highly impulsive children tended to dominate all computer-based works when working with those with moderate or low impulsivity level which led to a leading by

one or two style of group dynamic. More opportunities to utilize the learning resources were occupied by the dominating children but were constrained to those who failed to gain the chances. In this sense, this style of group dynamic resulted in an inequality for children about learning opportunities as well as learning resources. For those children with compelled opportunities, they played a role of "supporting" or "watching" rather than "collaborating" when working with the dominating children. In addition, it was a lose-lose situation for both type of children. Working within the dominating group dynamics, it was difficult for children to learn an appropriate way to interact with others thus might influence their social development. If the dominating child knew little about computer skills, it would have been more difficult for his/her teammates to learn from a "more advanced others" (Vygotsky, 1978). Meanwhile, more intra-group conflicts took place when a group involved more than two impulsive children based on the interview with the teacher and the observational data. My opinion regarding this finding was not to advocate that by simply avoiding grouping certain cluster of children together could prevent problems occurred in the group. In fact, a variety of group dynamics as well as collaborative styles could result from grouping different individuals with unique characteristics in temperament; different combinations of individual entailed different collaborative problems within the group. My point is that it is necessary for teachers to recognize each student's specific temperamental dispositions in order to realize the types of interaction among children; therefore, practical strategies may be developed to prevent certain negative interactive behaviors.

Further, understanding student's temperament not only helps teachers to develop effective strategies for managing children's behaviors during collaborative activities but also to set up an environment of goodness-of-fit (Chess & Thomas, 1999) in the classroom. The temperamental traits were effective indexes for teachers to manage children's behaviors. Take

the highly active children for example; they may need extra exercises to consume their extraordinary energy in order to sit their behind on the chair. Children who was highly persistent needed to be told when to stop whereas those with high negative emotionality needed more encouragement to look at the bright side of the cloud. In his book, Carey (1997) suggested to us many detailed and effective strategies for effectively managing children's behaviors with different temperamental dispositions.

Another essential point proposed by Carey (1997) was that children's temperament can affect the caregivers both emotionally and physically (e.g., caregiver-children interactions as well as the contentment or dissatisfactions of the caregiver). It is possible that teachers were irritated by children's temperamental dispositions. For example, a teacher with negative emotionality level may see her students with moderate negative emotionality as dramatic and emotional. It is not uncommon for a teacher to mislabel her children with inappropriate level behavioral tendencies. For example, teachers may underreport the negative emotion of children with low negative emotionality level and expected them to work enthusiastically with any person. After all, the levels of temperamental characteristics were determined relatively to the norm group rather than absolutely. To set up appropriate expectations on children, teachers may also need to reflect their own temperamental traits so that they would not mislabel the children. At the same time, children can learn about their unique temperamental traits thus help them to adjust themselves during the collaboration. An inhibited child may need to learn step-by-step to approach people and perform in public. Children can also be encouraged to learn about their teammates' temperamental dispositions in order to help them be empathetic to the causal variables of other's behaviors and needs. Through understanding each other's different characteristics in temperament, children may learn to accept themselves as well as others.

In addition, Chess and Thomas (1999) proposed the concept of goodness-of-fit for education practioners to develop useful behavioral managing methods. According to Chess and Thomas, "Goodness of fit results when the properties of the environment and its expectations and demands are in accord with the organism's own capacities, characteristics, and style of behaving. When consonance between organism and environment is present, optimal development in a progressive direction is possible" (p. 3). Keogh (2003) described goodness of fit as "the match between a child's characteristics and the characteristics of environment ― including the values, expectations, demands, and temperaments of adults" (p. 3). In other words, the major components of goodness of fit are the interactions between children's characteristics, adult's characteristics, and anticipations in a social context. Adaptive outcomes will take place when the expectations and demands of the environment and the child's characteristics reach a congruent status.

In summary, to achieve better collaboration within the group, useful guidelines for students to work with each other are necessary; particularly to those who are not sensitive to other people's needs. It is not uncommon to see a teacher set up inappropriate expectations that were not helpful to redirect their behavioral tendencies on her children. Further, it also may be that a teacher places expectations on her children without providing them further know-how or a step-by-step guidelines in the classroom. Strategies can be developed according to the individual differences in temperament. For example, the inhibited child may need encouragement to actively participate in the activities while the highly emotional child may need help for self-regulation. After all, children were not born to have interpersonal skills to collaborate with others. Johnson and Johnson (2003) supported this view, they described that "Using cooperative learning requires group members to master the small group and interpersonal skills…The greater

the members' teamwork skills, the higher will be the quality and quantity of their learning" (p. 794). From this perspective, children need instructions to learn the knowledge of collaborative skills particularly to work with those who have a very different behavioral tendency from their own.

Another finding of this study suggested that computer-supported learning activities were more attractive to student's attention than the non-computer-supported activities. Students with intense temperamental traits were found more attentive to the computer-based tasks as well; they were observed to be able to sit down and worked at the computer for a long time during the course of this study. Significant differences were found on the interactive behaviors; more positive interactive behaviors such as helping teammates during the computer-assisted activities. At the same time, all participants admitted in the interview that they preferred using computers to complete an assignment than using the traditional tools such as paper and pencil. They explained that through the interesting special effects and functions provided by the computer they were able to create fascinating documents. In addition, the participants expressed a favor of working with friends as beneficial because they could learn from each other. Based on these findings, computers played an important role on mediating children's interactive behaviors in the classroom. As indicated by Johnson and Johnson (2003), "The capabilities of computers can be used as mediating tools that help students to focus their attention on mutually shared objects" (p. 796). From this perspective, the role of computer in the classroom was not only a physical tool providing hands-on experiences but also a mediational tool for group discussion that was believed to benefit to student's learning (Säljö, 1999). It is unfortunate that some teachers see the computer as a "toy" merely for games or a powerful online encyclopedia for searching information. Inasmuch as the computer is increasingly used in the classroom in this country,

teachers may concern involving more computer-based activities to achieve more effectiveness of the computer.

Contrasting to the animated interactive behaviors during the computer-supported activities, fewer interactive incidents were found in the environment without the support of the computer. More positive interactive behaviors such as providing assistance and contributing ideas among children and fewer negative behaviors such as distracting teammates' attention were found during the computer-based activities. It is not difficult to understand that while paying attention on the computer-based tasks children were less likely to demonstrate disturbing behaviors to other members. In other words, computers "keep children busy." Further, the powerful functions of computer allowed children to have hands-on experiences. In the field of education, it is believed that children learning by doing. However, there are two critical issues to be concerned about involving computers in the classroom activities. First, how long can a child maintain his/her focus on the computer-based activity? Although the findings indicated that even an easily distracted child was able to spend a long time working at the computer, little was known about the length of time a computer could engage and sustain children's attention when it is applied for the involvement in most of the school courses. In this study, all participants had a certain level of computer skills. Suppose this study was conducted on a group of children who knew little about using a computer to create documents, how long would they have stayed at the computer enthusiastically? Due to the short-term observation of the current study, a longitudinal study is preferred in order to further investigate this issue.

Second, there was space for studying the design of the computer-based activity. In this study, students were simply required to develop a *PowerPoint* document by themselves for an assigned topic. The task was not explained in detail by the teacher regarding the learning objects

and the expected contents. Further, the teacher did not provide any suggestion for designing a *PowerPoint* documents. Despite the belief that children learn through doing, they learn from a more advanced others as well (Vygotsky, 1978). From my perspective, had the activity been well-designed each individual would have been more likely to be aware of the learning objects and contents. Similar to the idea proposed by Crook (1998) that grouping does not guarantee collaboration, simply assigning a task to student to work together at the computer does not exactly lead to learning. A well-designed computer-supported task is necessary for facilitating children's group interaction and learning. In this sense, future study is recommended about the structures and contents of the computer-supported activities in order to contribute more useful suggestions to develop a successful computer-supported activity.

To implement CSCL in the classroom, there were many other issues to be concern. For example, there is an urgent need for establishing conceptual models in order to create operational procedures for practice (Crook, 1998; Johnson & Johnson, 2003). Therefore, inspired by the interpretive production perspective of Corsaro (2005), I proposed a flow chart as the following.

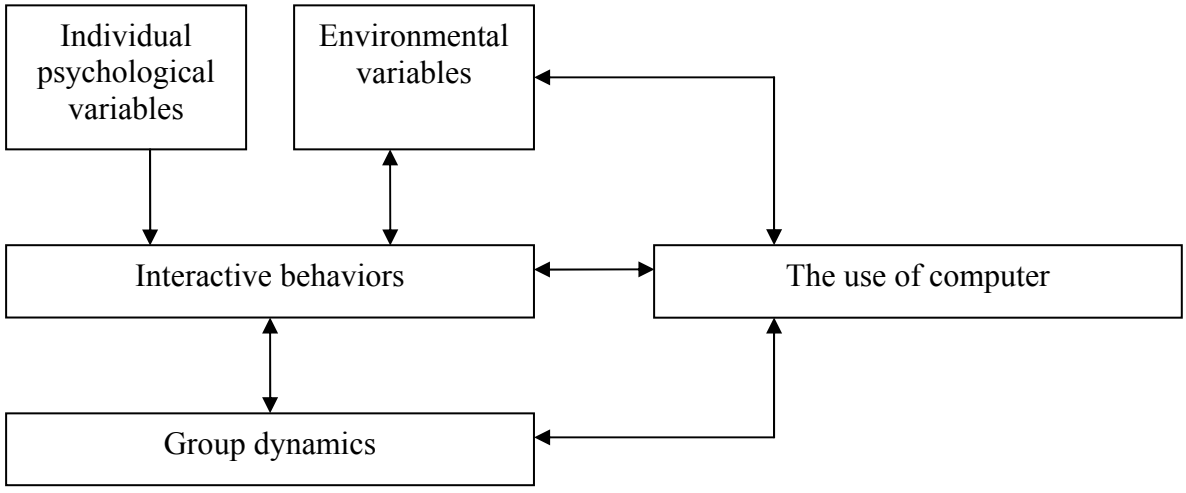

Figure 10.1 The conceptual model for the operational procedure within the CSCL environment.

In the CSCL classroom setting, the psychological variables (i.e. temperament) and the environmental variables (e.g., guidance from the teacher) have impact on the interactive behaviors of the individuals. The environmental variables also impact how computers are used in the classroom. Meanwhile, the computer plays the physical and psychological roles in individual interactive behaviors so that there is a mutual influencing relationship between the two sides. Finally, the individual interactive behaviors in the group reflects on the style of group dynamic, and the style of group dynamic will reinforce certain interactive behaviors. Group dynamics and the use of computer in the classroom are related to each other and mutually influenced. Within the CSCL learning environment, when the teacher is intervening in children's interactions, their behaviors will result in a new style of group dynamics and the way of using the computer. At the same time, the way of using the computer is influenced by the change of the interactive behaviors and the intervention from the teacher. This procedure of reproduction of behaviors continues as the group members searching for the best way of collaboration.

By this model, I intended to help teachers to meditate the way they implement CSCL strategy in the classroom. However, there remained spaces for discussions and modifications about this model. For example, children's computer skills and task-oriented knowledge are not involved in the model. Children's learning outcomes is also missing, and further, what next will the learning outcomes lead us to concern? In the future, more discussions are absolutely needed in order to modify this model.

In sum, CSCL was found beneficial to promote group interactions and attractive to children with intense impulsivity and activity level. On the other hand, implementing CSCL was considered more complicated than the traditional instructional strategies because teachers needed to manage a variety of skills both physically and psychologically. Through proposing a

conceptual model, I intended to provide a complete picture for teachers to understand the flow and the relationships between each variable within the CSCL environment. Therefore, teachers may reflect the strength and weakness on their implementation of CSCL strategy in the classroom setting. However, the limitation of the model remained a lot of space for modification and reformation.

Returning to the third research question, I intended to compare different research methods, namely the quantitative and the qualitative inquiry regarding their findings. A qualitative-based method was adopted in this study and findings were contrasting with those resulted from the quantitative-based method. For investigating the current topic, the qualitative method was useful to recognize the specific behaviors within the computer-supported learning environment. Data collected via observation and interview provided rich information for contrasting and comparing the impact of temperament on behaviors across the five participants. Further, contradictory behaviors from the quantitative-based research were able to be recognized. However, there remained spaces for improvement to the research method.

First of all, data collected from the limited period of observation may lead to a linear conclusion of the findings. Based on only 12 consequential observations in one semester, the validity of the qualitative inquiry used in this study was somehow weak. A more than half a year longitudinal observation may be more persuasive about the findings. Second, information from the parents was missing. Inasmuch as the study only interviewed the teacher and the children, information regarding children's temperament and behaviors as well as computer skills from the parents was unknown. From the parents' perspectives, reports about children's temperamental characteristics and behavioral tendencies when interacting with friends might be different from the teacher and the children themselves. After all, parents know better than teachers. Third,

findings from the qualitative method cannot be generalized to other group of children. Because temperament was found related to culture (Chen, Rubin, & Li, 1995), the deliberately selected demography of the participants in this study may not be seen representative. Therefore, the contradictive behavioral tendencies of children found in this study might be seen as exceptions. In the future, a large sample quantitative method is encouraged to provide global explanations of children's behavioral tendencies during the computer-supported collaborative learning activities. Fourth, Martin's questionnaire utilized for selecting expected participants identified only several temperamental characteristics. Although in the questionnaire the selected items were particularly focused on soliciting information from school teachers and therefore developed particularly for teachers' convenience (Martin, 1988), in my opinion the range of the temperament was not complete enough for understanding students. For example, distractibility and sociability were not involved in the teacher-rated TABC. Inasmuch as the overall range of children's interactive behaviors may be underreported, the influence of temperament on interactive behaviors may be underestimated. Finally, children may exhibit different behaviors within different context (Graue & Walsh, 1998). The behavioral tendencies of children observed within the CSCL context during the course of this study may not be seen in other cultural contexts. Even within a CSCL context with different arrangement of computers and ways of grouping, children may display different interactive behaviors. To explore this issue more accurately, more studies will be needed in a variety of classroom settings.

Another difficulty took place during the operational procedure when I was videotaping the scenarios of children's group interaction. It was impossible to completely hide myself behind the camera. As noted by Graue and Walsh (1998), "neither researcher nor camera ever become invisible" (p. 111). In some occasions, children inquired me about skills for using computers or

mediating in the episodes of conflicts. As an adult and a volunteer in the classroom, I was supposed to give them a hand. On the other hand, I did not want to intervene in the ways the participants interact with each other. Corsaro (2005) suggested researchers to take the "reactive" role waiting for the approach and reactions from the children (p. 52). In this sense, children were able to reduce their anxiety and accept the presence of the researcher. In addition, Corsaro thought the researcher shared a part in the context of children's peer interactions. Reflecting these concepts on my study, the reactive role was useful to participate in the group interactions of children. Fortunately, when I was first introduced to the children, I was not introduced as an authority figure (e.g., a teacher or a researcher) but as a helper. It did not take long for children to accept me as someone to talk with. They were willing to share their little secrets and hobbies with me and asked for my help about classroom activities when needed. However, this also caused a problem during the course of my audiovisual recording. In order to recording "pure" interactive behaviors among children, I did not want intervene in their interactions particularly when they need instructions about managing conflicts. I was anxious that children's behaviors could change because of my suggestions. In this case, the first reactions from children were not possible to be collected.

In summary, there was no right or wrong choice for selecting the research method. Utilizing either the quantitative or the qualitative inquiry has its advantages and disadvantages. This qualitative-based study was beneficial for seeing more particular behaviors which were not found in the quantitative-based research. However, the in-depth data provided conclusions reachable only for the participants during the course of this study. Neither the generalization to other children of different ethnic groups and age nor the predictions of interactive behavior in the

future were available. Future studies may consider adopting a mix-method strategy to further investigate the current issue so that the accurate "triangulations" can be achieved.

Conclusion

To date, as the limited number of computers was offered to students in the classroom setting, CSCL is inevitably a frequently used strategy. Although scholars indicated that a computer-supported collaborative learning course is more difficult to establish than the traditional project (Florea, 1998) because of the involvement of the complexity of human (Johnson & Johnson, 2003), researches also described many benefits entailed by the implementation of the CSCL strategy in the classroom (Clements & Nastasi, 1988; Dickinson, 1986; Erkens, Jaspers, Prangsma, & Kanselaar, 2005; Lingnau, Hoppe, & Mannhaupt, 2003; Muller & Perlmutter, 1985; Oshima, Oshima, Murayama, Inagaki, Takenaka, Nakayama, & Yamaguchi, 2004; Schiller & Tillett, 2004; Staarman, 2003). As increased researchers are devoting themselves in investigating the issues of promoting CSCL strategy in the classroom, more difficulties can be answered and conquered. Teachers should not give up the strengths and benefits of promoting CSCL for its disadvantages. This study spoke importance to education of preliminary findings regarding how psychological variables such as temperament influenced group interactions within the CSCL context. To understand how the findings of this study influence the development of children, more research is encouraged to investigate the relationships between temperament and group interactions within different social and cultural contexts in the future.

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