

CLASSROOM CULTURE AND INFORMAL REASONING ABILITIES AMONG KOREAN  
HIGH SCHOOL STUDENTS

by

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(Under the Direction of Ronald L. VanSickle)

ABSTRACT

The study reported here examined the relationship between classroom culture and Korean high school students' informal reasoning abilities. Classroom culture was represented by four factors: epistemological beliefs, argumentativeness, verbal aggressiveness, and classroom climate. The study addressed the following research questions: (1) How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness differ between different types of schools? (2) How do students' reasoning skills differ between different types of schools? (3) How do the four variables of classroom culture correlate? (4) How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness correlate with their argumentation skills? (5) What are the best predictors of students' argumentation skills?

Participants of the present study were selected from three different types of college preparatory schools located in urban areas of Korea: Foreign Language High School, Science High School, and regular type public school.

The data analysis of the present study indicated that students with more sophisticated epistemologies produced more premises and arguments and the quality of their arguments tended

to be higher than students with less sophisticated epistemologies. Further, argumentativeness correlated positively with the number of arguments produced and the quality of arguments, while verbal aggressiveness correlated negatively with students' informal reasoning skills. The data analysis also indicated that students who had more sophisticated epistemologies were more argumentative and less verbally aggressive, and they felt freer to express their opinions about social issues in their classrooms.

Students of the three schools differed in their argumentativeness and classroom climate. Foreign Language High School students were more argumentative and felt freer to express their opinions about social issues than students of the other two schools. School type also correlated with students' informal reasoning skills. A multiple regression analysis indicated that the school type was the best predictor of students' performance in argumentation. Foreign Language High School students performed better than the other two schools' students in most aspects of argumentation skills. Science High School students stated more premises and arguments than the regular public school students.

**INDEX WORDS:** Informal reasoning, Classroom culture, Epistemological beliefs, Argumentativeness, Verbal aggressiveness, Classroom climate, Argumentation

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## DEDICATION

This dissertation is dedicated to my mother and father. Without their sacrifice and love, this goal may not have been accomplished.

This dissertation is also dedicated to my lovely wife and son, Hyunjung and Minjae.

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## TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS .....	v
LIST OF TABLES .....	viii
CHAPTER	
1 INTRODUCTION .....	1
Teaching Thinking as a Cultural Phenomenon .....	2
Thinking as Arguing.....	4
Elements of Reflective Classroom Culture .....	7
The Significance of the Korean Case in the Study of Classroom Culture and Informal Reasoning .....	10
2 REVIEW OF LITERATURE .....	12
The Nature of Informal Reasoning.....	12
Major Factors Contributing to the Development of Informal Reasoning .....	22
Importance of Cultural Factors in Explaining the Development of Reasoning .....	30
Methodological Issues in Measuring Informal Reasoning Skills.....	38
Conclusion.....	41
3 METHODOLOGY.....	43
Participants.....	44
Instruments.....	46
Administration Procedure.....	57

	Data Analysis Procedure .....	58
4	DATA ANALYSIS.....	60
	How Do Students' Epistemological Beliefs, Perceptions of Classroom Climate, Argumentativeness, and Verbal Aggressiveness Differ between Different Types of Schools?.....	60
	How Do Students' Reasoning Skills Differ between Different Types of Schools?.....	69
	How Do the Four Variables of Classroom Culture Correlate?.....	82
	How Do Students' Epistemological Beliefs, Perceptions of Classroom Climate, Argumentativeness, and Verbal Aggressiveness Correlate with Their Argumentation Skills?.....	84
	What Are the Best Predictors of Students' Argumentation Skills?.....	84
	Summary.....	91
5	CONCLUSIONS.....	94
	Discussion of Results .....	95
	Implications .....	98
	REFERENCES .....	104
	APPENDICES .....	114
	A INSTRUMENTS.....	115
	B ESSAY QUESTIONS ON SOCIAL ISSUES .....	121
	C SAMPLE ESSAYS AND ARGUMENT ANALYSES.....	123

## LIST OF TABLES

	Page
Table 3.1: Premise Rating Scheme .....	54
Table 3.2: Inference Rating Scheme .....	55
Table 3.3: Guidelines for Premise Rating .....	56
Table 3.4: Guidelines for Inference Rating .....	57
Table 3.5: Data Analysis Techniques .....	59
Table 4.1: Means and Standard Deviations of Epistemological Beliefs .....	61
Table 4.2: Analysis of Variance for Epistemological Beliefs .....	62
Table 4.3: Means and Standard Deviations of Argumentativeness .....	63
Table 4.4: Analysis of Variance for Argumentativeness .....	64
Table 4.5: Pairwise Contrasts for Argumentativeness between Schools Using the Bonferroni Method .....	65
Table 4.6: Means and Standard Deviations for Verbal Aggressiveness Scale .....	66
Table 4.7: Analysis of Variance for Verbal Aggressiveness .....	66
Table 4.8: Means and Standard Deviations for Classroom Climate Scale .....	67
Table 4.9: Analysis of Variance for Classroom Climate Scale .....	68
Table 4.10: Pairwise Contrasts for Classroom Climate between Schools Using the Bonferroni Method .....	69
Table 4.11: Means and Standard Deviations for the Number of Claims .....	70
Table 4.12: Analysis of Variance for the Number of Claims .....	71

Table 4.13: Pairwise Contrasts for the Number of Claims between Schools Using the Games-Howell Method .....	72
Table 4.14: Means and Standard Deviations for the Number of Valid Premises .....	73
Table 4.15: Analysis of Variance for the Number of Valid Premises .....	74
Table 4.16: Pairwise Contrasts for the Number of Valid Premises between Schools Using the Games-Howell Method .....	74
Table 4.17: Means and Standard Deviations for the Number of Valid Counter Premises .....	75
Table 4.18: Analysis of Variance for the Number of Valid Counter Premises .....	76
Table 4.19: Pairwise Contrasts for the Number of Valid Counter Premises between Schools Using the Games-Howell Method .....	77
Table 4.20: Means and Standard Deviations for the Number of Valid Arguments.....	78
Table 4.21: Analysis of Variance for the Number of Valid Arguments.....	79
Table 4.22: Pairwise Contrasts for the Number of Valid Arguments between Schools Using the Games-Howell Method .....	80
Table 4.23: Means and Standard Deviations of the Quality of Arguments .....	81
Table 4.24: Analysis of Variance for the Quality of Arguments .....	81
Table 4.25: Pairwise Contrasts for the Quality of Arguments between Schools Using the Bonferroni Method.....	82
Table 4.26: Correlation Matrix for Classroom Cultural Factors and Argumentation Skills .....	83
Table 4.27: Regression Models for the Number of Valid Premises .....	87
Table 4.28: Regression Models for the Number of Valid Counter Premises .....	88
Table 4.29: Regression Models for the Number of Valid Arguments .....	89
Table 4.30: Regression Models for the Quality of Arguments .....	91

## CHAPTER 1

### INTRODUCTION

The study reported here investigated the relationship between classroom culture and reasoning abilities. Classroom culture was represented by four factors: epistemological beliefs, classroom climate, argumentativeness, and verbal aggressiveness. These factors characterize students' assumptions and expectations about the nature of knowledge, learning, and the way class members communicate.

The study addressed the following research questions:

1. How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness differ between different types of schools?
2. How do students' reasoning skills differ between different types of schools?
3. How do the four variables of classroom culture correlate?
4. How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness correlate with their argumentation skills?
5. What are the best predictors of students' argumentation skills?

This study employed two basic premises. First, this study assumed teaching thinking is a cultural phenomenon, because only particular cultural groups provide students with opportunities to think. Conceptions of thinking and knowing shared by these groups facilitate students' thoughtfulness. Second, this study defined thinking as argumentation rather than formal logic, because reasoning in everyday situations involves producing an argument and supporting it with

reasonable evidence, rather than deducing an answer from a true premise (Toulmin, Rieke, & Janik, 1984).

### *Teaching Thinking as a Cultural Phenomenon*

In many countries across the globe, teaching young people higher order thinking skills is a growing concern (Lee, Adams, & Cornbleth, 1988; Walker, Bridges, & Chan, 1996). In developing countries, including Korea, educators show a special interest in engaging their students in problem solving, analytical thinking, and creative thinking. Their interest is demonstrated by their introduction of new instructional methods for teaching higher order thinking. These instructional programs are based on models developed mostly in western countries, such as the United States. Furthermore, these societies urge their students to go to higher educational institutions or to study abroad to learn the secrets of higher cognitive skills.

This phenomenon is largely explained by current economic trends. As the value placed on new ideas and high technology grows relative to the value placed on standard products, the demand for higher cognitive skills surges (Reich, 1991). The development of a “symbolic analytic industry” attracts young people with ever-higher anticipated incomes in the years ahead. People in this industry are engaged in problem solving that requires manipulating symbols. The manipulations are conducted with analytical tools including mathematical algorithms, legal arguments, financial gimmicks, scientific principles, psychological insights, or systems of induction and deduction. Such problem solvers sometimes call themselves research scientists, design engineers, software engineers, civil engineers, public relations executives, investment bankers, real estate developers, and creative accountants. To qualify for employment in the symbolic analytic industry, millions of people around the world are trying to acquire the ability to solve problems and think analytically. Policy-makers of developing countries believe that

these kinds of skills will translate into new products; therefore, they believe expanding their nations' symbolic analytic human capital will increase the wealth of their nations.

Even with tremendous effort and investment, it is not likely that these developing countries are successfully teaching their students higher cognitive skills. In the case of Korea, goals such as “problem solving,” “creative thinking,” and “decision making” are legally mandated as official objectives of the national curriculum. However, there is little indication that higher order thinking occurs frequently in classrooms (Ministry of Education, 1997). According to Kwon (1991) and Lee et al. (1988), efforts to introduce innovative teaching methods, including “the inquiry method,” and “the problem solving method” failed.

The situation is not much different in the United States. Many studies report a conspicuous absence of attention to teaching thinking in the classroom (Onosko, 1991; Parker, 1991). Despite widespread interest and investment in teaching reasoning, there is a hue and cry concerning the need to emphasize reasoning instead of rote memorization and information acquisition. Paradoxically, when the need for reasoning was most urgent, the most powerful slogan was “back to basics” (Voss, Perkins, & Segal, 1991).

However, American education is special in preparing its most fortunate and talented students. According to critical scholars in education, teaching higher cognitive skills is encouraged by both teachers and parents only for economically privileged students (Anyon, 1980; Reich 1991). Some of these students attend elite private schools, followed by the most selective universities and graduate schools. Others go to high quality suburban public schools where they are tracked through advanced placement courses (Oakes, 1985). Parents of these students are very interested and involved in their education. Their classes are relatively small and their peers are intellectually stimulating. Most of all, teachers, professors, and parents

implicitly share the assumptions and values of teaching higher order thinking. These students are privileged both economically and culturally.

Although this critical perspective is inclined toward economic determinism, it provides us with a valuable insight: Teaching for higher order thinking is a cultural phenomenon found only in particular groups. Students in groups that do not share this specific cultural code might be uninterested or even hostile to the process of practicing higher-order thinking. Such disinterest or hostility often would undermine or destroy well-prepared lesson plans and activities. The teacher's thoughtful questions could be regarded as a waste of time by these students.

Given potential disinterest or even hostility toward higher-order thinking, how can educators teach higher order thinking to those who do not value it? To help answer this question, this study gave special attention to cultural traits that facilitate teaching thinking where such dispositions are encouraged and nourished. These cultural traits include students' beliefs about thinking, learning, and knowing, as well as classroom environment. This study assumed that higher order thinking could be facilitated by a thoughtful classroom culture. From this perspective, teaching thinking is not reduced to requiring students to prepare a set of skills or introducing a special teaching method. Teaching thinking requires a classroom culture where dispositions of thoughtfulness are cultivated.

### *Thinking as Arguing*

The type of thinking explored in the study is that which occurs in people's everyday lives. This kind of thinking contrasts with those elicited on intelligence tests or in psychological laboratories or the kinds emphasized in logic class. Everyday reasoning is distinguished from formal-deductive reasoning in that premises are implicit or not supplied at all (Galotti, 1989). Because insufficient information is given about premises, there are typically several possible

answers that vary in quality. In addition, it is hard to find established procedures for solving problems. Reasoning that takes place under these conditions seeks the best solution in a given situation rather than inferring a true answer. Such terms as informal reasoning (Perkins, 1985a), practical thinking, (Scribner, 1986), dialogical thinking (Paul, 1987), and ill-defined problem solving (Voss, Green, Post, & Penner, 1983) map onto everyday reasoning. In this study, informal reasoning was the term representing these types of thinking.

Informal reasoning has long been neglected by both philosophers and psychologists. Traditionally, philosophers regarded formal logic as the preferred model of thinking (Kuhn, 1991). This view is still prominent, but by the middle of the twentieth century, logic and thinking became distinguished. At that time, some philosophers including Toulmin (1958) began to claim that formal logic was too limited as a model of thinking. For Toulmin, thinking is a process of argumentation producing an assertion and its accompanying justification. In other words, thinking is an internal process “formulating and weighting the arguments for and against a course of action, a point of view, or a solution to a problem.” (Kuhn, 1991, p. 2) This internal argument models public debate (Billig, 1996).

Thinking as argumentation has special relevance in democratic citizenship education. By defining thinking as a process of seeking the best solution, democratic discussion is possible. If thinking is a process of seeking one true answer, it is not necessary for citizens to communicate with each other to provide any additional “reasons” or “supporting arguments.” Instead, the person who is considered to have the ability to see the truth provides a solution to the given problem and gives orders to other members of the community. In this case, only “instrumental” communication takes place (Toulmin et al., 1984). Because an order or a command does not

have to be “supported with reasons,” it takes the form of an authoritative statement. Dogmatic indoctrination is the typical form of communication.

An order or a command cannot achieve its intended goal if it is disobeyed or ignored. When there are multiple answers or objections from those who do not share the definition of the given problem, instrumental communication does not make the members of the communication community follow the solution. On the other hand, if all the members participate in the process of seeking solutions, the justifiable obligation to implement the solutions is distributed to each member. In this situation, argumentative communication should take place. Each solution provided by each member should be followed by reasonable persuasion. As Habermas (1979) argues, the goal of argumentative communication is to follow the best argument until consensus is achieved. Disobedience of an agreed upon solution is then taken as an ethical burden by dissenting members.

This line of thought is also found in social studies education. For example, “the jurisprudential inquiry model” developed by Oliver and Shaver (1966) emphasizes dialogical reasoning instead of deductive reasoning. In this model, “there is much less concern with rhetorical devices or the logic of deductive reasoning than anatomy of legitimate communication and persuasion (Oliver & Shaver, 1966, p. 115).” Oliver and Shaver regarded the ability to engage in public debate as the heart of democratic citizenship. The resolution of complex public issues within democratic society requires citizens to engage in argumentation through which they can find solutions or an agreement. From this perspective, informal reasoning is an important skill required by reasonable citizens who need to discuss and make political decisions about controversial issues.

Informal reasoning skill is also important in classroom learning, especially in social studies where issues and perspectives should be developed, defended, and evaluated (Means & Voss, 1996). The development of reasoning skills about controversial issues is one of the long-standing goals of social studies education. The purpose of issue-centered social studies education is “to teach students to offer defensible and intellectually well-grounded answers” to the problematic issues of society (Evans, Newmann, & Saxe, 1996). From this perspective, learning is not reduced to the acquisition of information or the process of plugging information into algorithms, but it is the production and evaluation of arguments. Reasoning that takes place in this kind of learning is informal in nature (Perkins, 1985a).

#### *Elements of Reflective Classroom Culture*

Dewey (1916) argued that, since education is a social process, the quality of education is determined by its socio-historical conditions. The social ideal is implied in the standards and methods of education. He believed that only democratic societies could provide “a type of education which gives individuals a personal interest in social relationships and control, and the habits of mind which secure social changes (p. 115).” On the other hand, despotic societies “internally and externally set up barriers to free intercourse and communication of experience (p. 115).” Therefore, democracy, as “a mode of associated living,” should take precedence in education.

Dewey’s argument provided a foundation to establish a relationship between the two premises of the present study: thinking as argumentation and teaching thinking as a cultural phenomenon. Borrowing Dewey’s hypothesis, this study assumed that socio-cultural conditions determine the quality of teaching informal reasoning; teaching and learning argumentation is best encouraged in certain contexts. A certain socio-cultural environment is a prerequisite to

facilitate argumentative thinking effectively. When these conditions are not fulfilled, a well-organized lesson plan could produce a boring and arduous experience for students.

What, then, are essential elements of reflective classroom culture? When classroom culture is defined as "certain unstated values, assumptions and expectations about classroom behavior and practice" shared by teachers and students (Robinson, 1992, p. 3), those cultural elements include the underlying assumptions about the nature of knowledge, knowing, learning, and the way classroom members communicate. The present study included the following four factors as essential features characterizing the reflective classroom environment: a flexible conception of knowing; an open climate; active participation; and cooperative relationships.

These elements do not exhaust all the characteristics of a reflective classroom, but there are several reasons why this study included the four factors. First, these four elements are 'cultural' because they are related to belief systems shared implicitly by particular groups. Second, these factors are directly related to classroom practices. Third, these cultural dispositions can be measured by quantitative instruments that have already been validated in previous studies (see Chapter 2). In addition to their merits as scales of classroom culture, the four cultural dispositions have the following strengths in explaining students' reasoning abilities.

*Flexible Conception of Knowing and Learning: Epistemological Beliefs*

Most problems in the social sciences and humanities are ill structured, and solutions to these problems are not always immediately available. According to research on ill-defined problem solving, epistemological beliefs play critical roles in facilitating problem solving. These epistemological beliefs influence how individuals understand the nature of intellectual tasks and choose strategies to deal with them, especially in complex and ill-structured problem situations. Epistemological beliefs are defined as "intuitions about the nature of knowledge and the nature

of learning" (Schommer, 1994a, p. 300). The more students believe learning is quick, the more likely they will avoid investing time in problem solving and the more likely their solution will be naive (Schommer, 1990). The more students believe knowledge is certain, the more likely they will misinterpret tentative findings as unchanging facts. (Schommer, Crouse, & Rhodes, 1992)

### *Open Classroom Climate*

Open climate is another essential element of a reflective classroom. "Open climate" refers to an instructional environment in which students are encouraged to explore and express differing views on controversial public issues (Hahn, 1996). Controversial issues instruction has positive effects on students' political efficacy and attitudes when it is conducted in an open climate (Ehman, 1969). Also, students improve their tolerance for diverse beliefs through discussion of problematic issues in an open climate (Grossman, 1975). On the contrary, students who experience a closed classroom climate, one in which teachers do not present multiple views on social problems and students do not feel comfortable expressing their opinions, report low levels of political efficacy, participation, and citizen duty (Ehman, 1969).

### *Active Participation in Argumentation*

Argumentativeness is the third essential element for effective communication about controversial issues. Communication scholars assert that personal dispositions and beliefs about arguing can provide valuable insights into communication behavior (Nicotera, 1996). People who have positive attitudes toward arguing are more likely to perceive argumentation as an exciting intellectual challenge which entails defending and persuading (Infante & Rancer, 1982). When confronted with controversial issues, argumentative people present ideas and defend positions. In contrast, those who are not argumentative tend to be inhibited by the prospect of such communicative transactions.

*Cooperative Relationship: The Locus of Attack*

Cooperation is important for the effective communication of ideas. If cooperative relationships are not maintained in discussion, the dialogue often deteriorates into a shouting match with low intellectual quality (Passe & Evans, 1996). To maintain cooperative communication, the locus of attack is crucial (Infante & Lancer, 1982). Cooperative argumentation involves presenting and defending positions on controversial issues while attacking the positions taken by others on the issues. In contrast, verbal aggression denotes attacking the self-concept of another person. When arguing, a naive arguer often displays a tendency to escalate hostilities and attack another's self concept instead of, or in addition to, the person's position on a topic of argumentation. By focusing on others' positions instead of their self concepts, a cooperative relationship can exist between arguers.

*The Significance of the Korean Case in the Study of Classroom Culture and Informal Reasoning*

This study focused on Korean high school students in the Republic of Korea, their classroom cultures, and their reasoning abilities. Although the results from the investigation of the Korean case are hard to generalize to other cases, insights from this case are useful for both Korean and U.S. educators. The Republic of Korea imports educational theories and teaching models mostly from the United States. The Korean educational knowledge system was structured under the influence of the American educational system (Lee et al., 1988). U.S. educated scholars introduced various American instructional models to Korea including problem solving, the inquiry method, the discovery method, and cooperative learning. Using these imported theories, Korean educators have tried to create reflective classrooms and to increase the reasoning abilities of their youth. Considering this relationship between the two countries, the

investigation of the Korean case provides valuable lessons for educators both in the country where these models were developed and in a country where the models have been applied.

Further, the investigation of Korean high school students contributes to explaining the relationship between classroom cultural dispositions and informal reasoning abilities.

Considering that little research on informal reasoning of high school students exists, this study provides meaningful knowledge on the nature of adolescent reasoning. Also, this study describes general characteristics of Korean high school students' beliefs and attitude toward knowing and arguing. Finally, the investigation of the Korean classroom culture provided an opportunity to characterize its academic culture in terms of the scales presented above.

## CHAPTER 2

### REVIEW OF LITERATURE

The purposes of this review are 1) to present the intellectual context for thinking about the kind of reasoning that this study investigated, 2) to distinguish major variables important to the development of reasoning skills, and 3) to identify a valid and reliable procedure for assessing informal reasoning. Therefore, this review of the literature raises four questions: 1) What is the nature of reasoning that occurs in people's everyday lives? 2) What factors contribute to the development of informal reasoning? 3) Why are classroom cultural factors important in explaining the development of reasoning? 4) How can informal reasoning skills be measured? These four issues are dealt with in the four sections of the review.

#### *The Nature of Informal Reasoning*

What is the nature of human thinking? The traditional approach to this question is theoretical investigation of formal logic. For a long time, philosophers have used logic, as a science, as the model of human thinking (Toulmin, 1958). Given this assumption, reasoning is narrowly defined as "thinking according to the theorems of a logical system (Galotti, 1989, p. 332)." Many psychological studies focused on reasoning tasks such as linear series, propositional, syllogistic, and analogical reasoning. According to the Piagetian perspective, the acquisition of a more powerful logical system is the hallmark of the mental maturation that takes place during the adolescent years (Byrnes, 1996).

Recently, criticism has been leveled against the traditional approach. The main argument is that most theoretical work on formal reasoning does not make any explicit connection to

everyday reasoning. According to Galotti (1989), the relationship between formal reasoning tasks in laboratory settings and reasoning tasks in everyday situations is never explicated by any psychological theories. Current theoretical models tend to focus on a narrow range of tasks and leave open the question of whether the tasks being studied are really significant for everyday reasoning tasks. To extend the understanding of human reasoning, it is necessary to develop a relatively broad definition of reasoning grounded in its relationship to everyday reasoning.

What, then, is the nature of reasoning performed in everyday situations? One of the most common strategies to characterize everyday reasoning is to contrast it with formal reasoning. To distinguish formal and everyday reasoning (Perkins, 1985a), several schemes have been proposed, including formal versus informal logic (Walton, 1989), practical thought versus theoretical thinking (Scribner, 1986), well-structured versus ill-structured problem solving (Kitchener, 1983), and monological versus dialogical thinking (Paul, 1987). These attempts to conceptualize informal reasoning in contrast with formal reasoning are discussed in this review.

*Informal Logic: Logic in Practice*

In 1958, Toulmin published a book, titled *The Uses of Argument*, that awakened interest in the practical aspects of logic. He classified logic into two categories: logic in theory and logic in practice. While logic in theory focuses on the formal relationships between propositions, logic in practice relates to the uses of propositions in everyday situations. Walton (1989) called these two kinds of logic logical semantics and logical pragmatics. Logical semantics emphasizes semantic relationships between true or false propositions. Logical pragmatics addresses arguments practiced in natural language in the real market places of persuasion on controversial issues in all aspects of daily life. Thus, informal logic is a practical discipline and an applied art (Walton, 1989).

Informal logic has the following characteristics. First, it is the logic of argumentation (Johnson, 1992). According to Johnson and Blair (1988, p. 140), informal logic is “the area of logic which seeks to develop standards, criteria and procedures for the interpretation, evaluation and construction of arguments and argumentation used in natural language.” The argumentative uses of language are distinguished from other types of language uses in that the utterances are supported by reasons and evidence that have a rational foundation (Toulmin et al., 1984). Also, the logic of argumentation is distinguished from the logic of implication/inference. While the purpose of implication/inference is to draw a conclusion from given premises, the purpose of argumentation is to persuade other people holding different views in a rational way.

Second, informal logic as argumentation is dialogical. A basic requirement of argumentation is that an argument must be expressed in the context of dialogue (Walton, 1989). Argumentation occurs in the question and answer context in which reasoned criticism and analysis of argumentation take place. An argument takes place in a challenge-response model of dialogue in which participants “reason together.” Thus, the essential locus of argumentation is a public, interpersonal, or social one (Toulmin et al., 1984).

Third, the goals and methods of informal logic as argumentation vary from situation to situation and from forum to forum (Toulmin et al., 1984). Each situation and forum has its own type of discussion. Examples of forums are law, science, and business. Because different kinds of issues are raised in each forum, the manner in which claims and arguments are presented and defended also varies. These variations of discussion from forum to forum result in the functional differences. Each situation produces “field dependent rules” (Toulmin, 1958). Not only the kinds of grounds supporting conclusions are different, but also the ways in which these grounds support conclusions vary between fields.

Fourth, informal logic as argumentation is sound. According to Toulmin et al. (1984), only within the abstract arguments of pure mathematics can statements be linked by relations of “absolute necessity.” On the other hand, in practical realms, the connections between claims and grounds are more or less qualified and more or less conditioned. Thus, in everyday situations, arguments are put forward not as being formally irrefutable, but as being practically strong or reliable.

*Practical Thought: Thinking in Action*

Scribner (1986) provides a practical/theoretical distinction that has special applicability to problem solving. According to Scribner (1986, p. 15), practical thinking refers to “thinking that is embedded in the larger purposive activities of daily life and that functions to achieve the goals of those activities.” As seen in the definition, practical thinking is instrumental and differs from the isolated mental tasks undertaken as ends in themselves. Practical thinking emphasizes thinking embedded in naturally occurring actions. Therefore, it cannot be analyzed as individual mental tasks separated from one another. Instead, it requires an analysis of thinking functions within a system of activity. The common methodologies employed in the studies of practical thinking have been combinations of ethnographic and experimental techniques. Scribner (1986) described the following characteristics of practical thinking based on the results of her studies about cognitive aspects of work in a milk-processing plant (Scribner, 1984).

First, practical thinking involves problem formation or redefinition of the initial problem. In the case of formal problem solving, problems are given and intellectual tasks are centered on selecting and executing a series of steps that will lead to a solution. In contrast, in everyday problem solving, as seen in the dairy studies, experienced workers often reformulate problems in terms of new elements or operations. Further, professional workers exhibit the creative capacity

to devise problems in a way that facilitates solving problems or applying a preferred method of problem solving.

Second, practical thinking is flexible about methods of solutions. A skilled practical thinker solves the same problem differently on different occasions. In formal problem solving, repetitive problems or the problems of the same logical class are solved by the same steps or algorithms. In contrast, practical problem solvers use different component operations to solve recurring problems of the same kind. Expert problem solvers build up a repertoire of solution modes that fit specific properties of problems or circumstances, and they accomplish the problem-solving task in minimally effortful ways. For example, secretaries learning how to use a new copy machine did not follow written instructions but they collaboratively constructed methods for overcoming problem situations. Further, these skilled practical problem solvers preferred “shortcuts” or “ad hoc procedures.”

Third, practical thinkers skillfully exploit the task environment in the problem solving system. In practical thinking, environmental properties including people, things, and information take functional roles in problem solving. Skilled workers displayed more resourcefulness than novices in using the environments to simplify and improve the accuracy of their problem solving. For example, advanced bartending students used external memory cues to remember drink orders and recipes whereas beginners relied more often on information retrieval from memory.

Fourth, skilled practical thinkers are economical and seek the modes of solution requiring the least effort. In the analysis of dairy tasks, skilled workers chose the mode of solution with the fewest steps or the least complex procedures. For example, when dairy workers assembled various sizes of dairy products to store in standard size cases according to orders, the procedure

was based exactly on the mode that satisfied the order in the fewest moves; they minimized the moves of products from one case to another. Effort saving here refers to the psychological reorganization of tasks in the interest of economy and simplicity. These effort saving strategies are considered higher-order strategies that produce good solutions.

Fifth, practical thinking is dependent on setting-specific knowledge. According to this view, problem solving abilities are closely connected to the amount and organization of specific subject matter knowledge. In the dairy studies, experienced workers displayed the ability to use specific job-related knowledge in devising flexible and economical problem solving procedures. When they computed the price of products, they did not solve the pricing problem by an algorithm procedure based on either unit prices or case prices, but they reduced the work load by converting the unit amount of a product into an equivalent case amount and computing cost through the application of case prices. These computational techniques were dependent on workers' personal knowledge of case and unit prices for particular products in particular amounts. Specific prior knowledge is crucial in saving time and reducing the risk of error.

### *Dialogical Reasoning*

Paul (1987) presented the concept of dialogical reasoning as a cure for the primary nature of human thinking, which is spontaneous, egocentric, and irrational, rather than as a conceptual tool for the description of informal reasoning. Dialogical thinking refers to exploring competing frames of references; it occurs when one sets different points of view against one another dialectically (Parker, 1989). It assumes that the reasonableness of one logic's criteria competes with the reasonableness of another logic's criteria.

According to Paul (1987), dialogical reasoning should be taught to students because most important issues in everyday life are multilogical. Paul categorized problems and issues as

monological or multilogical issues. Monological issues are settled within one frame of reference with a definite set of logical steps. Multilogical issues, by contrast, require some arguable choice among alternative frames of references for the precise identification and definition of the problem. According to Paul (1987), students' lives are deeply involved in multilogical issues. He argues that we do not "deal with the world-in-itself but with the world-as-we-define-it in relation to our interest, perspective, and point of view." Because more than one frame of reference competes for their settlement, it is necessary to set the frames of reference dialectically.

According to Paul (1987), people have both a primary and a secondary nature. The systematic practice of dialogical reasoning is necessary to develop people's capacity to function as rational persons, their secondary nature. People's primary nature provides the basis for the instinctual thought; it is spontaneous, egocentric, and apt to be irrational. Consequently, people need to be aware of this tendency to form irrational beliefs. They need extensive practice to cultivate rationality, the tendency to seek reasons and evidence and to consider fairly views other than their own.

Dialogical reasoning cures inert knowledge. The problem of inert knowledge was originally suggested by Whitehead (1929). Inert knowledge refers to ideas that just "sit there in our minds, as it were, without activating force (Paul, 1987)." According to Paul (1987), the inert knowledge problem derives from activated beliefs that are firmly entrenched in egocentric thinking. Once certain opinions or beliefs on a specific subject are set in mind, those do not tend to be changed because of people's egocentric tendency. This is a state of "activated ignorance." Only by exposing students' own ideas in a dialogical setting can students reconstruct and transcend the state of "activated ignorance."

Dialogical thinking is an efficient strategy for breaking down egocentric thought. Egocentric children and adults tend to assimilate everything they experience to their own point of view. According to Paul (1987), when students are treated with monological instruction inculcating authoritative perspectives, the learned perspectives are often incompatible with students' egocentric perspectives. In this case, the inculcated perspectives are simply superimposed and students' primitive belief systems are still maintained. Paul (1987) suggested "teaching critical thinking in the strong sense" so that students learn to understand and critique their own prejudices, biases and misconceptions. This is the process of guiding students to contest their own egocentric thought with sociocentric perspectives.

### *Ill-Structured Problem Solving*

The varieties of problems that humans have to solve cluster into two kinds of problems: well-structured problems and ill-structured problems (Kitchener, 1983). According to Kitchener (1983), all the elements of problem solving are knowable and known in well-structured problems, and there is an effective procedure. In contrast, there is no single and agreeable solution to ill-structured problems that can be determined effectively by employing a particular procedure. Most problems encountered in the everyday world are ill-structured. The importance of ill-structured problems derives from the recognition that well-structured problems in school contexts have limited relevance to solving problems in everyday contexts (Jonassen, 1997). The general characteristics of ill-structured problem solving, mostly based on Jonassen's (1997) explanation, can be summarized as follows.

First, the problems in ill-structured problem solving contain elements that are unknown or not known well (Jonassen, 1997). Often, the nature of the problem is vaguely defined and the problem solving goal is not clearly stated (Voss & Post, 1989). For example, when we discuss

the problem of environmental pollution, it is hard to find a consensus on whether the problem is related to less advanced environmental technology or people's inappropriate attitudes and habits. In contrast, well-defined problems present all elements of the problem. Problems presented to learners are defined well and parameters of the problem are specified in the problem statement.

Second, there is no consensus on one right solution to an ill-structured problem. As Kitchener (1983) pointed out, there are multiple solutions and solution paths. Sometimes, there is no solution at all. There is uncertainty about which concepts, rules, and principles are necessary for the solution (Jonassen, 1997). In contrast, well-defined problems have correct, convergent answers. The typical problem-solving activity is the application of a limited number of algorithms. The rules and principles of problem solving are well organized in predictable ways. Also, there is a preferred, prescribed process of problem solving.

Third, there is no prototypical case for ill-structured problems (Jonassen, 1997). Case elements are different in different contexts. Cases are not described with general rules or principles. For example, the nature of a historical event, such as a war or a revolution, is so complex and different from other cases that it is difficult to categorize it under any single principle. Further, the relationships between concepts, rules, and principles are inconsistent between cases. In well-structured problem solving, by contrast, rules and principles are well organized in a predictable way. Also, they are consistently applied to describe instances of the same kind of case.

Fourth, ill-defined problems often require participants to make judgments about solutions and defend their judgments. Because there are multiple criteria for evaluating solutions, participants must make a choice from many alternatives. Further, there is no explicit means for

determining appropriate action. On the other hand, well-structured problems permit little opportunity for decision making because there are well prescribed paths to the solution.

Fifth, ill-defined problem solving is an interpersonal activity. Participants are required to express personal opinions or beliefs about the problem. According to Kitchener (1983), this kind of problem is “dialectical,” because different and opposing assumptions underlie different perspectives. Participants on opposing sides define the problem in different ways and use the same evidence in support of different perspectives. Therefore, participants typically are engaged in argumentation activities in which they exchange pro and con arguments.

#### *Distinctiveness of Informal Reasoning: Discussion*

Several views have been suggested by researchers to compare formal and informal reasoning. Galotti (1989) summarizes three perspectives. The first perspective considers formal reasoning as a part of everyday reasoning. According to this view, daily reasoning is closely related to the activity of generating premises and solving problems with generated premises. Daily reasoning processes involve solving problems with given premises that are the same as those of formal reasoning, but they add extra steps: generating and evaluating processes.

The second view also recognizes the similarities between the two types of reasoning, but argues that formal reasoning requires more steps and is more difficult. According to this view, formal reasoning is more demanding, because the reasoner must solve problems solely based on given knowledge and must ignore personal information or certain kinds of heuristics. Also, formal reasoning tasks employ a more analytical approach, refraining to make inferences based on common sense or conventional maxims.

The third view believes that informal reasoning and formal reasoning are very different processes and share few similarities. According to Perkins (1986), these two types of thinking

are contrasted in the following three ways. First, formal reasoning has “a long chain structure,” while informal reasoning has a “fork structure” which has shorter lines of argument. Second, formal reasoning focuses on one side of a case while informal reasoning typically includes both pros and cons. Third, formal reasoning is “closed” and relies on given premises, while informal reasoning is more open and draws data from any source.

The third perspective is of special interest, because it focuses on the differences between formal and informal reasoning, while the first two perspectives emphasize the similarities. The emphasis on structural differences implies that informal reasoning has distinctive features, irreducible to formal reasoning

On the contrary, those who emphasize the similarity between the two types of thinking expect formal reasoning ability to predict ability at informal reasoning (Barratt, 1975; Galotti, 1989). The study of formal reasoning is seen as the exploration of abilities and skills under more controlled situations than occur in everyday life. However, insufficient evidence exists to support this assumption. Formal reasoning ability predicts only specific abilities, for example, mathematical or spatial reasoning (Perkins, 1985a), but it cannot index reasoning skills in general. Difficulties in everyday reasoning are not difficulties in properly executing inferences (Perkins, Allen, & Hafner, 1983). Therefore, informal reasoning calls for a different theoretical model or methodological approach that fits its own nature.

#### *Major Factors Contributing to the Development of Informal Reasoning*

If formal reasoning skills do not contribute to the development of informal reasoning, what factors, then, do make a difference? Because studies investigating factors related to the development of informal reasoning are few and very recent (Galotti, 1989), it is hard to find generalizable results. Given the limitations, this review of literature concentrated on six studies

(Ceci & Liker, 1984; Perkins, 1985b; Wagner & Sternberg, 1985; Voss, Blais, Means, Greene, & Ahwech, 1986; Furlong, 1993; Means & Voss, 1996) which investigated the relationship between informal reasoning abilities and major personal factors including educational level, domain-specific knowledge, motivation, meta-cognition, and intelligence. Although each study specially focused on one or two factors, it generally addressed other factors, too.

### *Educational Level*

Perkins (1985b) conducted a study to appraise the impact of education on informal reasoning. In this study, the reasoning performances of first and fourth year high school students, first and fourth year college students, first and fourth year graduate students, and adults who had been neither students nor teachers for more than five years were compared. Each participant expressed his or her opinions and produced arguments about public issues not demanding extensive knowledge. In addition, Perkins gathered information about subjects' prior consideration of the issues, intelligence, and years of education.

Comparisons between the first and fourth year students at each school level revealed that statistically significant improvements in producing lines of argument occurred at only the high school level. However, high school students' gains were very small: 0.4 line of argument for three years. Although statistically significant mean differences were detected between students of each school level, such differences are interpreted as deriving from the effects of a selective admission procedure and maturation. When a multiple linear regression test was conducted to explore the major variables contributing to argumentation skills, intelligence turned out to be the most influential variable. Years of education emerged as having a statistically significant influence on informal reasoning; statistical significance levels mostly ranged from .06 to around

.1. However, prior consideration of the issue and age failed to attain statistical significance. The non-student group displayed the same pattern.

To summarize, improvements in informal reasoning were generally small across the school levels. Although the influence of educational level attained statistical significance, the researcher did not report the effect size and it is hard to determine whether differences between groups were of practical significance. Further, the amount that education and maturation contributed to the improvement of informal reasoning was very small: 0.1 line of argument per year. The influences of education and maturation were not as much as one might expect.

Voss et al. (1986) reported a similar result. They conducted a study to investigate the relationship between subject matter knowledge and informal reasoning in solving economics problems. In addition, the study provided information about the influence of college education, economics training, and vocational experience on the use of subject matter knowledge and informal reasoning. Participants were divided into six groups according to whether they had or did not have college education, economic courses, and vocational experience in economics-related areas.

The data analysis showed that only college education had a statistically significant effect both on subject matter knowledge and informal reasoning. The college educated groups demonstrated a greater knowledge of economics and reasoning skills than non-college educated groups. On the other hand, formal training in economics and vocational experiences in this area had no statistically significant influence on both knowledge-related performance and informal reasoning. However, as seen in the Perkins's (1985b) study, not much is known about how college educated individuals develop subject matter knowledge and reasoning skills.

### *Subject Matter Knowledge*

Voss et al. (1986) also examined the relationship between subject knowledge and informal reasoning. The result of the study generally indicated that those groups having more knowledge of economics also demonstrated better performance in informal reasoning. The authors explained this finding as the result of the interaction between the two factors. Reasoning skills enhanced the acquisition of subject matter knowledge, and vice versa.

Another study conducted by Means and Voss (1996) confirmed the role of subject matter knowledge in improving informal reasoning. In this study, two experiments were conducted to address the relationship between reasoning skills and students' grade, ability and knowledge levels. In the first experiment, students in grades 5, 7, 9, and 11 participated. These students were selected from three ability groups: gifted, average, and low ability students. Three tasks were given to the students. They were asked to provide solutions to ill-structured problems, to rate the quality of given solutions, and to order given problems from the most difficult to the easiest. The results revealed that the informal reasoning performance of gifted students was generally superior to that of average and low ability students. A number of measures showed that quality of performance improved with grade level, although ability level generally had a much stronger effect. However, one could argue that the better performance of gifted students and students in higher grades is explained by the presumed greater knowledge of these older students.

The second experiment was designed to examine the effect of domain knowledge on informal reasoning. Students in grades 8, 10, and 12 in three ability groups were asked to provide reasons in support of and in opposition to the chosen position, to compare two opposing arguments, and to answer twenty multiple choice knowledge questions. The results of

experiment 2 also provided evidence of significant differences in reasoning skills between ability groups. However, there was insufficient evidence to support a statistically significant relationship between grade levels and reasoning performances. Some apparent effects of grade level were not statistically significant when knowledge was controlled. With regard to knowledge, students with more knowledge generated more and better reasons. However, when ability level was controlled, knowledge was not significantly related to the number of sound arguments.

To summarize, knowledge is important in informal reasoning performance, but, in this study, informal reasoning was better explained by ability level. Means and Voss (1996) explained that students of high ability have reasoning skills and language structures operating beyond knowledge. What, then, makes these students able to process knowledge in an effective way?

### *Intelligence*

If informal reasoning is influenced by students' ability level, intelligence is of special interest. To examine the effect of intelligence on complex real world reasoning tasks, Ceci and Liker (1984) conducted a study of racetrack handicappers. In this study, the authors measured each subject's intelligence and modeled the complexity of the judgment processes involved in handicapping. Subjects in this study were middle-aged horse racing fans experienced at handicapping. They were grouped into expert and nonexpert categories.

First, this study provided the zero order correlation between intelligence and handicapping skills: there was no statistically significant correlation between the two variables. Subjects with quite modest intelligence could pick not only the "winner," but the trifecta.

The second question of the study was about intellectual complexity: Does successful handicapping involve high-level reasoning processes? According to interviews with the subjects, successful handicapping involves between ten and twenty variables with multiple levels of each. To be able to examine precisely which of the variables handicappers utilized, Ceci and Liker designed a racing program made of fifty hypothetically constructed races. Experts were able to consider each variable's interaction with other variables and groups of variables. On the other hand, nonexperts considered each variable independently and did not use an interactive model. Although the expert handicappers engaged in an intellectually demanding task, their reasoning performances had little relationship to intelligence.

Intelligence scores of handicappers did not predict performances of real world reasoning tasks. In this study, intelligence was a poor predictor of non-academic intelligence and was unrelated to the ability to perform intelligently on complex everyday tasks. This result contradicted findings of Perkins's (1985b) study which reported a statistically significant correlation between intelligence and argumentation skills. Intelligence was only applicable to a limited aspect of the task which was situated on a relatively well-elaborated model. Also, in Perkins's (1985b) study, the effect of domain knowledge was not completely "washed out."

#### *Tacit Knowledge*

If intelligence tests measure only a restricted range of the intellectual competencies required for success in real life pursuits, what factors can explain the remaining competencies? Wagner and Sternberg (1985; 1986) suggested one factor, tacit knowledge. They conducted three experiments to examine the role of tacit knowledge in real world reasoning tasks. Tacit knowledge is defined as "knowledge that usually is not openly expressed or taught (Wagner & Sternberg, 1985, p.438)." In the first experiment, a questionnaire was used to compare the tacit

knowledge of three groups of subjects: psychology professors, graduate students, and undergraduate students. The second and third experiments were designed to replicate and generalize the findings with samples of business managers and bank managers. The results of the three experiments confirmed the importance of tacit knowledge in practically intelligent performances. In the academic work situations, experts displayed greater uses of tacit knowledge in managing self, others and career. This result was replicated in the second experiment which compared the uses of tacit knowledge by business managers, graduate students and undergraduate students. The findings of the study also displayed a statistically significant relationship between tacit knowledge and career performance in professional and managerial career pursuits. For example, in experiment 1 strong relations were found between levels of tacit knowledge and academic performance including academic rank, number of publications, citations, and conference attendance. This result also was replicated in the cases of business and bank managers.

Meta-cognitive knowledge is an important part of tacit knowledge. Meta-cognitive knowledge is, in another word, reasoning know-how. Reasoning know-how increases one's ability to handle situation modeling, as well as makes it possible to monitor thinking so that one can reason close to one's performance ceiling. In a study conducted by Perkins et al. (1983), meta-cognitive guidance substantially improved students' ability to produce counterarguments. This study showed that some reasoning know-how could be instructed. Simple guidance or instruction can improve reasoning substantially. This result was confirmed by Parker's (1989) study about adolescents' reasoning. Parker (1989) provided both oral and written direction for novice students and successfully engaged 92% of the subjects in a form of dialogical reasoning. Furlong (1993) repeated the same results in a study of adults' reasoning about federal budget-

deficit problems. In this study, participants given specific prompts produced more counterarguments than those without meta-cognitive prompts.

### *Motivation*

People might be willing to reason when they have a personal interest in the issues at hand. Furlong (1993) investigated motivational factors influencing people's reasoning about economic issues. In this study, need for cognition and issue involvement were examined as motivational factors. The Need for Cognition Scale (Cacioppo & Petty, 1982) was developed to measure "the tendency for an individual to engage in and enjoy thinking (p.116)." This scale distinguishes between "those who did and those who did not engage in meaningful thought (p. 116)." The Issue Involvement Scale measures a person's belief regarding whether an issue is personally relevant to him or her. Furlong's findings did not support the positive effect of need for cognition on subjects' informal reasoning. On the other hand, issue involvement had statistically significant effects on two criterion variables: the number of premises and soundness of argument. However, issue involvement was not statistically significantly correlated with counterarguments. Individuals with high interest in an issue are ready to support their positions but fail to reason dialogically. With these findings, motivation, although important, does not fully guarantee the quality of reasoning in everyday life.

### *The Causes of Better Informal Reasoning: Discussion*

Five major factors were examined in terms of their influence on performance in everyday reasoning. However, a key question remains unanswered: What factors make reasoning better? The review of five factors suggested that the traditional intelligence score does not guarantee good reasoning in everyday situations. Intelligence appears to work only in well-organized situations. Although subject knowledge is important, informal reasoning is better explained by

the ability to operate beyond knowledge. As seen in Perkins's (1985b) study, however, little is known about how people develop this kind of reasoning skill. Motivation also failed to predict the ability of dialogical thinking. Only tacit knowledge appears to contribute to the development of everyday reasoning. Findings from Perkins et al. (1983), Parker (1989) and Furlong (1993) suggest that explicit instruction in meta-cognitive strategies can improve people's dialogical reasoning.

However, there is a limit to teaching tacit knowledge in such an explicit way. Tacit knowledge is, by nature, implicitly shared by a group of people. That means that not every person does share tacit knowledge. As Perkins, Farady, and Bushey (1991) argued, many people do not feel the need for this meta-cognitive strategy in order to consider critically the issues at hand. From this perspective, the performance of informal reasoning is a matter of a person's belief system or habit of mind. An informal reasoning approach that focuses too much on specific skills or rules might be less successful than an approach that focuses on disposition or attitudes.

#### *Importance of Cultural Factors in Explaining the Development of Reasoning*

The difficulties of promoting reasoning lie in the fact that reasoning is not merely a set of skills but also depends on dispositions or attitudes. Onosko's (1991) investigation showed that achieving goals of teaching higher-order thinking does not rely solely on innovative instructional methods, but also on comprehensive factors, including various environmental and classroom cultural factors. Onosko (1991) investigated dominant barriers to the promotion of higher order thinking in social studies by means of interviews with teachers, department chairs, principals, and staff developers, observations of lessons, and a perusal of the social studies research literature and reports of school change. He identified six major barriers in his study: instruction

by transmission and absolutist conceptions of knowledge; broad and superficial content coverage; teachers' low expectations of students; large number of students; lack of teacher planning time; and the culture of teacher isolation.

Onosko's (1991) study used the concept of "classroom thoughtfulness" which was articulated by Newmann (1990). According to Newmann (1990), higher-order thinking cannot be attained through the mere practice of several kinds of thinking skills, but rather through a comprehensive set of resources, which includes in-depth knowledge and the dispositions of thoughtfulness. The dispositions of thoughtfulness encompass various aspects such as attitude, personality, general values, and epistemological beliefs. Besides personal factors, Newmann (1990) emphasized general qualities of classroom interaction that could be expected to help students face a variety of higher-order challenges.

#### *Classroom Culture and Teaching Thinking*

Newmann's conception of classroom thoughtfulness broadened the scope of discussion of higher-order thinking to all the phases of learning, especially the socio-cultural context in which higher-cognitive thinking skills are learned. Recently, special attention has been given to the cultural context of learning. For example, Brown, Collins, and Duguid (1989) insisted that knowledge is a product of the activity, context, and culture in which it is developed and used. They argued that individuals need to learn the codes and assumptions of the academic culture which values the promotion of higher-order thinking. They expected that teachers (or students) who share the conceptions of learning appropriate for the culture which values higher-order thinking would perform thoughtful instructional (or learning) practice.

In the same context, Robinson (1992) provided an interesting example. Robinson (1992) described American classroom culture from international students' perspectives. This study

showed that students from other academic cultures tended to consider instructional methods practiced in American classrooms as meaningless or embarrassing. Those students were found to have conceptions of learning and knowledge that were quite different than the conceptions possessed by American students.

What, then, are characteristics of thoughtful classroom culture? Newmann (1990) presented seventeen indicators of classroom thoughtfulness which can be used as observational dimensions for empirical work. These indicators include general characteristics of the lesson and specific types of teacher and student behaviors. However, as Newmann (1990) suggested, the concept of classroom thoughtfulness encompasses not only observational behaviors but also personal beliefs about knowledge and thinking and the general quality of classroom interaction. Therefore, the study reported here focused on students' personal beliefs about knowledge and thinking (arguing) and openness of classroom interaction. Four factors were used to describe the classroom culture: epistemological beliefs, argumentativeness, verbal aggressiveness, and classroom climate.

When compared to Newmann's (1990) indicators of classroom thoughtfulness, these four scales have advantages: First, these scales provide information about personal dispositions and perceptions related to thinking, whereas Newmann's indicators focus only on observable behaviors. Second, these classroom cultural scales make it possible to gather individual scores for every single subject, while Newmann's indicators give scores only for whole class groups. Third, these factors are 'cultural' in that they are related to implicitly shared assumptions on knowing and thinking, while Newmann's scales are related to explicitly controllable factors.

### *Epistemological Beliefs*

The classroom consequences of implicit beliefs about knowledge have interested cognitive psychologists. For example, Schoenfeld (1983) found that the beliefs with which one approaches a particular task or one's interaction with a task environment can drive people's behavior as they generate problem solutions. Besides domain-specific knowledge and strategic knowledge, beliefs about knowledge, or epistemological beliefs, have been added recently as new elements that are central to successful learning and problem solving (Schommer, 1993; Schommer, 1994a; Hofer & Pintrich, 1997). Epistemological beliefs are believed to influence how individuals understand the nature of intellectual tasks and decide what kind of strategies are appropriate for dealing with them, especially in complex and ill-structured problem situations (Kitchener, 1983). Schommer (1994a) defined epistemological beliefs as "intuitions about the nature of knowledge and the nature of learning (p. 300)."

Learners who are exposed to conventionally structured instructional environments often possess a rigid notion of knowledge. In a synthesis of research literature about epistemological beliefs, Schommer (1994b) revealed that there are strong relationships between individuals' epistemological beliefs and various aspects of learning. The more students believe learning is quick, the more likely they will avoid investing time in problem solving and the more likely they will earn low grade point averages. The more students believe knowledge is certain, the more likely they will misinterpret tentative findings to be unchanging facts.

The academic cultural context of instructional environments can be considered a factor in shaping epistemological beliefs. Jehng, Johnson, and Anderson (1993) compared the epistemological beliefs of university students at different educational levels and in different fields of study. The results revealed that graduate students showed a stronger tendency than

undergraduate students to believe that knowledge is often uncertain, that learning is not usually an orderly process, and that knowledge is best acquired by independent reasoning. Students who studied in the "soft" fields (e.g., social sciences and humanities) had a stronger tendency than students in "hard" fields (e.g., natural sciences and technology) to believe that knowledge is uncertain, to be more reliable in their independent reasoning, and to have stronger feelings that learning is not an orderly process.

The authors ascribed the differences in epistemological beliefs to the social context of instructional environments. For example, the curriculum at the undergraduate level is more systematically designed, and the problems that students work on are better structured than the curriculum at the graduate level. Students at the graduate level become more context-sensitive or context-adaptable learners as a result of the instructional environments they have encountered. The entire intellectual climate in the "soft" fields is less rigid compared to the "hard" fields. Most problems in the social sciences, arts, and humanities are ill-structured, and solutions to these problems are not always immediately available.

#### *Argumentativeness and Verbal Aggressiveness*

According to findings in communication studies, an individual's predisposition toward arguing is significant in explaining communication behavior and perception (Infante & Rancer, 1982; Rancer & Infante, 1985; Rancer, Kosberg, & Baukus, 1992; Levine & Boster, 1996). Argumentativeness and verbal aggressiveness are important concepts in describing argumentative behavior.

Argumentativeness is defined as "a generally stable trait which predisposes the individual in communication situations to advocate positions on controversial issues and to attack verbally the positions which others take on these issues (Infante & Rancer, 1982, p.72)". Argumentation

is viewed as the tendency to approach argumentation minus the tendency to avoid argumentation (Levine & Boster, 1996).

Infante and Rancer (1982) conceptually distinguished argumentation from verbal aggressiveness. In verbal aggression, the locus of the attack is focused on another person's self concept, instead of that person's position on controversial issues. On the other hand, argument involves presenting and defending positions on issues and the locus of attack is on the position taken by the other side.

Several studies reported the effects of argumentativeness on communication. For example, Rancer and Infante (1985) investigated how high and low argumentative subjects prepare to argue with high and low argumentative adversaries. They found that highly argumentative subjects are more motivated to argue than less argumentative subjects. Levine and Boster (1996) investigated the relations between argumentativeness and the number of arguments and the type of resolution produced in conversation about a controversial issue. They reported that higher argumentative subjects produce more arguments.

Sanders, Gass, Wiseman, and Brusckke (1992) conducted an analysis of the relationship between three traits related to argumentation behavior: argumentativeness, verbal aggressiveness, and need for cognition. This study also provided a cross-cultural comparison between Euro-American, Hispanic American, Asian American, and African American subjects. Need for cognition was found to have a positive correlation with argumentativeness but a negative correlation with verbal aggressiveness. Those who preferred less cognitive rigor appeared more likely to resort to the use of *ad hominem* attack rather than focusing on substantive issues. Findings from the ethnic comparisons provided interesting information. There were no ethnic differences associated with argumentativeness. However, the comparisons

of the need for cognition and verbal aggressiveness yielded small but statistically significant differences. Asian Americans reported a lower need for cognition and higher verbal aggressiveness than other ethnic groups.

### *Classroom Climate*

According to Bruning, Schraw, and Ronning (1995), “an open participant structure” is essential for a more reflective classroom. Open participant structure refers to the ability of students to talk freely with each other as they would in ordinary conversations. In an open participant structure, students can initiate discussion topics. They argued that open participation leads classroom discourse to be more “authentic.”

The openness of classroom discourse can be measured by the “Classroom Climate Scale” (Hahn, 1996; Hahn 1998). Ehman (1969) first developed the Classroom Climate Scale which contained items to measure the extent to which students perceived openness when teachers treated controversial issues, or, in other words, the extent to which they felt free to express their opinions. According to Hahn (1998), “an open climate” encourages students to explore and express different views on controversial public issues. On the other hand, a closed climate in which teachers do not present multiple views on social issues makes students feel uncomfortable in expressing their opinions.

Studies about classroom climate have mainly focused on its relationship with students’ political attitudes. For examples, Ehman (1969) surveyed Detroit high school students to examine the relationship between classroom climate and students’ political efficacy. This study reported a positive relationship between the openness of classroom climate and students’ political interests and participation. In another study, Ehman (1980) surveyed students in nine midwestern high schools. In that study, students who explored a wider range of views in their

social studies classroom, when compared to those who were exposed to only one perspective, reported higher levels of political interest and confidence in their ability to influence decisions.

In addition to political attitudes, open classroom climate appears to contribute to the development of argumentation skills. According to a study by Long and Long (1975), students who experienced open climates reported discussing political matters with friends and family and following current events in the media more frequently than students who experienced closed climates.

#### *Classroom Cultural Dispositions and Informal Reasoning: Discussion*

Cultural factors have been neglected in studies as factors influencing one's reasoning abilities. However, as seen above, individuals' notions of thinking and arguing and the way they communicate appear to influencing the quality of reasoning and argumentation, especially in everyday situations in which a single right solution for a problem does not exist. First, beliefs about knowing could influence how thinkers (or arguers) understand the nature of intellectual tasks and choose strategies to deal with them. Second, a positive conception of arguing could increase the level of argument and communication. Third, an open climate could provide a helpful environment for dealing with challenging issues.

These classroom cultural scales also serve as measuring rods with which actual classrooms can be described. Because these scales provide quantifiable data, it is possible to assess certain classroom members' cultural dispositions related to thinking and their way of communicating. Further, these quantifiable scales make it possible to replicate this study for other groups in various settings.

### *Methodological Issues in Measuring Informal Reasoning Skills*

Only a small number of studies about informal reasoning have been conducted, because an established, appropriate methodology does not exist (Galotti, 1989; Perkins et al., 1991). When compared to the study of formal reasoning, the study of informal reasoning raises many practical issues. Most of these practical problems originate from the ill-structured nature of informal reasoning. Also, in everyday situations, it is hard to control many unexpected factors that can influence the results of experiments. Given these limitations, the research reported here concentrated on methodological issues raised in five studies (Perkins, 1985b ; Parker, 1989; Kuhn, 1991; Furlong, 1993; Means & Voss, 1996). General features of the methodology employed in these studies are described below.

#### *Controversial Issues Employed*

All five studies administered a procedure that asked subjects to think about everyday social and political issues. These issues were current, genuinely vexing, and allowed several solutions on both sides of the case. Subjects were required to think about the issues and to produce arguments or solutions. The issues presented in the five studies were of three kinds. The first kind of issue involved problem solving. The federal budget deficit problem (Furlong, 1993) and the behavior control problem (Means & Voss, 1996) are the examples of the first kind. The second kind of problem required subjects to choose a position in a dilemma situation. The military draft (Perkins, 1985b) and the language use problem (Parker, 1989) are examples of this category. The third type of issue required subjects to provide causal explanations for a problem (Kuhn, 1991). For example, subjects were asked, "What causes school violence?" Except for the federal budget deficit problem, most problems did not require extensive domain knowledge.

### *General Procedure of Data Collection*

The common methods of data collection were interviews and written essays. Subjects were asked to provide arguments and to support their solution, position, or explanation. Also, subjects were asked to think about counterarguments. Subjects received sufficient time and guidance or scaffolding to facilitate dialogical reasoning. Two studies (Furlong, 1993; Parker, 1989) employed experimental designs that divided groups into experimental and control groups. The treatment was the amount of scaffolding. In addition to the scaffolding, many other personal factors including intelligence, ability, and educational level were considered. Two studies (Furlong, 1993; Means & Voss, 1996) included a knowledge test.

### *Scoring*

Two types of argument evaluation were employed in the five studies. The first method focused on the quality of informal reasoning, while the second one emphasized the structure of arguments. The following criteria were commonly used to measure the quality of reasoning.

*Number of claims.* A claim is an opinion about a specific issue. A claim is distinguished from an argument in that it has not been supported by reasons yet. All five studies asked subjects to provide opinions about social issues, and two studies (Furlong 1993; Parker 1989) counted the number of claims separately from the number of arguments.

*Lines of reasoning (or lines of argument).* A claim should be supported by reasons to develop an argument. An argument here denotes a line of reasoning that makes a claim-reason relation. A supporting reason could be either evidence or a premise. All five studies asked subjects to provide supporting reasons for their opinions.

*Number of premises.* The premise is a statement that qualifies an argument. Two studies (Furlong 1993; Kuhn 1991) included the number of premises as a criterion of sound arguments.

A premise provides general principles or evidence that support the argument. From Toulmin's (1958) perspective, the premise denotes the warrant or backing that permits the datum-claim relation to be made.

*Number of counterarguments.* Counterargument refers to the other side of an argument. The number of counterarguments is an important scale to measure subjects' dialogical reasoning. Counterargument also denotes a line of argument which has a claim-evidence structure. All five studies counted the number of counterarguments.

*Qualifiers.* According to Toulmin et al. (1984), the appropriate uses of qualifiers characterize sound informal reasoning. Qualifiers conditionalize the applicability of arguments. Also, by conditionalizing an argument, qualifiers provide occasions to generate multiple arguments. Means and Voss (1996) counted the number of qualifiers.

*Rebuttals.* Rebuttal refers to a statement that includes an evaluation about counterarguments. Usually, rebuttals take the form of criticism against counterargument. Kuhn (1991) included this criterion.

*Soundness of inference.* Furlong's study (1993) included the soundness of inference. This criterion depends on a holistic evaluation of soundness and it evaluates two aspects of inference: (1) Does the evidence properly support claims? (2) Does an argument have an acceptable reason? In most cases, each performance was given two ratings for overall quality, and inter-rater reliability was reported. This holistic rating often used a five-point scale ranging from 1-5.

*Structure of arguments.* In addition to the measure of argument quality, two studies (Kuhn, 1991; Means & Voss, 1996) provided the analysis of argument structure. According to Toulmin et al. (1984), argument structure provides a basis for evaluating the soundness of an

argument. Means and Voss (1996) categorized argument structures into three categories: skeletal, enhanced, and elaborated. Skeletal structure includes only a claim-reason relation while enhanced structure adds qualifiers to this relation. Elaborated structure includes multiple lines of reasoning and qualifiers.

### *Conclusion*

This review of literature suggested that, first, informal reasoning calls for a different theoretical model or methodological approach than does formal reasoning. Instead of the traditional IQ test or logic test, the analysis of argumentation in everyday situations is appropriate for studying informal reasoning.

Second, the discussion of previous studies revealed that subject knowledge and tacit knowledge influenced to some degree the quality of informal reasoning. However, informal reasoning is better explained by the ability to operate beyond knowledge, and tacit knowledge is more a matter of a person's belief system or habit of mind than a specific set of skills. From this perspective, the study reported here focused on classroom cultural factors as variables influencing the quality of informal reasoning.

Third, the discussion of methodology used in previous studies provided a general procedure for data collection and eight criteria for assessing the quality of informal reasoning. Utilizing this methodology, this study collected data by asking subjects to write their opinion about controversial issues and assessed their quality of reasoning with criteria including the number of claims, the lines of reasoning, the number of premises, the number of counterarguments, the number of rebuttals, the soundness of argument, and the argument structure. To summarize, the review of literature guided this research project to analyze people's

argumentation about social issues in terms of argument quality and structure and to examine their relationships with classroom cultural factors.

## CHAPTER 3

### METHODOLOGY

This study was designed to investigate the relationship between classroom culture and students' reasoning abilities. Classroom culture was represented by four factors: epistemological beliefs, classroom climate, argumentativeness, and verbal aggressiveness. Students' argumentation skills about controversial issues were measured to estimate students' reasoning abilities. The study addressed the following research questions:

1. How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness differ between different types of schools?
2. How do students' reasoning skills differ between different types of schools?
3. How do the four variables of classroom culture correlate?
4. How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness correlate with their argumentation skills?
5. What are the best predictors of students' argumentation skills?

To answer these questions, this study produced quantitative data about each variable with a questionnaire and essay tests administered to three groups of students. The questionnaire was comprised of four different instruments measuring epistemological beliefs, classroom climate, argumentativeness, and verbal aggressiveness. The quality of students' reasoning was measured by scoring each student's essays. The questionnaire is attached in Appendix A.

### *Participants*

The sampling of this study considered both research purposes and convenience. The target population of this study is all the Korean college preparatory high school students enrolled in the 11th grade. However, for the convenience of the researcher, three accessible schools were selected in two urban areas of Korea. Two classes from each school were randomly selected and the questionnaire and essay test were administered to the students of these classes. A total of 157 students participated in this study: 58 (36.9%) students from Foreign Language High School: 43 (27.4%) students from Science High School: and 56 (35.7) students from a regular public high school. The first two schools are coeducational schools, while the regular public high school is only for male students.

Although the convenience sample limits generalization of the results, this study provided meaningful information for the following reasons. First, the three schools represent the three different types of college preparatory schools in Korea. Curriculum and matriculation differentiate the three types of high schools. The first type is a regular public school but maintains high selectivity in admission, such as rank in the top 10% of middle school grade point average. The second school, named “Foreign Language High School,” seeks students gifted in language and social sciences and emphasizes foreign language, literature and social sciences. The third school, named “Science High School,” recruits students gifted in science and mathematics, and emphasizes science and mathematics fields.

Second, by comparing these three different types of schools, it is possible to control the effects of ability and socio-cultural environments. The three schools pursue academic excellence and maintain high levels of selectivity in admission. Most students are from middle class

families, possess high academic abilities, and go to college. As mentioned in Reich's (1991) argument, these students display the characteristics of "privileged groups."

Subjects were all in the eleventh grade. Eleventh grade students were appropriate as subjects because they have been exposed to the curriculum of each school for more than one year. The sample size of 157 students in this study was big enough when a medium effect size is expected in a multiple regression model. Green (1991) recently suggested a new rule of thumb for the estimation of appropriate sample size. Green's formula was designed to calculate an appropriate sample size for the regression analysis, and it provides estimates of sample size that are close to those recommended by Cohen (1988). The minimum sample size was determined using the following formula:

$$N \geq L/f^2$$

Where  $N$  = sample size

$L(\lambda)$  is 8 with a single predictor in this rule of thumb. When the number of predictors is less than 11,  $L$  increases for each additional predictor by 1.5, 1.4, 1.3, 1.2, 1.1, 1.0, 0.9, 0.8, and 0.7 respectively. Algebraically, for  $k < 11$ ,

$$L = 6.4 + 1.65(k) - 0.05(k)^2$$

$k$  = the number of predictors

$f^2$  = the effect size,  $R^2/(1-R^2)$

When a multiple regression model is tested at  $\alpha = .05$  and  $1 - \beta = .80$  and a medium effect size [ $R^2 = .13$  (see Cohen, 1988)] is necessary, the minimum sample size would be calculated as

$$L = 6.4 + 1.65(5) - 0.05(5)^2$$

$$= 13.4$$

$$N \geq 13.4/.15$$

$\geq 89.67$

Therefore, the sample size of 157 satisfied Green's recommendation.

### *Instruments*

A questionnaire was produced to investigate each student's perception of classroom culture. The questionnaire contained four instruments to quantify a student's epistemological beliefs, classroom climate, argumentativeness, and verbal aggressiveness. Each instrument was developed as described below.

#### *Epistemological Beliefs*

Epistemological beliefs are beliefs about knowledge and learning (Schommer, 1990). Led by the initial work of Perry (1970), several researchers in the field designed models that reflected structural and developmental sequences. Recently, interested in the relationship between epistemological beliefs and academic learning, Schommer (1990) developed a model that is more quantitative than previous models and takes a more analytical view of the components of beliefs. She hypothesized five beliefs continua about the nature of knowledge (Schommer 1990). (1) Omniscient ability ranges from knowledge is handed down by omniscient authority to knowledge is reasoned out through objective and subjective means. (2) Certain knowledge ranges from knowledge is absolute to knowledge is constantly evolving. (3) Simple knowledge ranges from knowledge is compartmentalized to knowledge is highly integrated and interwoven. (4) Quick learning ranges from learning is quick or not at all to learning is a gradual process. (5) Fixed ability ranges from ability to learn is genetically predetermined to ability to learn is acquired through experience.

Based on the hypothesis of multidimensionality, Schommer developed a questionnaire and named it Epistemological Beliefs Questionnaire (EQ), consisting of 63 short statements that

characterize epistemological beliefs. However, Schommer's epistemological beliefs questionnaire displayed a practical shortcoming in this study. The 63 items required too much response time for students who needed to respond to three more types of instruments and essay questions.

Given the limitations, this study used a more feasible instrument consisting of 32 items. Bendixen, Schraw, and Dunkel (1998) developed the instrument and named it the Epistemic Beliefs Inventory (EBI). EBI items were constructed based on the criteria for each of the five epistemological categories proposed by Schommer (1990). First, such items as "Children should be allowed to question their parents' authority" and "People who question authority are trouble makers" illustrate both ends of the continuum related to "omniscient ability." Second, "Truth means different things to different people" and "If two people are arguing about something, at least one of them must be wrong" are examples of both ends of the "certain knowledge" continuum. Third, "The best ideas are often the most complicated things" and "The more you know about the topic, the more there is to know" reference "simple knowledge." Fourth, "Students who learn things quickly are the most successful" and "Working on a problem with no quick solution is a waste of time" relate to "quick learning." Fifth, "Some people will never be smart no matter how hard they work" and "Smart people are born that way" illustrate "fixed ability." These EBI items are stated in either the negative or the positive extreme on the questionnaire and respondents rate the statements on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

The original questionnaire was translated into Korean by this researcher. To check the appropriateness of the translation, a volunteer who speaks both Korean and English back-translated the questionnaire to English. The researcher and the volunteer compared it with the

original version. As a result, no significant discrepancy between the Korean translation and the back translation was detected.

A factor analysis was conducted to see if the five theoretical components of epistemological beliefs are retrieved in the Korean translation of the instrument. After eliminating 11 items that showed low correlations with total score, the principal factor analysis yielded 8 components with eigenvalues greater than 1. The first five factors were examined to see whether they corresponded to the theoretical factors. The first observed factor included four items from Schommer's Fixed Ability (12, 15, 5, 26), four items from Quick Learning (3, 16, 21, 29), one item from Omniscient Authority (28), and one item from Certain Knowledge (14) with loadings in excess of .30. The second observed factor included two items from Certain Knowledge (23, 25) and one item from Simple Knowledge (18). The third factor included two items from Simple Knowledge (10, 13) and one item from Quick Learning (9). The fourth factor included one item from Certain Knowledge (31) and one item from Fixed Ability (8). The fifth factor included one item from Certain Knowledge (19). These findings indicated that the theoretical factor structure was not recovered in the empirical factor structure. Schommer's factor structure was not replicated even by rotating the factor matrix. Further, the dimensions of epistemological beliefs were not independent of each other.

This result is in line with results found in other studies using a translated version of the questionnaire (Lodewijk, Vermetten, & Schellings, 1999; Clarebout, Elen, Luyten, & Bamps, 2001). In those studies, Schommer's five-factor structure was not retrieved in a Dutch translation of items. Further, Schommer's hypothesis of multidimensionality was not supported.

Results of the factor analysis in this study and previous studies using translated instruments guided this researcher to use the overall score of epistemological beliefs. Twenty-

one items were included in further analyses after dropping 11 items that demonstrated low correlations with the total score of the original 32 items. The coefficient alpha of these items was .65.

### *Argumentativeness and Verbal Aggressiveness*

Infante and Rancer (1982) first developed the Argumentativeness Scale; Infante and Wigley (1986) suggested the Verbal Aggressiveness Scale. First, argumentativeness is, technically, defined as the tendency to engage in argumentation minus the tendency to avoid argument (Levine & Boster, 1996). Such items as “I feel good when I am winning an argument” and “When I finish arguing with someone, I feel nervous and upset” illustrate both kinds of tendency related to argumentativeness. Second, verbal aggressiveness refers to the tendency to attack another’s self-concept, instead of the other’s position on an issue (Infante & Rancer, 1982). An item such as “When people criticize my faults, I do not let it bother me and do not try to get back at them” illustrates this kind of tendency.

These scales were originally developed for adult populations. Roberto and Finucane (1997) extended the work of Infante and Rancer (1982) and Infante and Wigley (1986) by assessing their existence and measurability in adolescents. The results indicated that the revised version of the instrument was adaptable to adolescent populations.

Roberto and Finucane (1997) conducted a pilot study to see if both scales were clearly understood by adolescents. First they applied the Fry Readability Index (Estes & Vaughan, 1978). Second, they conducted two focus groups to see if adolescents had difficulties in interpreting the items. The language of the modified argumentativeness and verbal aggressiveness instruments proved appropriate for adolescents.

When the adolescent argumentativeness (ADARG) scale was factor analyzed by Roberto and Finucane, 10 of the 20 items loaded on a factor. The internal consistency of the 10 items was assessed by calculating the coefficient alpha, which was .81. In the case of the Adolescent Verbal Aggressiveness Scale (ADVA), factor analysis revealed that eight of the twenty items loaded on one factor. The subset provided a coefficient alpha of .76. Considering the result of Roberto and Finucane's (1997) study, the questionnaire of the present study included 18 items: Ten items that loaded on the argumentativeness factor and eight items that loaded on the verbal aggressiveness factor.

The original questionnaire was translated into Korean by this researcher. To check the appropriateness of the translation, a volunteer who speaks both Korean and English back-translated the questionnaire to English. The researcher and the volunteer compared it with the original version. As a result, no significant discrepancy between the Korean translation and the back translation was detected.

The 10 argumentativeness items written in Korean were factor analyzed by the researcher. Nine of the 10 items on the argumentativeness scale loaded on one factor in excess of .40. Item 3 (i.e., When I finish arguing with someone, I feel nervous and upset) loaded on the first factor with .22 but loaded on the second factor with .79. The coefficient alpha of those nine items was .86. In the case of verbal aggressiveness scale, factor analysis revealed that seven of the eight items loaded on one factor in excess of .50. Item 16 (i.e., When people criticize my faults, I do not let it bother me and do not try to get back at them) loaded at the first factor with .33 and also loaded on the second factor (.78). The coefficient alpha of those seven items was .77.

### *Classroom Climate Scale*

Classroom climate refers to the extent to which students perceived openness when teachers treated controversial issues and the extent to which they felt free to express their opinions (Ehman 1969). Such items as “In our class pupils are encouraged to make up their minds about issues” and “In our classes the teachers try to get students to speak freely and openly” measure the extent to which the climate is open.

Ehman (1969) first developed the Classroom Climate Scale. In this study, however, items used in Hahn’s (1998) adaptation of the scale form the basis of the classroom climate scale. Items in Hahn’s study were administered to students in Denmark, England, Germany, the Netherlands, and the United States in 1986 and 1993. Nine items were used in Hahn’s study and all of items had been used in other studies. Respondents were supposed to rate each statement on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). Coefficient alpha was calculated to examine the consistency of the scale; the values were .58 for the sample in 1986 and .80 in 1993. This study included nine items used in the 1993 study. Translation was done in the same way as those of other instruments. According to a factor analysis, all the items loaded on one factor in excess of .50. Coefficient alpha of the Korean translation was .84.

### *Scale for Measuring Students’ Informal Reasoning Skills*

An essay test was administered to assess students’ argumentation skills. Considering the review of literature conducted in Chapter 2, students’ argumentation skills were tested in the following way.

First, students were asked to think about everyday social issues. In this study, issues of juvenile crime and high school admission policy were employed for several reasons. These issues are common problems faced by average Korean students. Because these problems are

common, students are generally familiar with them and it was not necessary to give students extensive information before they provided solutions. In addition, the two issues required two different argumentation types. In the case of juvenile crime, the task required causal reasoning and was administered by asking students about the major causes of juvenile delinquency. On the other hand, the issue of admission policy presented a dilemma in which students had to choose a position. Students were asked to state whether they agreed or not with the policy that allows some schools to maintain high selectivity in admission and to support their positions.

Second, students received specific guidelines in written form. Each task contained three specific questions. The first question asked students to provide their explanations or positions on the issue. For example, “What causes juvenile delinquency? Please explain specifically the major causes of juvenile delinquency.” For another example, “Do you agree with the policy that allows some high schools to be very selective in admission or not? State your position on the issue.” The second question asked students to support their positions. One of the sample questions was “How would you convince someone else that your view is right?” The third question asked students to consider counter arguments. One of the examples was “Suppose now that someone disagrees with your view that this is the cause. Why might they say that you are wrong?”

Third, to measure the quality of students’ reasoning, the following scoring criteria were employed. First, the number of claims, premises, and arguments were counted. An argument denotes a line of reasoning that contains a claim-reason structure. Second, the soundness of each argument was scored. According to Grennan (1997), the soundness of an argument is defined, in probabilistic terms, as the mathematical product of both epistemic support of the premise or

evidence and the logical support of an inference for a conclusion (claim). This definition can be expressed mathematically as,

$$p(C) = p(P) \times p(C/P).$$

$p$  = probability

C = Claim

P = Premise

Two raters evaluated both the premise and inference of each argument. The quality of each premise and inference was numerically rated from 0.0 to 1.0, and then the quality of an argument was calculated using the formula. The rating criteria of both the premise and inference evaluation followed Grennan's (1997) suggestion for the argument evaluation. Grennan's rating scheme was developed to judge the overall soundness of arguments used in everyday situations. This rating scheme was suggested based on two psychological studies in which subjects were asked to provide numerical definitions of particular probabilistic expressions (Lichtenstein & Newman, 1967; Behn & Vaupel, 1982). Grennan's rating scheme is presented in Table 3.1 and Table 3.2 (Grennan, 1997, p. 53).

Table 3.1.

*Premise Rating Scheme*

Verbal rating	Assigned rating
P is true	1.0
P is very likely	0.9
P is quite likely	0.8
P is likely	0.7
P is be somewhat likely	0.6
P is likely as not	0.5
P is more likely false than true	0.4
P is somewhat unlikely	0.3
P is unlikely	0.2
P is very unlikely	0.1
P is false	0.0

Table 3.2.

*Inference Rating Scheme*

Verbal rating	Assigned rating
If P is true	
C is true	1.0
C is very likely	0.9
C is quite likely	0.8
C is likely	0.7
C is be somewhat likely	0.6
C is likely as not	0.5
C is more likely false than true	0.4
C is somewhat unlikely	0.3
C is unlikely	0.2
C is very unlikely	0.1
C is false	0.0

However, the raters found that Grennan's rating scheme was vague. In a pilot study, the level of agreement between two raters on the quality of each argument was low. Therefore, the two raters developed more specific guidelines for the judgment of reasoning quality. These guidelines were used as supplements to Grennan's rating scheme.

Table 3.3.

*Guidelines for Premise Rating*

Verbal rating	Assigned rating
- When no premise is given or a premise has no connection with the claim (invalid premise):	.0
- When a premise just repeats the claim with no further information.	.1 or .2
- When a premise is based on personal feeling or unreliable information that one heard from someone else	.2 or .3
- Hasty judgment or excessive generalization	.3 or .4
- Plausible but little information to judge the validity of argument	.5
- Plausible but insufficient evidence given	.6 or .7
- Plausible with some reliable evidence	.7 or .8
- Plausible with sufficient evidence	.9 or .10

Table 3.4.

*Guidelines for Inference Rating*

Verbal rating	Assigned rating
- Claim and premise have no connection	.0
- Premise is connected to claim in some way but gives little help in evaluating the validity of claim	.1 or .2
- Premise is connected to claim but jeopardizes the validity of claim	.3 or .4
- Premise is connected to claim but not enough to evaluate the validity of claim	.5
- Premise is favorably relevant to claim but more explanations are required	.6 or .7
- Premise is favorably relevant to claim with some specific explanation	.7 or .8
- Validity of claim is evident without any additional explanation	.9 or 1.0

*Administration Procedure*

The researcher obtained permissions for the study from schools, teachers, and students, following the procedure approved by the University of Georgia Institutional Review Board. First, the researcher contacted principals of the schools and requested permissions from them. Second, after receiving permissions from principals, the researcher visited the schools and met with teachers. Third, the researcher and teachers worked together to select participants. Fourth, before the administration of the test, the researcher attended classes and asked for students to

participate in the study. Students were notified that they could choose not to participate without any penalty and they could quit at any time.

A questionnaire containing four instruments and essay questions was handed out to each student in a regularly scheduled class period. The following administration guide was given to class teachers.

- If needed, adjust the class schedule with students.
- Give students enough time to respond to all the questions in no hurry.
- Remind students the week before the test that the questionnaire will be administered.
- Specify the purpose of the test.
- Explain that the purpose of the test is pure research.
- Notify students that the result of the test will not influence their grade.
- Notify students that there are no right or wrong answers and that people will answer the questions differently because of who they are and how they feel.
- Tell students to let the teacher know if they don't understand a question.
- Emphasize that students should respond to all the questions.

#### *Data Analysis Procedure*

Collected data were analyzed according to the following procedures. First, two raters scored students' two essays. The raters were this researcher and a doctoral student who had taken more than five courses of logic and critical thinking in the University of Georgia Philosophy Department. For training, the two raters first carefully read Grennan's suggestion and previous studies that employed the procedure similar to the procedure used in this study. Second, the two raters discussed and negotiated about the general criteria for ratings before

analyzing the essays. Third, the two raters practiced rating with the pilot test data. Finally, inter-rater reliability was calculated. The intra-class correlation coefficient alpha was .75.

Second, students' responses to the four instruments were coded and scored in a numerical form. The sum of each scale was counted separately according to the scoring guideline of each instrument. The data were analyzed using the SPSS program (SPSS Inc., 2002). The analysis included descriptive statistics, analysis of variance, correlation analysis, and multiple regression analysis. Table 3.5 displays the relationships between the research questions and data analysis techniques.

Table 3.5.

*Data Analysis Techniques*

	Research Questions	Data analysis Techniques
1	Differences in four factors of classroom culture among three school groups	Analysis of variance
2	Differences in argumentation skills among three school groups	Analysis of variance
3	Correlations among four factors of classroom	Correlation analysis
4	Correlations between four factors of classroom culture and students' argumentation skills	Correlation analysis
5	Identification of the best predictors of students' argumentation skills	Multiple-regression Analysis

## CHAPTER 4

### DATA ANALYSIS

This study intended to answer five research questions: (1) How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness differ between different types of schools? (2) How do students' reasoning skills differ between different types of schools? (3) How do the four variables of classroom culture correlate? (4) How do students' epistemological beliefs, perceptions of classroom climate, argumentativeness, and verbal aggressiveness correlate with their argumentation skills? (5) What are the best predictors of students' argumentation skills? The results of data analysis are summarized for each research question.

*How Do Students' Epistemological Beliefs, Perceptions of Classroom Climate, Argumentativeness, and Verbal Aggressiveness Differ between Different Types of Schools?*

In order to figure out how students of different schools and genders differ in their conceptions of knowing, learning, arguing and the way they communicate in their classroom, this study used analysis of variance.

*Mean Differences in Epistemological Beliefs between Schools*

Table 4.1 summarizes the means and standard deviations of epistemological beliefs among the three school groups. The higher the epistemological beliefs score, the more naive the personal epistemology.

Table 4.1.

*Means and Standard Deviations of Epistemological Beliefs*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	48.67	7.25	12
	Female	47.87	6.33	46
	Total	48.04	6.46	58
Science	Male	48.37	9.65	30
	Female	49.24	11.24	13
	Total	48.63	10.03	43
Regular	Male	50.43	8.45	56
Total	Male	49.58	8.67	98
	Female	48.17	7.59	59
	Total	49.05	8.29	157

A two-factor ANOVA test was conducted to detect differences in the epistemological beliefs mean scores of the school and gender groups. Levene's test of equal variance confirmed the hypothesis of equal variance [ $F(4,152) = 2.10, p > .05$ ]. Further, there was insufficient evidence to reject the null hypothesis of equal means between schools [ $F(2,152) = .56, p > .05$ ] and genders [ $F(1,152) = .00, p > .05$ ]. Further, no statistically significant interaction effect between the two independent factors was detected [ $F(1,152) = .19, p > .05$ ].

Table 4.2.

*Analysis of Variance for Epistemological Beliefs*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>h</i> <sup>2</sup>
School	77.75	2	38.87	.56	.57	.01
Gender	.21	1	.21	.00	.90	.00
Interaction	12.82	1	12.82	.19	.67	.00
Error	10522.87	152	69.23			
Total	10709.59	156				

*Mean Differences in Argumentativeness between Schools*

The second analysis of variance was conducted to detect differences in argumentativeness among groups. Means and standard deviations are summarized in Table 4.3. Levene's test of equal variance confirmed that the error variance was equal across groups [ $F(4,152) = .99, p > .05$ ].

An analysis of variance was performed to detect differences of means among groups. The results are summarized in Table 4.4. An analysis of variance for argumentativeness detected statistically significant differences in argumentativeness among schools [ $F(2,152) = 4.74, p < .05$ ]. The strength of relationship between school and argumentativeness was assessed by Eta Square ( $h^2$ ). Eta Square is one of the commonly used measures of effect size in ANOVA (Olejnik & Algina, 2000). Measures of effect size in ANOVA are measures of the degree of association between an effect and the dependent variable, while such measures as Cohen's  $d$  and Hedges'  $g$  involve standardized mean differences. Eta Square is an estimate of the degree of association for the sample and computed as  $SS(\text{between})/SS(\text{between})+SS(\text{within})$ .

Traditionally,  $h^2$  values of .01, .06, and .14 represent small, medium, and large effect sizes, respectively. The school factor accounts for the variance in argumentativeness at a medium level with an  $h^2$  value of .06. The effects of gender and interaction were not statistically significant at the .05 level: [ $F(1,152) = .13, p > .05$ ] and [ $F(1,152) = .07, p > .05$ ], respectively.

Table 4.3.

*Means and Standard Deviations of Argumentativeness*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	33.00	6.73	12
	Female	32.11	5.65	46
	Total	32.29	5.84	58
Science	Male	29.60	7.03	30
	Female	29.46	4.56	13
	Total	29.56	6.33	43
Regular	Male	27.61	6.56	56
Total	Male	28.88	6.89	98
	Female	31.53	5.50	59
	Total	29.87	6.51	157

Table 4.4.

*Analysis of Variance for Argumentativeness*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>h</i> <sup>2</sup>
School	372.56	2	186.28	4.74	.01	.06
Gender	4.93	1	4.93	.13	.73	.00
Interaction	2.63	1	2.63	.07	.80	.00
Error	5978.24	152	39.33			
Total	6617.45	156				

Finally, a two factor ANOVA test was conducted by including only Foreign Language High School students and Science High School to see the differences between schools affected by gender. However, the effect of gender was not statistically significant at the .05 level in the two schools [ $F(1, 97) = .13, p > .05$ ].

For the comparison between pairs of means, all possible pairwise contrasts were made. In the contrasts, the Bonferroni method was used because equal variances were assumed. The results are summarized in Table 4.5. Table 4.5 shows that the Foreign Language High School produced a higher argumentativeness score than the regular high school at the .05 level.

Table 4.5.

*Pairwise Contrasts for Argumentativeness between Schools Using the Bonferroni Method*

Pairs	Mean	SE	p	Confidence Interval	
				Difference	Lower Bound
Foreign Language and Science	2.74	1.27	.10	-.32	5.79
Foreign Language and Regular	4.69	1.17	.00	1.84	7.53
Science and Regular	1.95	1.27	.38	1.13	5.03

*Mean Differences in Verbal Aggressiveness between Schools*

An analysis of variance was conducted to detect mean differences in verbal aggressiveness among groups. Means and standard deviations are displayed in Table 4.6. Levene's test of equal variances confirmed the assumption of equal variances [ $F(2,152) = 4.90$ ,  $p > .05$ ].

However, the ANOVA failed to detect statistically significant differences in verbal aggressiveness among students of the three schools [ $F(2,152) = .08$ ,  $p > .05$ ] and between male and female students [ $F(1,152) = 2.51$ ,  $p > .05$ ]. Also, the interaction effect was not statistically significant [ $F(1,152) = 2.47$ ,  $p > .05$ ].

Table 4.6.

*Means and Standard Deviations for Verbal Aggressiveness Scale*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	19.92	5.21	12
	Female	16.44	4.09	46
	Total	17.16	4.53	58
Science	Male	18.40	4.36	30
	Female	18.38	5.94	13
	Total	18.40	4.82	43
Regular	Male	18.86	5.07	56
Total	Male	18.85	4.85	98
	Female	16.86	4.58	59
	Total	18.10	4.83	157

Table 4.7.

*Analysis of Variance for Verbal Aggressiveness*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>h2</i>
School	3.67	2	1.84	.08	.92	.00
Gender	56.80	1	56.80	2.51	.16	.02
Interaction	55.86	1	55.81	2.47	.12	.02
Error	3439.36	152	22.63			
Total	3642.37	156				

*Mean Differences in Classroom Climate between Schools*

In order to see how free the students of different groups felt to discuss controversial issues in their classrooms, classroom climate mean scores among groups were compared. Table 4.6 shows the means and standard deviations for classroom climate in the groups. Levene's test of equal variance confirmed the hypothesis that variances are equal [ $F(4,152) = .314, p > .05$ ].

Table 4.8.

*Means and Standard Deviations for Classroom Climate Scale*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	33.67	6.53	12
	Female	33.89	5.40	46
	Total	33.85	5.59	58
Science	Male	29.27	6.37	30
	Female	28.69	6.60	13
	Total	29.09	6.37	43
Regular	Male	28.57	5.67	56
Total	Male	29.41	6.16	98
	Female	32.75	6.03	59
	Total	30.66	6.30	157

An analysis of variance for the classroom climate scale was conducted to see the effects of school, gender and interaction. The results are summarized in Table 4.9. Table 4.9 reports that there is sufficient evidence to reject the null hypothesis that there is no effect of school [ $F(2,152)$

= 7.24,  $p < .05$ ]. A more than medium effect size was detected ( $h^2 = .09$ ). Gender and interaction effects were not statistically significant: [ $F(2,152) = .57, p > .05$ ] and [ $F(1,152) = .09, p > .05$ ], respectively. A two factor ANOVA including only Foreign Language High School students and Science High School revealed that the effect of gender was not statistically significant at the .05 level [ $F(1, 97) = .08, p > .05$ ].

Table 4.9.

*Analysis of Variance for Classroom Climate Scale*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$h^2$
School	499.78	2	249.89	7.24	.00	.09
Gender	.57	1	.57	.02	.90	.00
Interaction	2.97	1	2.97	.09	.77	.00
Error	5249.47	152	34.54			
Total	6191.11	156				

Because equal variances were assumed, the Bonferroni method was used to make all possible pair wise contrasts to see which school produced a higher score for classroom climate. Table 4.10 shows that the Foreign Language High School recorded a higher classroom climate score than the other two schools at the .05 level of statistical significance.

Table 4.10.

*Pairwise Contrasts for Classroom Climate between Schools Using the Bonferroni Method*

Pairs	Mean	SE	p	Confidence Interval	
				Difference	Lower Bound
Foreign Language and Science	4.75	1.18	.00	1.89	7.61
Foreign Language and Regular	5.27	1.10	.00	2.61	7.94
Science and Regular	.53	1.19	1.00	-2.36	3.40

*How Do Students' Reasoning Skills Differ between Different Types of Schools?*

This study measured students' informal reasoning skills by counting the number of claims, valid premises, valid counter premises and valid arguments in addition to scoring students' reasoning quality.

*Mean Differences in the Number of Claims between Schools*

An analysis of variance was performed to compare means of the number of claims produced by students in different groups. Means and standard deviations for the number of claims are summarized as Table 4.11.

Levene's test of equal variance indicated that there was sufficient evidence to reject the null hypothesis of equal variance [ $F(4,148) = 5.54$ ,  $p < .05$ ]. However, because the sample sizes of three groups were similar and the differences of variances were not extreme, a decision was made to proceed with the analysis of variance.

Table 4.11.

*Means and Standard Deviations for the Number of Claims*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	3.17	1.19	12
	Female	2.96	1.05	46
	Total	3.00	1.08	58
Science	Male	3.20	1.42	30
	Female	2.85	.99	13
	Total	3.09	1.31	43
Regular	Male	2.29	.72	52
Total	Male	2.69	1.14	94
	Female	2.93	1.03	59
	Total	2.78	1.10	153

Table 4.12 indicates that there was sufficient evidence to reject the null hypothesis that there were no differences in the number of claims produced by students of the three different schools [ $F(2,148) = .7.86, p < .05$ ]. Effect size was calculated to be .10. On the contrary, there was insufficient evidence to reject the null hypothesis of equal means between male and female students [ $F(1,148) = .1.34, p > .05$ ]. Further, no statistically significant interaction effect was detected [ $F(1,148) = .09, p > .05$ ]. A two factor ANOVA including only Foreign Language High School students and Science High School revealed that the effect of gender was not statistically significant at the .05 level [ $F(1, 97) = .07, p > .05$ ].

Table 4.12.

*Analysis of Variance for the Number of Claims*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>h</i> <sup>2</sup>
School	17.28	2	8.64	7.86	.00	.10
Gender	1.48	1	1.48	1.34	.25	.01
Interaction	.10	1	.10	.09	.77	.00
Error	162.75	148	1.10			
Total	183.88	152				

Because equal variances were not assumed, an alternative solution was necessary to reduce the risk of the Type I error. Olejnik and Lee (1990) reviewed textbooks and a sample of research studies and recommended the Games-Howell procedure among three alternative solutions including Dunnett's C confidence interval and Dunnett's T3 solution. They argued that the Games-Howell method would provide a valid test for most research studies. Table 4.13 shows the results of all possible pair wise contrasts using the Games-Howell method.

The mean differences between Foreign Language High School and the regular high school, and between Science High School and the regular high school were statistically significant at the .05 level.

Table 4.13.

*Pairwise Contrasts for the Number of Claims between Schools Using the Games-Howell Method*

Pairs	Mean	SE	p	Confidence Interval	
				Difference	Lower Bound
Foreign Language and Science	-.09	.21	.92	-.68	.49
Foreign Language and Regular	.71	.17	.00	.30	1.12
Science and Regular	.80	.22	.00	.27	1.34

*Mean Differences in the Number of Valid Premises between Schools*

The numbers of valid premises produced by students in the different groups were compared. Means and standard deviations are summarized in Table 4.14. Before the ANOVA, Levene's test of equal variances was conducted. It indicated that there was sufficient evidence to reject the null hypothesis of equal variance [ $F(4,148) = 4.93, p < .05$ ]. However, because the sample sizes of the three groups are similar and the differences in variances were not extreme, a decision was made to proceed with the analysis of variance.

Table 4.14.

*Means and Standard Deviations for the Number of Valid Premises*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	4.25	1.91	12
	Female	3.87	1.72	46
	Total	3.97	1.75	58
Science	Male	2.90	1.35	30
	Female	3.57	1.20	13
	Total	3.09	1.32	43
Regular	Male	2.00	1.10	52
Total	Male	2.54	1.50	94
	Female	3.80	1.61	59
	Total	3.05	1.65	153

The results of the ANOVA are summarized in Table 4.15. The analysis of variance suggested that there was sufficient evidence to reject the null hypothesis of equal means in the number of valid premises produced by students in the three different schools [ $F(2,148) = 13.32$ ,  $p < .05$ ]. A moderately big effect size was calculated ( $\eta^2 = .15$ ). On the contrary, there was insufficient evidence to reject the null hypothesis of equal means between male and female students [ $F(1,148) = .15$ ,  $p > .05$ ]. Further, no statistically significant effects of interaction were detected [ $F(1,148) = 2.34$ ,  $p > .05$ ]. A two factor ANOVA including only Foreign Language High School students and Science High School revealed that the effect of gender was not statistically significant at the .05 level [ $F(1, 97) = 1.92$ ,  $p > .05$ ].

Table 4.15.

*Analysis of Variance for the Number of Valid Premises*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>h</i> <sup>2</sup>
School	54.97	2	27.49	13.32	.00	.15
Gender	.31	1	.31	.15	.70	.00
Interaction	4.82	1	4.82	2.34	.13	.02
Error	305.40	148	2.06			
Total	414.68	152				

All possible pair wise contrasts were performed to see which school outperformed the others in producing valid premises. The contrasts were made using the Games-Howell Method because equal variances were not assumed. The results are summarized in Table 4.16.

Table 4.16.

*Pairwise Contrasts for the Number of Valid Premises between Schools Using the Games-Howell Method*

Pairs	Mean	<i>SE</i>	<i>p</i>	Confidence Interval	
	Difference			Lower Bound	Upper Bound
Foreign Language and Science	.86	.31	.02	.13	1.58
Foreign Language and Regular	1.95	.28	.00	1.29	2.61
Science and Regular	1.09	.25	.00	.49	1.70

*Mean Differences in the Number of Valid Counter Premises among Groups*

Counter premises provide principles or evidence suggesting that a claim is not true. The numbers of valid counter premises produced by students of different groups were compared. Means and standard deviations of the number of valid counter premises are presented in Table 4.17.

Table 4.17.

*Means and Standard Deviations for the Number of Valid Counter Premises*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	2.33	1.15	12
	Female	2.33	1.70	46
	Total	2.33	1.59	58
Science	Male	2.10	1.30	30
	Female	1.92	1.44	13
	Total	2.05	1.33	43
Regular	Male	1.10	1.03	52
Total	Male	1.57	1.25	94
	Female	2.24	1.64	59
	Total	1.83	1.45	153

Levene's test of equal variances indicated that there was sufficient evidence to reject the null hypothesis of equal variances [ $F(4,148) = 3.08, p < .05$ ]. However, because the sample

sizes of the three groups were similar and the differences of variances were not extreme, a decision was made to proceed with the analysis of variance.

The results of ANOVA were summarized in Table 4.18. The ANOVA provided sufficient evidence to reject the null hypothesis of equal means in the number of valid counter premises produced by students in the three different schools [ $F(2,148) = 7.04, p < .05$ ]. A medium level effect size was reported ( $h^2 = .09$ ). On the contrary, there was insufficient evidence to reject the null hypothesis for equal means between genders [ $F(1,148) = .09, p > .05$ ], and the interaction effect was not statistically significant [ $F(1,148) = .07, p > .05$ ]. A two factor ANOVA including only Foreign Language High School students and Science High School students revealed that the effect of gender was not statistically significant at the .05 level [ $F(1, 97) = .07, p > .05$ ].

Table 4.18.

*Analysis of Variance for the Number of Valid Counter Premises*

Source	SS	df	MS	F	p	$h^2$
School	25.96	2	12.98	7.04	.00	.09
Gender	.16	1	.16	.09	.77	.00
Interaction	.13	1	.13	.07	.79	.00
Error	272.92	148	1.84			
Total	317.58	152				

All possible pair wise contrasts were performed using the Games-Howell method because equal variance was not assumed (see Table 4.19). The contrasts suggested that students of the

Foreign Language High School and Science High School produced more counter premises than students of the regular type public high school.

Table 4.19.

*Pairwise Contrasts for the Number of Valid Counter Premises between Schools Using the Games-Howell Method*

Pairs	Mean	SE	p	Confidence Interval	
				Difference	Lower Bound
Foreign Language and Science	.28	.27	.60	-.41	.97
Foreign Language and Regular	1.23	.25	.00	.63	1.83
Science and Regular	.95	.25	.00	.36	1.54

*Mean Differences in the Number of Valid Arguments among Groups*

The number of arguments indicates the number of claim-premise linkages made by students. Table 4.20 summarizes the means and standard deviations of the number of valid arguments produced by different groups of students.

Levene's test of equal variances suggested that there was sufficient evidence to reject the null hypothesis of equal variance [ $F(4,148) = 3.73, p < .05$ ]. Because the sample sizes of the three groups were similar and the differences of variances were not extreme, the analysis of variance was conducted.

Table 4.20.

*Means and Standard Deviations for the Number of Valid Arguments*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign Language	Male	7.00	2.86	12
	Female	6.24	2.89	46
	Total	6.40	2.88	58
Science	Male	5.13	2.18	30
	Female	5.54	2.03	13
	Total	5.26	2.12	43
Regular	Male	3.14	1.67	52
Total	Male	4.27	2.43	94
	Female	6.08	2.72	59
	Total	4.97	2.69	153

The results of ANOVA are summarized in Table 4.21. The ANOVA provided sufficient evidence to reject the null hypothesis of equal means among three different schools [ $F(2,148) = 17.04, p < .05$ ]. A moderately big effect size was calculated to be .19. However, the ANOVA failed to detect statistically significant effects for gender [ $F(1,148) = .11, p > .05$ ], and the interaction of the two independent variables [ $F(1,148) = 1.18, p > .05$ ]. A two factor ANOVA including only Foreign Language High School students and Science High School revealed that the effect of gender was not statistically significant at the .05 level [ $F(1, 97) = .09, p > .05$ ].

Table 4.21.

*Analysis of Variance for the Number of Valid Arguments*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	<i>h</i> <sup>2</sup>
School	183.11	2	91.55	17.04	.00	.19
Gender	.59	1	.59	.11	.74	.00
Interaction	6.31	1	6.31	1.18	.28	.01
Error	795.13	148	5.37			
Total	1098.84	152				

All possible pair wise contrasts were made using the Games-Howell method because equal variances were not assumed. As seen in Table 4.22, statistically significant mean differences were detected between the Foreign Language High School and the Science High School, Foreign Language High School and the regular high school, and the Science High School and the regular high school.

Table 4.22.

*Pairwise Contrasts for the Number of Valid Arguments between Schools Using the Games-Howell Method*

Pairs	Mean	SE	p	Confidence Interval	
				Difference	Lower Bound
Foreign Language and Science	1.14	.50	.06	-.04	2.32
Foreign Language and Regular	3.26	.44	.00	2.21	4.32
Science and Regular	2.12	.40	.00	1.17	3.07

*Mean Differences in the Quality of Arguments between Schools*

The quality of argument is the average score of arguments made by each student. Each argument was rated according to guidelines presented in Chapter 3. Table 4.23 shows means and standard deviations of the quality of arguments.

Levene's test of equal variances indicated that there was insufficient evidence to reject the null hypothesis of equal variance [ $F(4,148) = 1.54, p > .05$ ]. The ANOVA test (see Table 4.24) revealed that there was sufficient evidence to reject the null hypothesis of equal means among students of the three schools [ $F(2,148) = 6.67, p < .05$ ]. A medium effect size was detected ( $h^2 = .08$ ). However, the influence of gender and interaction turned out not to be statistically significant: [ $F(1,148) = 3.02, p > .05$ ], and [ $F(1,148) = .65, p > .05$ ], respectively. Further, a two factor ANOVA excluding the regular public school revealed that the effect of gender was not statistically significant at the .05 level [ $F(1, 97) = 2.95, p > .05$ ].

Table 4.23.

*Means and Standard Deviations of the Quality of Arguments*

School	Gender	<i>M</i>	<i>SD</i>	<i>n</i>
Foreign	Male	.23	.05	12
Language	Female	.28	.10	46
	Total	.27	.09	58
Science	Male	.18	.08	30
	Female	.20	.08	13
	Total	.18	.08	43
Regular	Male	.17	.08	52
Total	Male	.18	.08	94
	Female	.26	.10	59
	Total	.21	.10	153

Table 4.24.

*Analysis of Variance for the Quality of Arguments*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$\bar{h}^2$
School	.10	2	.05	6.67	.00	.08
Gender	.02	1	.02	3.02	.08	.02
Interaction	.05	1	.01	.65	.42	.00
Error	1.12	148	.01			
Total	1.49	152				

All possible pair wise contrasts were made using the Bonferroni method because equal variances were assumed. The results indicate that students of Foreign Language High School recorded higher argument quality scores than students of the other two schools (see Table 4.25).

Table 4.25.

*Pairwise Contrasts for the Quality of Arguments between Schools Using the Bonferroni Method*

Pairs	Mean	SE	p	Confidence Interval	
				Difference	Lower Bound
Foreign Language and Science	.09	.02	.00	.05	.13
Foreign Language and Regular	.10	.02	.00	.06	.14
Science and Regular	.01	.02	.76	-.03	.05

*How Do the Four Variables of Classroom Culture Correlate?*

Table 4.26 displays the linear relationships between the classroom cultural factors and informal reasoning skills. Variables of classroom culture correlated with each other and argumentation skills at statistically significant levels where  $p < .05$ . Epistemological beliefs correlated positively with verbal aggressiveness ( $r = .27, p < .05$ ) and negatively with argumentativeness ( $r = -.25, p < .05$ ) and classroom climate ( $r = -.17, p < .05$ ). If one's epistemology tended to be naïve, then one's locus of attack was more likely to be another person's self-concept. Those who had a more sophisticated epistemology were more likely to

participate in the argumentation and felt freer to express their opinion about social issues in the classroom.

In addition to epistemological beliefs, classroom climate had statistically significant linear relationships with other cultural factors. Classroom climate correlated positively with argumentativeness ( $r = .32, p < .05$ ) and negatively with verbal aggressiveness ( $r = -.17, p < .05$ ). This means that those who felt freer to talk about social issues in the classroom tended to participate more in argumentation and their locus of attack was less likely to be another person's self-concept.

Table 4.26.

*Correlation Matrix on Classroom Cultural Factors and Argumentation Skills*

	EB	A	VA	CC	NC	NP	NCP	NA	QA
Epistemic Beliefs (EB)	-								
Argumentativeness (A)	-.25*	-							
Verbal Aggressiveness (VA)	.27*	-.07	-						
Classroom Climate (CC)	-.17*	.32*	-.17*	-					
Number of Claims (NC)	-.06	.02	-.06	.10	-				
Number of Valid Premises (NP)	-.18*	.21*	-.03	.22*	.30*	-			
Number of Counter-Premises (NCP)	-.12	.24*	-.08	.13	.20*	.39*	-		
Number of Valid Arguments (NA)	-.18*	.27*	-.06	.20*	.30*	.86*	.79*	-	
Quality of Argument (QA)	-.21*	.32*	-.20*	.29*	.09	.60*	.42*	.61*	-

\*  $p < .05$ , two-tailed.

*How Do Students' Epistemological Beliefs, Perceptions of Classroom Climate, Argumentativeness, and Verbal Aggressiveness Correlate with Their Argumentation Skills?*

The correlation analysis indicated statistically significant relationships between classroom cultural factors and argumentation skills. Epistemological beliefs had negative linear relationships with the number of valid premises ( $r = -.18, p < .05$ ), the number of valid arguments ( $r = -.18, p < .05$ ), and the quality of reasoning ( $r = -.21, p < .05$ ). This means that those who were more naive in their epistemologies produced fewer premises and arguments and lower quality arguments.

Argumentativeness correlated positively with informal reasoning skills. The more argumentative students produced more valid premises ( $r = .21, p < .05$ ), valid counter premises ( $r = .24, p < .05$ ), and valid arguments ( $r = .27, p < .05$ ) and they produced higher quality arguments ( $r = .32, p < .05$ ).

Verbal aggressiveness had a negative correlation with quality of arguments ( $r = -.20, p < .05$ ). Those who were more likely to focus on another person's self-concept produced lower quality arguments.

Classroom climate correlated positively with the number of valid premises ( $r = .22, p < .05$ ), the number of valid arguments ( $r = .20, p < .05$ ) and the quality of arguments ( $r = .29, p < .05$ ). This means that those who felt freer to talk about social issues in their classrooms produced more valid premises and arguments and higher quality of arguments.

*What Are the Best Predictors of Students' Argumentation Skills?*

The correlation analysis revealed that independent variables affecting the quality of informal reasoning skills correlated with each other. This means that the effect of each variable could be smaller than suggested by correlation coefficients. In order to identify which variables

can adequately explain the quality of informal reasoning skills, multiple regression analysis was conducted.

As a method of variable selection, this study used “directed search on  $t$ ” as an alternative to all possible regression. Many researchers have recommended examining all possible regression models as an alternative to the stepwise method (Thomson, 1995). However, selecting the best set of variables from among a large number of possible solutions is still complicated and the success rate in identifying the authentic variables is not very high when the number of predictors is large (Olejnik, Mills, & Keselman, 2000). Given that limitation, the variable selection based on “direct search on  $t$ ” provides a simpler solution by considering the absolute values of  $t$  in advance. The absolute value of  $t$  is related to the possibility that the slope of a predictor is not zero. The greater the absolute value of  $t$ , the likelihood that the slope is zero is smaller.

This method of variable selection first runs a full model regression, then the variables are ordered by the absolute value of  $t$  ( $|t|$ ). Next, separate regression equations are computed by sequentially adding one variable at a time in the rank order of the variables. Finally, the best equation is chosen based on particular criteria such as  $C_p$  statistics.

Mallow’s  $C_p$  statistics is one of the most frequently used methods of evaluating regression models with the adjusted  $R^2$  (Olejnik et al., 2000).  $C_p$  is a measure of bias (Montgomery & Peck, 1992, pp. 272-274).  $C_p$  is  $k+1$  when the model bias is 0. In the “direct search on  $t$ ” method, the model with the smallest  $C_p$  value is defined as the best subset of predictors (Daniel & Wood, 1980). By contrast, in the case of adjusted  $R^2$ , the model with the largest value is defined as the best model. In the present study, the  $C_p$  statistic was used to identify the best subset of predictors.

### *Predictors of the Number of Valid Premises*

Before a multiple regression was conducted to figure out the best predictors of the number of valid premises, a diagnostic check was performed to identify outliers, the influential and inaccurate data points with large residuals. In the present study, Dfbeta and Cook's distance were calculated to identify unusual data points. Dfbeta indicates the difference between the regression coefficients when the specific case is included or excluded. Cook's distance measures the change in dependent variable when the specific case is deleted. However, no data point was bigger than 1 in Dfbeta and Cook's distance; no data point influenced the regression slope. Next, collinearity statistics were examined to see if there was any serious inflation of the variance of  $b$  (regression coefficient) caused by correlation between independent variables. The variance inflation factor (VIF) was computed close to the minimum value (1.00) with 1.21 for school, 1.15 for epistemological beliefs, 1.23 for verbal aggressiveness, and 1.25 for classroom climate. Therefore, there was no serious inflation of variance.

A full model regression was performed to calculate  $t$ -statistics of each predictor's coefficients for the number of valid premises when all the predictors were included in the regression equation. Based on the absolute value of  $t$ , variables were ordered in the sequence of school ( $|t| = 6.13$ ), epistemological beliefs, ( $|t| = 1.62$ ), verbal aggressiveness ( $|t| = 1.12$ ), argumentativeness ( $|t| = .48$ ), and classroom climate ( $|t| = .38$ ). According to this sequence, a regression analysis was conducted to compare the efficiencies of different models. The results are summarized in Table 4.27.

If we select the best model in terms of  $C_p$  statistics, the model with the smallest  $C_p$  statistics included school and epistemological beliefs. The  $C_p$  statistic of this model was 1.67. The adjusted  $R^2$  for this model was .25. The regression equation of this model was  $Y = 5.993 -$

$.943X1 - .022X2$  ( $X1 = \text{School}$ ,  $X2 = \text{Epistemological beliefs}$ ). Therefore, we can conclude that school and epistemological beliefs were the best predictors of the number of valid premises.

Table 4.27.

*Regression Models for the Number of Valid Premises*

Model	Adjusted $R^2$	$C_p$
School	.25	2.21
School, Epistemology	.25	1.67
School, Epistemology, Aggressiveness	.25	2.48
School, Epistemology, Aggressiveness, Argumentativeness	.25	4.14
School, Epistemology, Aggressiveness, Argumentativeness, Classroom climate	.25	6.00

$$Y = 5.993 - .943X1 - .022X2$$

$X1 = \text{School}$

$X2 = \text{Epistemological beliefs}$

*Predictors of the Number of Valid Counter-Premises*

A multiple regression was performed to find the best predictors of the number of valid counter premises. Standardized Dfbeta and Cook's distance statistics identified no influential data points to the regression slope. Collinearity statistics suggested that there was no serious inflation of variance with VIF ranging from 1.11 to 1.25.

A full model regression calculated the  $t$  statistics of each predictor's coefficients for the number of valid counter premises. Absolute values of  $t$  ordered predictors in the sequence of school ( $|t| = 3.92$ ), argumentativeness ( $|t| = 1.70$ ), classroom climate ( $|t| = .59$ ), epistemological beliefs ( $|t| = .52$ ), and verbal aggressiveness ( $|t| = .05$ ).

Following this sequence, a regression analysis was conducted to compare the efficiencies of different models. The results are summarized in Table 4.28.

Table 4.28.

*Regression Models for the Number of Valid Counter Premises*

Model	Adjusted $R^2$	$C_p$
School	.12	1.76
School, Argumentativeness	.14	.60
School, Argumentativeness, Classroom climate	.13	2.31
School, Argumentativeness, Classroom climate, Epistemology,	.13	4.00
School, Argumentativeness, Classroom climate Epistemology, Aggressiveness	.12	6.00

$$Y = 1.934 - .539X_1 + .032X_2$$

$X_1 =$  School

$X_2 =$  Argumentativeness

The regression equation that included school and argumentativeness resulted in the smallest  $C_p$  value ( $C_p = .60$ ). The adjusted  $R^2$  for this model was .14, which is the largest among

models. The regression equation of this model was  $Y = 1.934 - .539X1 + .032X2$  ( $X1$ = school,  $X2$ = argumentativeness). We can conclude that school and argumentativeness were the most influential factors for the number of counter premises.

#### *Predictors of the Number of Valid Arguments*

In order to investigate each predictor's partial regression coefficients for the number of valid arguments, a multiple regression was conducted. Dfbeta and Cook's distance statistics identified no unusual data points. VIFs were close to the minimum value 1.00 with a range from 1.11 to 1.25. Based on absolute values of  $t$ , independent variables were rank ordered in the sequence of school ( $|t| = 6.33$ ), epistemological beliefs ( $|t| = 1.50$ ), argumentativeness ( $|t| = 1.37$ ), verbal aggressiveness ( $|t| = .80$ ), and classroom climate ( $|t| = .29$ ). A regression analysis was conducted by adding variables sequentially in the rank order of the variables. The results are summarized in Table 4-29.

Table 4.29.

#### *Regression Models for the Number of Valid Arguments*

Model	Adjusted $R^2$	$C_p$
School	.26	3.38
School, Epistemology	.27	2.55
School, Epistemology, Argumentativeness	.27	2.77
School, Epistemology, Argumentativeness, Aggressiveness	.27	4.08
School, Epistemology, Argumentativeness, Aggressiveness Classroom climate	.27	6.00

$$Y = 9.914 - 1.574X_1 + .038X_2$$

$X_1$  = School

$X_2$  = Epistemological beliefs

The regression equation with the smallest  $C_p$  value includes school and epistemological beliefs ( $C_p = 2.55$ ). The adjusted  $R^2$  for this model is .27. The regression equation of this model is  $Y = 9.914 - 1.574X_1 + .038X_2$  ( $X_1$ =school,  $X_2$ =epistemological beliefs). The results of the regression suggested that the best predictors of the number of valid arguments were school and epistemological beliefs.

#### *Predictors of the Quality of Arguments*

A full model regression that included all variables was performed to figure out coefficients of t-statistics for the quality of arguments. Dfbeta and Cook's distance statistics identified no data points influential to the regression slope. VIFs were close to 1.00 with a range from 1.11 to 1.25. The rank order of variables based on the absolute value of t is from school ( $|t| = 4.36$ ), argumentativeness ( $|t| = 1.16$ ), epistemological beliefs ( $|t| = 1.16$ ), verbal aggressiveness ( $|t| = 1.15$ ) and classroom climate ( $|t| = 1.11$ ).

A regression analysis was conducted by entering predictors sequentially in the rank order of variables; the results are presented in Table 4.30.

The equation model with the smallest  $C_p$  value included school, epistemological beliefs, and argumentativeness ( $C_p = 4.78$ ). The adjusted  $R^2$  for this model is .23. The regression equation is  $Y = .289 + .045X_1 + .003X_2 + .001X_3$  ( $X_1$ =school,  $X_2$ =argumentativeness,  $X_3$  epistemological beliefs). These results of regression analysis suggest that school,

epistemological beliefs, and argumentativeness were the most influential factors on the quality of arguments produced by Korean high school students.

Table 4.30.

*Regression Models for the Quality of Arguments*

Model	Adjusted $R^2$	$C_p$
School	.19	10.92
School, Argumentativeness	.23	5.33
School, Argumentativeness, Epistemology	.23	4.78
School, Argumentativeness, Epistemology, Aggressiveness	.24	5.24
School, Argumentativeness, Epistemology, Aggressiveness, Classroom climate	.24	6.00

$$Y = .289 + .045X_1 + .003X_2 + .001X_3$$

$X_1$  = School

$X_2$  = Argumentativeness

$X_3$  = Epistemological beliefs

*Summary*

The results of the data analysis indicated that, first, the three schools differed in their students' argumentativeness and classroom climates. The pair wise contrasts indicated that the Foreign Language High School students were more argumentative than the regular public high

school students and felt freer to talk about social issues in their classrooms than the other two schools' students do.

Second, the three schools differed in students' skills of informal reasoning. Statistically significant mean differences were detected in the number of claims, valid premises, valid counter premises, valid arguments, and the quality of arguments. The pair wise contrasts revealed that the Foreign Language High School students produced more premises and arguments than the other two schools' students and their quality of arguments were higher than those of students in the other schools. Further, the Foreign Language High School students produced more claims and counter premises than students at the regular public school. Science High School students outperformed students of the regular high school in the number of claims, valid premises, valid counter premises, and valid arguments.

Third, the four classroom cultural factors correlated with each other. If one's epistemology tended to be naive, then one's locus of attack was more likely to be another person's self-concept. Students having more sophisticated epistemologies were more likely to participate in argumentation and felt freer to express their opinions about social issues in the classroom. Further, those who felt freer to talk about social issues in the classroom tended to participate more in argumentation and their locus of attack was less likely to be another person's self-concept.

Fourth, classroom cultural factors correlated with students' informal reasoning skills. First, students who were more naive in their epistemologies produced fewer premises and arguments and lower quality arguments. Second, more argumentative students tended to produce more valid premises, valid counter premises, and valid arguments and higher quality arguments. Third, students who focused on another person's self-concept tended to produce lower quality

arguments. Fourth, students who felt freer to talk about social issues in the classroom produced more valid premises and arguments and higher quality arguments.

Fifth, when the partial regression coefficients of the independent variables were compared, school turned out to be the most important predictor of students' informal reasoning skills. School predicted best the number of valid premises, valid counter premises and valid arguments in addition to the quality of arguments. Epistemological beliefs were the second important predictor of informal reasoning skills. It contributed to explaining the number of valid premises and valid arguments and the quality of arguments. Argumentativeness was another important predictor of informal reasoning skills. It contributed to explaining the number of valid counter premises and the quality of arguments.

## CHAPTER 5

### CONCLUSIONS

The study reported here examined the relationship between classroom culture and Korean high school students' informal reasoning abilities. Classroom culture was represented by four factors: epistemological beliefs, argumentativeness, verbal aggressiveness and classroom climate. The four classroom cultural factors indicate students' dispositions related to the way they conceptualize such behaviors as knowing, arguing and communicating. Students' informal reasoning skills were measured by assessing the number and quality of arguments produced by them.

In addition to the relationship between classroom culture and students' informal reasoning abilities, the present study addressed four other research questions: (a) How do the four classroom cultural factors correlate with each other? (b) How do four classroom cultural variables differ between different student groups? (c) How do students' reasoning skills differ between different student groups? (d) What are the best predictors of students' informal reasoning skills?

To answer these questions, the present study administered a questionnaire and an essay test. The questionnaire included four instruments measuring students' dispositions related to four classroom cultural factors. The epistemological beliefs scale examined how students think about knowing and learning, sources and processes of knowledge and learning, and ability related to knowing and learning. The argumentativeness scale measured students' tendency to be engaged in argumentation. The verbal aggressiveness scale measured the tendency related to the locus of attack during argumentation. Classroom climate measured the extent to which students

feel free to address their opinions about social issues in their classrooms. The essay test asked students to produce arguments about two controversial social issues.

Participants of the present study were selected from three different types of college preparatory schools located in urban areas of Korea: Foreign Language High School, Science High School, and regular type public school. The three different types of schools are differentiated by their curricula and instructional atmosphere. Most students display the characteristics of “privileged groups” described by Reich (1991) in terms of their academic abilities and their parents’ socio-economic status.

### *Discussion of Results*

#### *Correlation between Classroom Cultural Factors and Informal Reasoning Skills*

The four classroom cultural factors have been neglected as factors affecting students’ reasoning skills in previous studies. It is hard to find studies examining the relationship between these four factors and students’ argumentation skills. Only Levine and Boster (1996) investigated the relationship between argumentativeness and the number of arguments constructed. They reported that more argumentative subjects produced more arguments.

The data analysis of the present study indicated that these four classroom cultural factors were correlated with students’ informal reasoning skills. Students with more sophisticated epistemologies produced more premises and arguments and the quality of their arguments tended to be better than students with less sophisticated epistemologies. Further, argumentativeness correlated positively with the number of arguments produced and the quality of arguments, while verbal aggressiveness correlated negatively with students’ informal reasoning skills. These results are consistent with those of Levine and Boster (1996). Classroom climate also correlated positively with the number of arguments and the quality of reasoning.

### *Correlations between Cultural Factors*

The present study also investigated the relationships between the four classroom cultural factors. The data analysis indicated that students who had more sophisticated epistemologies were more argumentative and less verbally aggressive, and they felt freer to express their opinions about social issues in their classrooms. The more argumentative students tended to be less verbally aggressive and felt freer to express their opinions about social issues. Classroom climate and verbal aggressiveness correlated negatively.

Previous studies focused only on the relationship between argumentativeness and verbal aggressiveness. For example, Sanders et al. (1992) reported negative correlations between argumentativeness and verbal aggressiveness. The result of their study is consistent with the present study. However, some studies on adolescent groups reported contradictory results. In these studies, verbal aggressiveness and argumentativeness correlated positively among adolescents (see Roberto & Wilson, 1996; Roberto & Finucane, 1997). The researchers of these studies interpreted the results as due to variable intellectual abilities of the subjects (Roberto & Finucane, 1997). Secondary school students used in these studies represented almost the entire range of ability groups while the adult samples used in other studies were much more restricted in intellectual abilities. The present study used homogeneous samples in terms of their intellectual abilities, and the relationship between argumentativeness and verbal aggressiveness was negative.

### *Academic Environments, Classroom Culture and Informal Reasoning*

Subjects in the present study were homogeneous but exceptional in their academic abilities. Students of the three high schools passed through a very competitive selection process. Most of the students ranked in the top 5 to 10 percent of middle school grade point averages.

However, students of the three schools differed in their argumentativeness and classroom climate. Foreign Language High School students were more argumentative and felt freer to express their opinions about social issues than students of the other two schools.

The present study examined the differences in the schools' academic environments and assessed differences in argumentativeness and classroom climate between the schools. As Jehng et al. (1993) reported, academic environment was related to students' dispositions related to classroom culture such as epistemological beliefs. The curricula and instructional atmospheres of the three schools varied. The Foreign Language High School emphasized "soft fields," including social sciences and humanities, while Science High School emphasized "hard fields" including math and sciences. Consequently, the foreign language high school assigned and allowed more discussion of social issues than the other schools. The regular public school maintained a balance between "soft fields" and "hard fields" but it put greater effort into the preparation for college entrance exams. In an interview with the researcher, a social studies teacher at the regular public school admitted that the class activities in the school are mostly centered on knowledge transmission and acquisition of test taking strategies. According to her, free discussions about social issues are seldom expected to occur in classrooms. In contrast, Foreign Language High School and Science High School students were relatively free from the burden of preparing for college entrance exams, because the majority of students in these schools receive favors (i.e., exemption of entrance exam and extra points in GPA) when they apply for colleges to major in language arts or natural sciences. A male social studies teacher in the Foreign Language High School said to the researcher that he could put some effort into engaging students in discussion about social issues in his classroom, because he received less pressure for test preparation. A social studies teacher in the Science High School also admitted that he

received less pressure for college entrance exam preparation than when he had worked in other regular public schools.

School type also correlated with students' informal reasoning skills. A multiple regression analysis indicated that the school type was the best predictor of students' performance in argumentation. Pair wise contrasts revealed that Foreign Language High School students performed better than the other two schools' students in most aspects of argumentation skills. Science High School students stated more premises and arguments than the regular public school students.

Considering that students of the three schools are homogeneous in their academic abilities, school curriculum and instructional atmosphere are crucial to the development of informal reasoning skills. The curriculum of Foreign Language High School provides more chances to discuss social issues than the other two types of schools. In contrast, the curriculum of the regular public school is driven by preparation for college entrance exams and their instructional practices are centered on knowledge transmission rather than the free discussion of social issues. These results suggest that informal reasoning skills are more closely related to academic environments in which various social issues are freely discussed than to individuals' intellectual abilities.

### *Implications*

#### *Methodological Issues*

The present study employed an alternative method to evaluate the quality of informal reasoning. Previous studies failed to provide a systematic, concrete and replicable method for argument evaluation (see Perkins, 1985b; Parker, 1989; Kuhn, 1991; Furlong, 1993; Means & Voss, 1996). Based on Grennan's (1997) suggestion, the present study developed a procedure

for rating arguments. The researcher and co-rater devised supplemental guidelines for rating premises and inferences. While Grennan's rating schemes focus on whether premises and inferences are true or false, these guidelines consider whether premises include sufficient information to determine the truthfulness of premises. A premise might be possibly true but was rated low if it did not provide enough information for the raters to determine its truthfulness. Further, the guidelines of this study evaluate usefulness of premises in relation to claims. If a premise had no connection to the claim, it was classified as a non-valid premise no matter how specific the information the premise provided. Also, the quality of inferences was evaluated in relation to information given by premises. If a premise provided a specific explanation about how the information in the premise helped to prove the truthfulness of a claim, the quality of the inference was rated high. The guidelines resulted in a comparatively high inter-rater reliability; the intra class coefficient alpha was .75. However, in order to increase the quality and utility of this rating system, it should be used in different settings, especially in different cultures using different languages.

The present study assessed epistemological beliefs using a scale based on Schommer's work (1990). However, this study failed to reproduce the theoretical factor structure of epistemological beliefs suggested by Schommer (1990). In this study, as in other studies using a translated version of the questionnaire (Lodewijk et al., 1999; Clarebout et al., 2001), the proposed five dimensions of epistemological beliefs were not completely independent of each other. More instrument development work is needed.

Finally, the data collection method could be a focus of interest in future research. The presented study evaluated students' argumentation skills based on their written statements. Written statements have advantages as a form of data when compared to verbal statements.

Subjects can be more careful and follow guidance more easily when they produce arguments. The procedure of data analysis can be more convenient. However, verbally expressed arguments are closer to natural arguments observed in everyday situations. Further, subjects may display different qualities of argumentation when they produce arguments verbally. A comparison of results between verbal argumentation and written argumentation needs to be planned in future research.

### *Research Implications*

To generalize the present findings about the relationships between informal reasoning skills and factors related to classroom culture, future research needs to include the following considerations. First, replicate the current research design in Korea and other cultural settings. The present study recruited research participants from specific schools in a specific culture. Consequently, the findings from this specific setting are hard to generalize with confidence. Further, investigation of the relationships between the five independent factors utilized in the present study and informal reasoning skills has been neglected in previous studies. Therefore, subsequent studies should continue to examine the relationships between these classroom cultural factors and informal reasoning skills.

Second, investigate the relationship between educational practice and the development of informal reasoning skills. The present study suggested that school curriculum and instructional environments might affect students' argumentation skills. However, the question of which aspects of educational practices are influential has not been answered yet. Especially, the effects of specific training programs on the development of argumentation skills need to be examined. Such activities as asking students to provide reasons for their claims and having them to suppose counterarguments could be parts of a training program for the development of informal

reasoning. For example, Cho and Jonassen (2002) reported that online argumentation scaffolds based on Toulmin's model of argument had positive effects on college students' generation of coherent arguments.

In order to investigate causal effects of specific educational treatments on informal reasoning skills or classroom cultural dispositions, experimental studies are necessary. For example, students treated with particular instructional programs can be compared with control groups to investigate how those programs improve students' argumentation skills or their epistemological beliefs, argumentativeness, and verbal aggressiveness. Another experimental design can be planned to observe students' changes in argumentation skills and classroom cultural dispositions after being exposed to different instructional environments in which free discussion about controversial issues is or is not encouraged.

Third, investigate students' attitudes and patterns of arguments. Statements using *ad hominem* arguments or including emotionally aggressive expressions were excluded in the present study's analysis. Such statements as "Why are you asking me such a foolish question?" or "They would say so because they are selfish" were rated as zero because these statements did not provide any relevant premises helpful in assessing the truthfulness of claims. However, these types of statements are commonly used in everyday arguments, and they should to be studied. For example, are there relationships between uses of *ad hominem* arguments and the overall quality of informal reasoning skills or classroom cultural dispositions? Particular types of arguments found among different groups of students could be another intriguing research topic.

Fourth, consider how the effects of the three schools' selection processes might be separated from academic environments. The Foreign Language Schools and Science High Schools recruit students who are talented in different subject fields. Foreign Language High

School students might perform better in producing arguments not just because of the academic environments, but also because they were talented already in addressing their opinions about social issues. This question also could be answered by experimental studies investigating the effects of different instructional environments between groups of students talented in the same field.

Fifth, compare the three types of schools' instructional atmospheres to figure out whether they made differences in their students' informal reasoning skills. Such concepts as "classroom thoughtfulness" suggested by Newmann (1990) could be used as criteria for comparing characteristics of classroom practices displayed in different types of schools (see Onosko, 1990). In addition to assessing their classroom thoughtfulness, qualitative approaches including classroom observation and in-depth interviews with students and teachers would provide helpful insights about creating classroom atmospheres in which thoughtful argumentation is encouraged.

#### *Educational Implications*

The present correlational study suggests that educational environments might affect students' classroom cultural dispositions and their argumentation skills. Students with high academic abilities often fail to provide appropriate evidence or principles supporting their claims in academic environments in which free discussions about controversial issues are not encouraged. Some students tend to display naive conceptions of knowing and learning and negative attitudes toward argumentation and classroom discussions. Students who produce low quality arguments and possess cultural dispositions that do not support argumentation might benefit from direct instruction on argumentation. Several researchers have advocated direct instruction on argumentation (Cerbin, 1988; Sanders, Wiseman, & Gass, 1994; Cho & Jonassen, 2002). Also, several social studies instructional models, including the "jurisprudential approach"

incorporate argumentation procedures, such as providing reasons for claims and supposing counterarguments, as essential parts of those programs and recommend that these cognitive skills be taught explicitly (VanSickle & Hoge, 1989). By providing students with environments that support free discussion of controversial issues and direct instruction on argumentation skills, students might develop their own informal reasoning abilities.

## REFERENCES

- Anyon, J. (1980). Social class and the hidden curriculum of work. *Journal of Education*, *162*, 67-92.
- Barratt, B. B. (1975). Training and transfer in combinatorial problem solving: The development of formal reasoning during early adolescence. *Developmental Psychology*, *11*, 700-704.
- Behn, R. D., & Vaupel, J. W. (1982). *Quick analysis for busy decision makers*. New York: Basic Books.
- Bendixen, L. D., Schraw, G., & Dunkel, M.E. (1998). Epistemic beliefs and moral reasoning. *The Journal of Psychology*, *132*(2), 187-200.
- Billig, M. (1996). *Arguing and thinking: A rhetorical approach to social psychology*. New York: Cambridge University Press.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, *18*(1), 32-41.
- Bruning R. H., Schraw, G. J., & Ronning R. R. (1995). *Cognitive psychology and instruction*. Upper Saddle River, NJ: Prentice Hall.
- Byrnes, J. P. (1996). *Cognitive development and learning in instructional context*. Boston, MA: Allyn and Bacon.
- Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, *51*, 1032-1043.
- Ceci, S. J., & Liker, J. (1984). Academic and nonacademic intelligence: An experimental separation. In R.J. Sternberg & R. Wagner (Eds.), *Practical intelligence* (pp. 119-142). Cambridge, England: Cambridge University Press.

- Cerbin, B. (1988, April). *The nature and development of informal reasoning skills in college students*. Paper presented at the National Institute on Issues in Teaching and Learning, Chicago (ERIC Document Reproduction Service No. ED298805)
- Cho, K., & Jonassen, D. H. (2002). The effects of argumentation scaffolds on argumentation and problem solving. *Educational Technology Research and Development, 50*(3), 5-22.
- Cohen, J., (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New York: Academic.
- Clarebout, G., Elen, J., Luyten, L., & Bamps, H. (2001). Assessing epistemological beliefs: Schommer's questionnaire revisited. *Educational Research and Evaluation, 7*(1), 53-77.
- Daniel, C., & Wood, E. S. (1980). *Fitting equations to data: Computer analysis of multifactor data* (2nd ed.). New York: John Wiley & Sons.
- Dewey, J. (1916). *Democracy and education*. New York: McMillan Company.
- Ehman, L. H. (1969). An analysis of the relationship of selected educational variables with political socialization of high school students. *American Educational Research Journal, 6*, 559-580.
- Ehman, L. H. (1980). Change in high school students' political attitudes as a function of social studies classroom climate. *American Educational Research Journal, 17*, 253-265.
- Estes, T. H., & Vaughan, J. L. (1978) *Reading and learning in the classroom: Diagnostic and instructional studies*. Boston: Allyn and Bacon.
- Evans, R. N., Newmann, F. N., & Saxe, D. W. (1996). Defining issues-centered education. In R. N. Evans & D. W. Saxe (Eds.), *Handbook on teaching social issues* (NCSS Bulletin 93, pp. 2-5). Washington, DC: National Council for the Social Studies.

- Furlong, P. R. (1993). Personal factors influencing informal reasoning of economic issues and the effect of specific instruction. *Journal of Educational Psychology, 85*, 171-181.
- Galotti, K. M. (1989). Approaches to studying formal and everyday reasoning. *Psychological Bulletin, 105*, 331-351.
- Green, S. (1991). How many subjects does it take to do a regression analysis. *Multivariate Behavioral Research, 26*, 499-510.
- Grennan, W. (1997). *Informal logic*. Montreal, Canada: McGill Queen's University Press.
- Grossman, D. L. (1975) *Educational climate and attitudes toward dissent: A study of political socialization of conflict norms in adolescents*. Unpublished doctoral dissertation. Stanford University.
- Hahn, C. L. (1996). Research on issue-centered social studies. In R. N. Evans & D. W. Saxe (Eds.), *Handbook on teaching social issues* (NCSS Bulletin 93, pp. 25-41). Washington, DC: National Council for the Social Studies.
- Hahn, C. L. (1998). *Becoming political: Comparative perspectives on citizenship education*. Albany, NY: State University of New York Press.
- Habermas, J. (1979). *Communication and evolution of society*. Boston: Beacon Press.
- Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*, 88-140.
- Infante, D. A., & Rancer, A. S. (1982). A conceptualization and measure of argumentativeness. *Journal of Personality Assessment, 46*, 72-80.
- Infante, D. A., & Wigley, C. J. (1986). Verbal aggressiveness: An interpersonal model and measure. *Communication Monographs, 53*, 61-69.

- Jehng, J., Johnson, S. D., & Anderson, R. C. (1993). Schooling and students' epistemological beliefs about learning. *Contemporary Educational Psychology, 18*, 23-35.
- Johnson, R. H. (1992). Critical reasoning and informal logic. In R.A. Talaska (Ed.), *Critical reasoning in contemporary culture* (pp.69-88). Albany, NY: State University of New York Press.
- Johnson, R. H., & Blair, J. A. (1988). The current state of informal logic/critical thinking. *Informal Logic, 9*, 140-152.
- Jonassen, D. H., (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. *Educational Technology Research and Development, 45*(1), 65-94.
- Kitchener, K. S. (1983). Cognition, metacognition, and epistemic cognition: A three-level model of cognitive processing. *Human Development, 26*, 222-232.
- Kuhn, D. (1991). *The skills of argument*. New York: Cambridge University Press.
- Kwon, O. (1991). The logic of Korean social studies instruction: Limitation of reform movements (in Korean). In U. Kang (Ed.), *Social studies should be changed* (pp.85-122). Seoul, Korea: Kyohaksa.
- Lee, J., Adams, D., & Cornbleth, C. (1988). Transnational transfer of curriculum knowledge: A Korean case study. *Journal of Curriculum Studies, 20*(3), 233-246.
- Levine, T. R., & Boster, F. J. (1996). The impact of self and other's argumentativeness on talk about controversial issues. *Communication Quarterly, 44*, 345-358.
- Lichtenstein, S., & Newman, J. R. (1967). Empirical scaling of common verbal phrases associated with numerical probabilities. *Psychonomic Science, 9*, 563-564.

- Lodewijk, H. G. L. C., Vermetten, Y., & Schellings, G. (1999, August). *How to assess epistemological beliefs?* Paper presented at the 8th EARLI-conference, Goteborg, Sweden.
- Long, S., & Long, R. (1975). Controversy in the classroom: Student viewpoint and educational outcome. *Teaching Political Science, 2*, 275-299.
- Means, M. L., & Voss, J. F. (1996). Who reasons well? Two studies of informal reasoning among children of different grade, ability, and knowledge levels. *Cognition and Instruction, 14*(2), 139-178.
- Ministry of Education. (1997). *Elementary, middle, & high school curriculum*. Seoul, Korea: Daehan Textbook Company
- Montgomery, D. C., & Peck, E. A. (1992). *Introduction to linear regression analysis* (3<sup>rd</sup> Ed.). New York: John Wiley & Sons.
- Newmann, F. D. (1990). Higher order thinking in teaching social studies: A rationale for the assessment of classroom thoughtfulness. *Journal of Curriculum Studies, 22*(1), 41-56.
- Nicotera, A. M. (1996). An assessment of the argumentativeness scale for social desirability bias. *Communication Report, 9*(1), 23-35.
- Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven, CT: Yale University Press.
- Olejnik, S., & Algina, J. (2000). Measures of effect size for comparative studies: Applications, interpretations, and limitations. *Contemporary Educational Psychology, 25*, 241-286.
- Olejnik, S., & Lee, J. (1990, April). *Multiple comparison procedures when population variances differ*. Paper presented at the annual meeting of the American Educational Research Association, Boston, MA.

- Olejnuk, S., Mills, J., & Keselman, H. (2000). Using Wherry's adjusted  $R^2$  and Mallow  $C_p$  from all possible regressions. *The Journal of Experimental Education*, 68, 365-380.
- Oliver, D. W., & Shaver, J. P. (1966). *Teaching public issues in the high school*. Boston: Houghton Mifflin Company.
- Onosko, J. J. (1990). Comparing teachers' instruction to promote students' thinking. *Journal of Curriculum Studies*, 22, 443-461.
- Onosko, J. J. (1991). Barriers to the promotion of higher order thought in social studies. *Theory and Research in Social Education*, 17(3), 174-195.
- Parker, W. C. (1989). Critical reasoning on civic issues. *Theory and Research in Social Education*, 17, 7-32.
- Parker, W. C. (1991). Achieving thinking and decision-making objectives in social studies. In J. Shaver (Ed.), *Handbook of research on social studies teaching and learning* (pp. 345-356). New York: McMillan.
- Passe, K. & Evans, R. W. (1996). Discussion methods in an issues-centered curriculum. In R.N. Evans & D.W. Saxe (Eds.), *Handbook on teaching social issues* (NCSS Bulletin 93, pp. 81-88). Washington, DC: National Council for the Social Studies.
- Paul, R. W. (1987). Dialogical thinking: Critical thought essential to the acquisition of rational knowledge and passions. In J.B. Baron & R.J. Sternberg (Eds.), *Teaching thinking skills: Theory and practice* (pp.127-148). New York: W.W. Freeman.
- Perkins, D. N. (1985a). Reasoning as imagination. *Interchange*, 16(1), 14-26
- Perkins, D. N. (1985b). Post-primary education has little impact upon informal reasoning. *Journal of Educational Psychology*, 77, 562-571.
- Perkins, D. N. (1986). *Knowledge as design*. Hillsdale, NJ: Erlbaum.

- Perkins, D. N., Allen, R., & Hafner, J. (1983). Difficulties in everyday reasoning. In W. Maxwell (Ed.), *Thinking: The expanding frontier* (pp.177-189). Philadelphia, PA: The Franklin Institute Press.
- Perkins, D. N., Farady, M., & Bushey (1991). Everyday reasoning and the roots of intelligence. In J.F. Voss, D.N. Perkins, & J.W. Segal, (Eds.), *Informal reasoning and education* (pp. 83-106). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Perry, W. G. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. New York: Holt, Rinehart and Winston.
- Rancer, A. S., & Infante, D. A. (1985). Relations between motivation to argue and argumentativeness of adversaries. *Communication Quarterly*, 33, 209-218.
- Rancer, A. S., Kosberg, R. L., & Baukus, R. A. (1992). Beliefs about arguing as predictors of trait argumentativeness: Implications for training in argument and conflict management. *Communication Education*, 41, 375-387.
- Reich, R. B. (1991). *The work of nations: Preparing ourselves for 21st-century capitalism*. New York: Vintage Books.
- Robinson, J. (1992, October). *International students and American university cultures: Adjustment issues*. Paper presented at the WATESOL Annual Convention. Arlington, VA. (ERIC Document Reproduction Service No. ED350968)
- Roberto, A. J., & Finucane, M. (1997). The assessment of argumentativeness and verbal aggressiveness in adolescent populations. *Communication Quarterly*, 45(1), 21-36.
- Roberto, A. J., & Wilson, S. R. (1996, May). *The effects of argumentativeness, verbal aggressiveness and situation on perception of intent and propensity towards violence in*

- adolescent boys*. Paper presented to the Interpersonal and Small group Communication division of the Speech Communication Association. Chicago.
- Sanders, J. A., Gass, R., Wiseman, R., & Brusckhe, J. (1992). Ethnic comparison and measurement of argumentativeness, verbal aggressiveness, and need for cognition. *Communication Reports*, 5(1), 50-56.
- Sanders, J. A., Wiseman, R., & Gass, R., (1994). Does teaching argumentation facilitate critical thinking? *Communication report*, 7(1), 27-35.
- Schoenfield, A. H. (1983). Beyond the purely cognitive: Belief systems, social cognition, and metacognitions as driving forces in intellectual performance. *Cognitive Science*, 7, 329-363.
- Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82, 498-504.
- Schommer, M. (1993). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology*, 85, 406-411.
- Schommer, M. (1994a). An emerging conceptualization of epistemological beliefs and their role in learning. In R. Garner & P. Alexander (Eds.), *Beliefs about text and about text instruction* (pp. 25-40). Hillsdale, NJ: Erlbaum.
- Schommer, M. (1994b). Synthesizing epistemological belief research: Tentative understanding and provocative confusions. *Educational Psychology Review*, 6, 294-310.
- Schommer, M., Crouse, A., & Rhodes, N.(1992). Epistemological beliefs and mathematical text comprehension: Believing it is simple does not make it so. *Journal of Educational Psychology*, 82, 435-443.
- SPSS Inc. (2002). *SPSS base 10.0: Application guide*. Chicago: SPSS Inc.

- Scribner, S. (1984). Studying working intelligence. In B. Rogoff & J. Lave (Eds.), *Everyday cognition: its development in social context* (pp. 166-189). Cambridge, MA: Harvard University Press.
- Scribner, S. (1986). Thinking in action: Some characteristics of practical thought. In R.J Sternberg & R. Wagner (Eds.), *Practical intelligence* (pp. 13-30). Cambridge, England: Cambridge University Press.
- Thompson, B. (1995). Stepwise regression and stepwise discriminant need not apply here: A guidelines editorial. *Education and Psychological Measurement*, 55, 525-534.
- Toulmin, S. E. (1958). *The uses of argument*. London: Cambridge University Press.
- Toulmin, S. E., Rieke, R., & Janik, A. (1984). *An introduction to reasoning*. New York: McMillan.
- VanSickle, R. L., & Hoge, J. D. (1991). Higher-cognitive thinking skills in social studies: Concepts and critiques. *Theory and Research in Social Education*, 19, 152-172.
- Voss, J. F., Blais, J., Means, M. L., Greene, T. R., & Ahwech, E. (1986). Informal reasoning and subject matter knowledge in the solving of economics problem by naïve and novice individuals. *Cognition and Instruction*, 3, 269-302.
- Voss, J. F., Green, T. R., Post, T. A., & Penner, B.C. (1983). Problem solving skill in the social sciences. In G.H. Vower (Ed.), *The psychology of learning and motivation* (Vol. 17, pp.165-213). New York: Academic Press.
- Voss, J. F., Perkins, D. N., & Segal, J. W. (1991). *Informal reasoning and education*. Hillsdale, NJ: Lawrence Erlbaum Associates.

- Voss, J. F. & Post, T. A. (1989). On the solving of ill structured problems. In M. T. H. Chi, R. Glaser & M. J. Farr (Eds.), *The nature of expertise* (pp. 261-285). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Wagner R. K. & Sternberg, R. J. (1985). Practical intelligence in real-world pursuits: The role of tacit knowledge. *Journal of Personality and Social Psychology*, 49, 436-458.
- Wagner R. K. & Sternberg, R. J. (1986). Tacit knowledge and intelligence in the everyday world. In R.J. Sternberg & R. Wagner (Eds.), *Practical intelligence* (pp.51-83). Cambridge, England: Cambridge University Press.
- Walker, A., Bridges, E., & Chan, B. (1996). Wisdom gained, wisdom given: Instituting PBI in a Chinese culture. *Journal of Educational Administration*, 34(5), 12-31.
- Walton, D. N. (1989). *Informal logic: A handbook for critical argumentation*. Cambridge, England: Cambridge University Press.
- Whitehead, A. (1929). *The aims of education and other essays*. New York: Dutton.

APPENDICES

APPENDIX A  
INSTRUMENTS

### Epistemic Beliefs Inventory

Directions: There are no right or wrong answers for the following questions. We want to know what you really believe. For each statement, write the number on the blank sheet for the degree to which you agree or disagree (Do Not Write Your Name On This Survey).

Strongly Disagree

1

2

3

4

Strongly Agree

5

- \_\_1. It bothers me when teachers don't tell students the answers to complicated problems.
- \_\_2. Truth means different things to different people.
- \_\_3. Students who learn things quickly are the most successful.
- \_\_4. People should obey the law.
- \_\_5. Some people will never be smart no matter how hard they work.
- \_\_6. Absolute moral truth does not exist.
- \_\_7. Parents should teach their children all there is to know about life.
- \_\_8. Really smart students don't have to work as hard to do well.
- \_\_9. If a person tries hard to understand a problem, they will most likely end up being confused.
- \_\_10. Too many theories just complicated things.
- \_\_11. The best ideas are often the most complicated things.
- \_\_12. People can't do too much about how smart they are.
- \_\_13. Teachers should focus on facts instead of abstract ideas.
- \_\_14. I like teachers who present several competing theories and let their students decide which is best.
- \_\_15. How well you do in school depends on how smart you are.
- \_\_16. If you don't learn something quickly, you won't ever learn it.
- \_\_17. Some people just have a knack for learning and others don't.

- \_\_18. Things are simpler than most experts would have you believe.
- \_\_19. If two people are arguing about something, at least one of them must be wrong.
- \_\_20. Children should be allowed to question their parents' authority.
- \_\_21. If you don't understand a chapter the first time through, going back over it won't help.
- \_\_22. Science is easy to understand because it contains so many facts.
- \_\_23. The moral rules I live by apply to everyone.
- \_\_24. The more you know about the topic, the more there is to know.
- \_\_25. What is true today will be true tomorrow.
- \_\_26. Smart people are born that way.
- \_\_27. When someone in authority tells me what to do, I usually do it.
- \_\_28. People who question authority are trouble makers.
- \_\_29. Working on a problem with no quick solution is a waste of time.
- \_\_30. You can study something for years and still not really understand it.
- \_\_31. Sometimes there are no right answers to life's big problems.
- \_\_32. Some people are born with special gifts and talents.

## Argumentativeness and Verbal Aggressiveness Scale

Directions: The following items contain statements about arguing. By “arguing,” I mean having a discussion or disagreement about a topic that has more than one side. For example, you might argue over who is the best basketball player or the best music group. Indicate how often each statement is true for you personally when you argue with your friends. Use the following scale.

- 1 = Almost never true
- 2 = Rarely true
- 3 = Sometimes true
- 4 = Often true
- 5 = Almost always true

- \_\_1. I have a great time when I argue.
- \_\_2. I feel good when I am winning an argument.
- \_\_3. When I finish arguing with someone, I feel nervous and upset.
- \_\_4. I enjoy a good argument.
- \_\_5. I get a bad feeling when I am about to get into an argument.
- \_\_6. I am happy when I keep an argument from happening.
- \_\_7. I do not like to miss the chance to argue.
- \_\_8. Arguments are a fun challenge.
- \_\_9. I feel refreshed and satisfied after an argument.
- \_\_10. I have the ability to do well in arguments.
- \_\_11. When people are stubborn, I use insults to soften their stubbornness.
- \_\_12. When others do things I think are stupid, I try to be very gentle with them.
- \_\_13. When I want my way and someone won't listen, I will call them names and let them know I think they are stupid.
- \_\_14. When people behave badly, I insult them in order to get them to behave better.
- \_\_15. When people will not budge on an important issue, I get angry and say really nasty things.
- \_\_16. When people criticize my faults, I do not let it bother me and do not try to get back at them.

\_\_17. When people insult me, I like to really tell them off.

\_\_18. I like making fun of people who do things which are very stupid in order to make them smarter.

## Classroom Climate Scale

Directions: There are no right or wrong answers for the following questions. We want to know how you feel about your social studies classroom. For each statement, write the number on the blank sheet for the degree to which you agree or disagree.

Strongly Disagree

1

2

3

4

Strongly Agree

5

- \_\_1. Our teachers respect our opinions and encourage us to express them.
- \_\_2. In our class pupils are encouraged to make up their minds about issues.
- \_\_3. In our classes the teachers try to get students to speak freely and openly.
- \_\_4. In our classes pupils feel free to express their opinions even when they are different from the teachers.
- \_\_5. I feel free to express my opinions in our classes when I disagree with most of the other students.
- \_\_6. In our classes we often discuss controversial political, economic, and social issues.
- \_\_7. In our classes teachers usually present more than one side to an issue when explaining them in class.
- \_\_8. In class discussions we are encouraged to consider many points of view on issues.
- \_\_9. Our teachers are interested in students' ideas about politics and government and they like to hear what we have to say.

APPENDIX B  
ESSAY QUESTIONS ON SOCIAL ISSUES

# The following questions are about juvenile crime. There are no right answers for the following questions. Please feel free and be specific in expressing what you think.

1. What causes juvenile crime? Please explain specifically the major causes of juvenile crime.
2. How would you convince someone else that your view is right? Please be specific, and provide some reasons or evidence you could mention to try to convince the person.
3. Suppose now that someone disagrees with your view that this is the cause. Why might they say that you are wrong? What evidence or reasons would they provide?

# The following questions are asking your opinion about high school admission policy. There is no right answer. Please feel free to express your opinion and be specific in supporting your idea.

1. Do you agree with the policy that allows some schools to maintain high levels of selectivity in admission or not? State your position on the issue.
2. Why do you think the selective admission policy is appropriate (or not appropriate)? Provide reasons and support your position.
3. Suppose now that someone disagrees with your position. Why do you think that the person disagrees with you? What reasons could the person provide?

APPENDIX C

SAMPLE ESSAYS AND ARGUMENT ANALYSES

## Sample Essay 1

1. What causes juvenile crime? Please explain specifically the major causes of juvenile crime.

- Bad influences of media

2. How would you convince someone else that your view is right? Please be specific, and provide some reasons or evidence you could mention to try to convince the person.

- Kids are always exposed to violent contents of TV programs and they just imitate what they saw in the TV. Also TV commercials drive them to buy something they cannot afford so they commit crimes to purchase those things.

3. Suppose now that someone disagrees with your view that this is the cause. Why might they say that you are wrong? What evidence or reasons would they provide?

- Most teenagers are not involved in criminal behavior although they watch TV everyday. Maybe parent influence is bigger in shaping their behavior pattern. Newspapers report that many juvenile criminals are mostly raised in the family atmosphere that either abuses or neglects their children.

### Argument Analysis in Sample Essay 1

#### 1) Argument Structure

Claim1: Bad influence of media causes juvenile delinquency.

Premise1: Teenagers have tendency to imitate violent behavior of TV program.

Premise2: TV commercials drive teenagers to want expensive items.

Premise3: Teenagers commit crimes to purchase what they have seen in TV commercials.

Counter premise 1: The majority of teenagers do not commit crimes even though they are exposed to TV.

Counter premise 2: Newspapers report that kids from negative family environments commit crimes

	—	P1
C1	—	P2+P3
	—	CP1
	—	CP2

#### 2) Scoring

Number of Claims: 1

Number of Valid Arguments 4 (4 lines of reasoning)

Number of Valid Premises 3

Number of Valid Counter Premises 2

Rating of Premises

P1: .6(somewhat likely: plausible but insufficient evidences given)

P2+P3: .7(likely: plausible but insufficient evidences given)

CP1: .9(very likely: plausible with sufficient evidences)

CP2: .7(likely: plausible but insufficient evidences given)

Rating of Inferences (suppose that p is true, c is ?)

P1 to C1: .6(somewhat likely: premise is favorably relevant to claim but more explanations are required)

P2+P3 to C1: .7(likely: somewhat likely: premise is favorably relevant to claim but more explanations are required)

CP1 to not C1: .5(as likely as not: premise is connected to claim but not enough to evaluate the validity of claim)

CP2 to not C1: .7(likely: somewhat likely: premise is favorably relevant to claim but more explanations are required)

Soundness of Arguments

$P1(C1/P1)=.36$

$(P2+P3)[C1/(P2+P3)]=.49$

$CP1(C1/CP1)=.45$

$CP2(C1/CP2)=.49$

## Sample Essay 2

The following questions are asking your opinion about high school admission policy. There is no right answer. Please feel free to express your opinion and be specific in supporting your idea.

1. Do you agree with the policy that allows some schools to maintain high levels of selectivity in admission or not? State your position on the issue.

- Do not agree

2. Why do you think the selective admission policy is appropriate (or not appropriate)? Provide reasons and support your position.

- It violates the principle of equal opportunity in education. Students who go to lower level schools will be very disappointed and feel humiliated. If smart students and average students study together, both will benefit from each other.

3. Suppose now that someone disagrees with your position. Why do you think that the person disagrees with you? What reasons could the person provide?

- Kids who do not want to get along with trouble makers in the school won't agree with my idea. They may say that education for elite is necessary for the development of our nation.

## Argument Analysis in Sample Essay 2

Claim 1: We should not allow some schools to maintain high levels of selectivity in admission

Premise 1: Selectivity violates the principle of equal opportunity in education.

Premise 2: Students who go to lower level schools will be very disappointed and feel humiliated.

Premise 3: If smart students and average students study together, both will benefit from each other.

Non-Valid Counter Premise 1: Kids who do not want to get along with trouble makers in the school won't agree with my idea.

Counter Premise 1: Education for elite is necessary for the development of the nation.

	—	P1
C1	—	P2
	—	P3
		NCP1
	—	CP1

## 2) Scoring

Number of Claims: 1

Number of Valid Arguments 4 (4 lines of reasoning)

Number of Valid Premises 3

Number of Valid Counter Premises 1

Number of Non-valid Premises

Rating of Premises

P1: .5(as likely as not: plausible but little information to judge the validity of argument)

P2: .5(as likely as not: plausible but little information to judge the validity of argument)

P3: .5(as likely as not: plausible but little information to judge the validity of argument)

NCP1: 0

CP1: .4(more likely false than true: hasty judgment or excessive generalization)

Rating of Inferences (Suppose that p is true, c is ?)

P1 to C1: .7(likely: premise is favorably relevant to claim but more explanations are required)

P2 to C1: .6(somewhat likely: premise is favorably relevant to claim but more explanations are required)

P3 to C1: .7(likely: premise is favorably relevant to claim but more explanations are required)

NCP1 to not C1: 0

CP1 to not C1: .4(more likely false than true: hasty judgment or excessive generalization)

Soundness of Arguments

$P1(C1/P1)=.35$

$P2(C1/P2)=.30$

$P3(C1/P3)=.35$

$NCP1(C1/NCP1)=0$

$CP1(C1/CP1)=.16$

### Sample Essay 3

1. What causes juvenile crime? Please explain specifically the major causes of juvenile crime.

- Weak relationship between parents and children

2. How would you convince someone else that your view is right? Please be specific, and provide some reasons or evidence you could mention to try to convince the person.

- Parents don't have enough time to be with their children and give little attention to them.

3. Suppose now that someone disagrees with your view that this is the cause. Why might they say that you are wrong? What evidence or reasons would they provide?

- Sometimes, parents' excessive concern for their children causes problems and makes their children engage in delinquency.

#### Argument Analysis in Sample Essay 3

##### 1) Argument Structure

Claim1: Weak relationship between parents and children causes juvenile delinquencies.

Premise1: Parents have little time to be with their children.

Premise2: Parents give little attention to their children.

Counter premise 1: Parents' excessive concern to their children can cause juvenile delinquencies.

C1 — P1+P2  
— CP1

##### 2) Scoring

Number of Claims: 1

Number of Valid Arguments (2 lines of reasoning)

Number of Valid Premises 2

Number of Valid Counter Premises 1

Rating of Premises

P1+P2: .2(unlikely: premises just repeat the claim with no further information)

CP1: .6(somewhat likely: plausible but insufficient evidence given)

Rating of Inferences (Suppose that p is true, c is ?)

P1+ P2 to C1: .0(claim and premise have little connection)

CP1 to not C1: .5(as likely as not: premise is connected to claim but not enough to evaluate the validity of claim)

Soundness of Arguments

$$(P1+P2)(C1/P1+P2)=0$$

$$CP1(C1/CP1)=.30$$

### Sample Essay 4

The following questions are asking your opinion about high school admission policy. There is no right answer. Please feel free to express your opinion and be specific in supporting your idea.

1. Do you agree with the policy that allows some schools to maintain high levels of selectivity in admission or not? State your position on the issue.

- Agree

2. Why do you think the selective admission policy is appropriate (or not appropriate)? Provide reasons and support your position.

- Our society needs to raise ten percent of elites who are going to feed the other ninety percent of dummies.

3. Suppose now that someone disagrees with your position. Why do you think that the person disagrees with you? What reasons could the person provide?

- They will talk about equal opportunities. However, I believe that giving a favor to those who deserve to have it is real equality in education.

### Argument Analysis in Sample Essay 4

Claim 1: We should allow some schools to maintain high levels of selectivity in admission

Premise 1: Education of elites will feed people.

Counter Premise 1: equal opportunity in education.

Premise 2 (rebuttal): equality means to give preference to those who deserve.

	—	P1
C1	—	CP1
	—	P2

### 2) Scoring

Number of Claims: 1

Number of Valid Arguments 3 (4 lines of reasoning)

Number of Valid Premises 2

Number of Valid Counter Premises 1

Number of Non-valid Premises

Rating of Premises

P1: .3(somewhat unlikely: when a premise is based on personal feeling)

CP1: .6(somewhat likely: plausible but insufficient evidence given)

P2: .4(more likely false than true : hasty judgment or excessive generalization)

Rating of Inferences (Suppose that p is true, c is ?)

P1 to C1: .3(somewhat unlikely: premise is connected to claim but jeopardize the validity of claim)

CP1 to not C1: .6(somewhat likely: premise is favorably relevant to claim but more explanations are required)

P2 to C1: .5(as likely as not: premise is connected to claim but not enough to evaluate the validity of claim)

Soundness of Arguments

$P1(C1/P1)=.09$

$CP1(C1/CP1)=.36$

$P2(C1/P2)=.20$