Gender Differences in Student-Teacher Interactions in Some Grade Seven Mathematics and Language Arts Classrooms in Canada and Cuba: A Pilot Study

by

Sarah Joyce

B. Sc., University of Glasgow, Scotland, 1967

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Name: Sarah Maclaine Joyce

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Examining Committee:

Chair: Robert Walker

Suzanne DeCastell
Senior Supervisor

Harvey Gerber
Associate Professor
Department of Mathematics

T. J. Kirschner
Professor
Department of Spanish and
Latin American Studies

A. W. (Sandy) Dawson
Associate Professor
Faculty of Education
Simon Fraser University
External Examiner

Date Approved December 4, 1990

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Gender-differences in Student Teacher Interactions in Some Grade Seven Mathematics and Languages Arts Classes in Canada and Cuba: A Pilot Study

Author:

(signature)

Sarah Maclaine Joyce

(name)

Dec 4, 1990

(date)

ABSTRACT

In most of the industrialized Western World, women are underrepresented in mathematics and mathematics-related fields. However, this is not the case in many socialist countries. This study is set out to identify some ways in which the school, as a social institution, may contribute to such differences. Specifically, it tries to determine whether there are any significant relations between the sex of students and the quantity and quality of their interactions with teachers in mathematics and in language arts in Cuba and Canada, two countries in which there is a wide variation in women's participation in mathematics-related occupations.

Grade seven has been chosen for observation because the literature suggests that significant differences in mathematics performance do not reliably emerge before that grade. The sample of this pilot study consists of sixteen classes in each country- eight lessons taught by the same teacher in both mathematics and language arts. Sample size was limited by the number of observations permitted during a twelve week stay in Cuba. A modified version of the Brophy-Good Dyadic Interaction Observation System has been used for data collection.

The results indicate a number of differences in student-teacher interactions between the two countries. The results of the Canadian sample show that boys dominate in classroom communication, especially in mathematics. Boys are involved in more process questions and more extended interactions with teachers than girls. They also call out more in class and are disciplined more often than girls. However, not all boys are the recipients of more teacher attention; rather a small group of students, mainly boys, dominate classroom communications.

In Cuba, on the other hand, the situation is reversed. Boys have more overall contact with teachers in language arts classes whereas girls have more contact in mathematics

classes. Girls are involved in more extended interactions in mathematics classes whereas boys are involved in more process questions and extended interactions in language arts classes. Finally, a number of differences in teaching styles between the two countries have been identified.

This pilot study suggests that women's difficulties with respect to mathematics are culturally induced.

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My sincere thanks to Teresa, Ian, and to my parents.

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INTRODUCTION

The importance of mathematics requires little justification. It is a pan-cultural phenomenon which is not only an academic discipline in its own right but which also performs a service function for other disciplines. Mathematics performance is used by universities as a screen for the acceptance of students into a variety of courses and faculties. In addition, an ability to perform comfortably in mathematics is an asset for full participation in the modern, industrialized, highly technical world of the 1990s. A strong mathematics background is needed for entry into, and full participation in, many professional and technical occupations. Like universities, many employers "filter" job applicants on the basis of mathematics' qualifications. For example, passing an arithmetic quiz is the sole criterion for students to work part-time at the Pacific National Exhibition grounds in Vancouver, British Columbia. Hence mathematics is fundamentally and critically related to educational and occupational opportunities.

In spite of the obvious importance of mathematics, relatively few students entering university programmes choose to specialize in the subject. For example, of all the B.A.'s awarded in American universities in 1975-76 only 1.7% were in mathematics and statistics (Chipman and Thomas, 1985). Of the 1724 students who graduated from Simon Fraser University in Burnaby, B.C. in 1989, 23, or 0.7%,, were in mathematics and statistics (Office of Analytical Studies, S.F.U.). This number included those who graduated in mathematical physics as well as in mathematics and computing. This situation of low enrolment and graduation is accentuated when women are considered.

In the industrialized world, women do not participate in mathematics to the same extent as men. In most Western industrial countries, current enrolment figures in university level courses show that fewer women than men register for advanced mathematics (Brush,

1980; Chipman & Thomas, 1985; Ernest,1976; Mura, 1987; Sells, 1980). In 1984, 35% of the mathematics degrees awarded by Canadian universities were earned by women (Peitchinis, 1989). In fact, beyond the compulsory level, the proportion of women involved in the subject decreases as the level of mathematics course increases (Gaskell, 1987; Kahle, 1985; Lee, 1987; Meece & Parsons et. al., 1982). Of those 23 graduates in mathematical fields from Simon Fraser University in 1989, only nine were women.

Courses taken in high school and university have an impact upon career options. As a result, many women, through lack of participation in mathematics classes, are denied opportunities for further formal academic training and for a wide range of careers by the absence of appropriate qualifications (Sells, 1980). Women, therefore, are underrepresented in the scientific professions. In her examination of 57 countries, Eliou (1987) found none in which women were in the majority in engineering courses, no matter what the cultural heritage, the economic situation or the enrolment rate of women at university. Similarly, in 1984, only 5% of the faculty in the Sciences in Canadian universities were female. In the faculties of applied sciences such as engineering, this number fell to 1.5% (Mura, 1987). In the United States,

> even though there has been 500% increase in the past ten years, women still constitute less than 5% of practicing engineers. Of the nation's 2.7 million scientists, only 5% are female (Campbell, 1986, p. 518).

In 1983 in Britain, 6.7% of engineering students were women (Sutherland, 1985). Moreover, although there has been an increase in the number of women in mathematics and mathematics-related fields in recent years, this is due mainly to an over-all increase in the number of women entering university rather than to an increase in the percentage choosing these fields (Berryman, 1983; Hilton & Lee, 1986). Concern for this startling lack of

participation by women in mathematics courses and in mathematics-related careers is reflected in the offering of grants solely to women in the sciences by the office of the Prime Minister of Canada (Vancouver Sun, March 29, 1988).

However, this situation is not universal. There are a number of socialist countries where participation is better balanced. For example, in the U.S.S.R. in 1975, women made up 40 percent of all scientists and 40 percent of engineers (Brown et al, 1982). In 1980, more than 45% of mathematics and natural science students at East German universities were female (Sutherland, 1985). In Cuba, 45% of the engineers are women (Pérez y Pascual, 1985) This is in marked contrast to the situation in Canada where only 10.7% of engineers are women (Guppy, Balson & Vellutini, 1987). These are provocative statistics which suggest that participation levels in mathematics are, at least partially, culturally determined.

1. Purpose of the Study

The " research conducted in recent years provides compelling evidence that teachers' classroom behavior can significantly affect students' attitudes and achievement." (Good & Brophy, 1987, p. xi.). Interaction patterns, part of this behaviour, have also been shown to affect students' achievement (Evertson, Anderson, Anderson, & Brophy, 1980; Evertson, Emmer & Brophy, 1980; Fennema & Peterson, 1987; Good & Grouws, 1979). The present study is set out to examine, cross-culturally, teacher-student interactions in both mathematics and language arts. Its purpose was to discover whether student gender affects the quantity and quality of interactions with teachers in two countries with widely different levels of female participation in mathematics-related fields. More specifically, it will examine the interactions of some grade seven teachers with boys and with girls and will try to determine to what extent they vary across subject areas. Grade seven was chosen for observation because the research suggests that, at least in industrialized countries, significant differences

in mathematics performance begin to appear at that grade level (Brush, 1980; Fennema & Sherman, 1977; Flanagan, 1964; Hilton & Berglund, 1974; Maccoby and Jacklin, 1974; Stannic and Reyes, 1987). Cuba was chosen as the country for the cross-cultural comparison because of its high proportion of women in mathematics-related fields.

Cuba is a small country in which both the entire educational system and the role of women changed in 1959. At that time, the Revolutionary forces of Fidel Castro overthrew the U.S.-backed regime of Fulgencio Batista which had controlled Cuba for much of the previous 25 years. As a result of the political and economic boycott of Cuba by the U. S. which began in 1964, there has been a dearth of studies of women and mathematics in Cuba by English-speaking researchers. According to the Cuban educator, Dr. Alberto Labarrere Sarduy, author of a number of books and articles on the topic, the lack can also be attributed to the government position that the question of the differential treatment of the sexes in education has been resolved as a result of the Revolution[1]. The contention that women are equitably represented in mathematics and mathematics-related fields, and that this results from government policy, was made clear to me on a number of occasions in personal interviews and meetings with representatives of the Federation of Cuban Women (Federación de Mujeres Cubanas [FMC]) and the Cuban Communist Party (Partido Comunista de Cuba [PCC]). That this has been important to the government is indicated by a comment contained in a speech to the FMC on December 9th, 1966, by Fidel Castro:

> This revolution has really been two revolutions for women; it has meant a double liberation: as part of the exploited sector of the country, and, second, as women, who were discriminated against not only as workers but also as women, in that society of exploitation. (Stone, 1981, p. 50).

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[1] Personal interview: Dr. Labarrere Sarduy, Experto del departamento de Psicología pedagógica, ICCP. La Habana, November, 1989.

Although there are numerous variables affecting women's participation in mathematics-related fields, the assumption here is that teacher-student interactions in mathematics classes are an important causal factor. Differences in the patterns of interactions between the two countries could suggest one possible direction for further research into the question of why women are underrepresented in such areas.

The specific questions proposed for this study are:

1. How do grade seven teachers differ in their interactions with boys compared to those with girls?

2. Are the interactions between teachers and girls and boys in mathematics different from those in language arts?

3. How do such interactions in both subject areas differ within the Canadian and Cuban samples?

This is a pilot study, therefore there are a number of limitations. Firstly, for reasons that will be described in Chapter III, the total number of classrooms observed was not large. Furthermore, it was not possible, as originally intended, to observe only in randomly-chosen classrooms within the city of Havana. Secondly, in such a non-experimental study, it was not possible to construct a sample in which all classrooms were identical in a number of characteristics such as class size and physical layout. However, it is an assumption of this study that such variations will have relatively little effect on the outcomes.

Thirdly, there are a number of difficulties in trying to quantify a process such as human interaction. The use of a pre-specified coding system assumes that interactions can be

classified as discrete, identifiable entities. This is problematical in such an intricate and complex area but, at present, there is no satisfactory alternative. Also, a limitation of the prespecified coding schedule is that it notes only interactions between the teacher and individual students and then, only in a limited number of categories. Consequently a large number and variety of interactions are not recorded. Some interactions may also be difficult to assign precisely to one particular code. Moreover, since only overt observable behaviour is being measured, it is possible that other important non-observable behaviour such as motivation or specific contextual data are omitted. Lastly, the effect of the presence of an observer on classroom interactions may affect investigations of this kind. Hence, this study is to be regarded as merely exploratory and, at best, an indicator of directions for further research. The findings, therefore, cannot necessarily be generalized to a wider population.

2. Study Areas

a. Burnaby, B.C. Canada

The Canadian sample was drawn from the school district of Burnaby in which I have taught for twenty years. The municipality of Burnaby is a suburb of Vancouver in the Lower Mainland of British Columbia. According to the 1986 census, the population was 145 000, occupying an area stretching from the Vancouver border in the west to the municipality of Coquitlam in the east. Within the district, there are 43 schools, of which 37 are elementary. The elementary school population for the academic year 1989-1990 is approximately 11,600 students (Burnaby School Board Information)

b. Cuba

Cuba, located in the Caribbean sea between North and South America, is made up of a number of islands, the largest of which is 1200 kilometres long with a width which varies

from 30 to 190 kilometers. It lies at the entrance to the Gulf of Mexico, approximately 150 kilometres south of Florida. The 1989 population was approximately 10,259,000 (Goodwin, 1988). In the country as a whole, there are 15,700 schools of which 10,866 are elementary (Eng, 1985). The elementary school population is approximately one and a half million students (Anuario Estadístico de Cuba, 1987).

Collecting research data in Cuba is extremely difficult. Because of this, I registered as a graduate student in the Simon Fraser University Latin American Field School which was to spend ten weeks in Cuba in the fall of 1989. As a participant in the Field School, I automatically gained official status under the auspices of both ICAP (The Cuban Institute of Friendship with the Peoples) and the University of Havana.

3. Outline of the Study

Chapter 1 presents a review of the literature on women and mathematics. This extensive literature can be classified into three broad areas each of which focusses on specific factors affecting the under-representation of women in mathematics and mathematics-related fields. These areas deal mainly with biological, sociological, and individual factors. The review will focus on one aspect of the broad area of socialization factors, namely, teacher-student interactions.

Because Canadian readers are less familiar with Cuba and the Cuban educational system, Chapter 2 sketches a brief history of pre- and post-revolution education in that country. Chapter 3 presents the data obtained in both study areas and discusses them in light of the information from the review of the literature. The comparison of the data from both countries and the conclusions are given in Chapter 4.

4. Definition of Terms

The following terms are defined because they are basic to the investigation.

Bias: A tendency or prejudice

FMC: Federation of Cuban Women (Federación de Mujeres Cubanas). An organization of women's groups, set up on August 23, 1960 in order to allow women to identify their problems and work within the government to alleviate them. According to representatives of the FMC interviewed in 1989, over 90% of Cuban women were members.

Management interaction: The teacher asks the assistance of a student for a class task such as cleaning the board, delivering messages or handing out papers.

Process question: A type of question which requires students "to explain something in a way that requires them to integrate facts or to show knowledge of their interrelationships." (Good and Brophy, 1987, p.86). It usually begins with "how?" or "why?" Some examples are: "Why do you think that?" or "How do you think that occurred?"

Product question: -A type of question which requires yes, no, or short phrase answers. It usually begins with "who?", "what?", "when?", "where?", or "how much?" Some examples of product questions are: "What is 7 times 6?" and "Who is the main character in the story?"

Sexual stereotype: - a set of characteristics that are believed to identify and to be possessed by each and every member of a particular sex.

Sex: - The term referring to the "biological dichotomy between females and males" (Mackie, 1987).

Gender: - The psychological and cultural term distinguishing the sexes by that "which is recognized as feminine or masculine by a social world" (Mackie, 1987).

CHAPTER I

GENDER-DIFFERENCES IN CLASSROOM INTERACTIONS: A CRITICAL APPRAISAL.

INTRODUCTION

The topic of gender-related differences in mathematics achievement has been a source of a great deal of debate. A number of studies have suggested that differences in favour of boys begin to appear by grade seven and that these differences increase as students progress through high school (Armstrong, 1981; Benbow & Stanley, 1980; Fennema, 1974; Fennema & Carpenter, 1981; Halpern, 1986; Maccoby & Jacklin, 1974; Marshall, 1984). Considerable research attention has been focussed on the causes of these differences. It generally encompasses three broad areas which deal with biological, socialization, and attitudinal factors (Aiken, 1986-1987; Leder, 1986; Meece, Parsons, Kaczala, Goff & Futterman, 1982; Reyes & Stannic, 1985).

Those researchers who base their arguments on biological considerations suggest that gender-differences in performance in mathematics are the result of innate differences in, for example, cerebral organization between boys and girls (Benbow & Stanley, 1980; Battista, 1990; Bock & Kolakowiski, 1973; Halpern, 1986; Peterson, 1976). In other words, differences in achievement in mathematics are considered to be a result of innate, male ability in at least some aspects of mathematics.

One such aspect which has received a great deal of research attention is spatial ability (Ben-Chaim, Lappan & Houang, 1988; Fennema & Tartre, 1985; Harris, 1981; Johnson & Meade, 1987). A positive correlation has been found between spatial skills and mathematics achievement test scores (Ben-Chaim, Lappan & Houang, 1988; Burnett et. al., 1979;

Conner, Schackman, & Serbin, 1977; Fennema & Tartre, 1985; Johnson & Meade, 1987; Sherman, 1980). Boys, particularly after grade 10, have been found to perform consistently better on tasks that require spatial visualization (Fennema, 1975; Maccoby & Jacklin, 1974). However, the small size and inconsistency of the sex differences research do not indicate a broad causal relationship between spatial ability and mathematics achievement.

The question of whether mathematics itself may possess characteristics that are more suited to boys than to girls has stimulated recent research on biological differences in learning styles. Some of the findings suggest that there is a difference in the way in which boys and girls learn. Belenky et. al. (1986) contend that women's intellect develops differently from that of men. There may then be a "woman's way of knowing" which is less suited to the learning of mathematics.

Moreover, mathematics classes, at least in the developed world, tend to involve a degree of competition amongst students. Since girls have been found to feel more comfortable within more collaborative and cooperative learning environments (Gilligan, 1982) this situation potentially leaves them at a disadvantage. In summary, according to these researchers, as a result of their biological nature, girls may face several obstacles in learning mathematics which boys do not.

Those researchers who concentrate on socialization factors, focus on the influence of cultural stereotypes which portray mathematics as a male domain and women as having poorer mathematics ability. The process by which these attitudes are passed to students via their parents, teachers, and society in general, has been extensively investigated (Bandura & Walters, 1963; Fennema, 1974; Fox, Tobin & Brody, 1979; Maccoby & Jacklin, 1974; Walden & Walkerdine, 1985). So too have parental and teacher attitudes and expectations, school curriculum (including courses available, timetabling and subject matter) as well as the

hidden curriculum, by which awareness of male/female roles are shaped (Holloway, 1986; Kissane, 1986; McNeil, 1987; Nash, 1979; Stitt, 1988).

The researchers who base their arguments on attitudinal and affective factors consider that students' achievement in mathematics is related to their attitudes towards the subject. A number of factors have been analyzed, including: confidence in learning mathematics, ability to work independently, attribution of success or failure in mathematics, and perception of mathematics as a useful field of study (Aiken, 1986-87; Brush, 1980; Chipman & Thomas, 1985; Fennema & Sherman, 1977, 1978; Fennema & Peterson, 1985; Sherman, 1980; Tobias, 1978).

There is, therefore, a large literature describing the numerous and complexly-interrelated factors which have been identified by members of the different schools of thought as potentially having an affect on women's performance and achievement in mathematics.

While learning mathematics in schools, students also learn the values and attitudes attached to the subject. In addition, they learn about the process of learning and also about expectations related to their own learning. In the schools, the values and mores of the dominant culture are passed on to the next generation. The classroom teacher is one of the most important bearers and transmitters of culture. School, classroom, and teacher are crucial to the learning of formal mathematics.

Classrooms are complex, busy places. Teachers engage in a variety of interactions with their students each day. The speed of these interactions make it difficult for the teachers to be fully aware of exactly what is happening (Sadker, Sadker & Thomas, 1986). As a result of this, problems may arise. Teachers may, in spite of their best intentions, vary their behaviour towards students on the basis of such characteristics as the student's sex,

race, socio-economic status, behaviour, or perceived ability, all of which are extraneous to the learning process.

Within this broad conceptual framework of socialization, this thesis will base its analysis on the specific research on student-teacher interactions.

1. Teacher Expectations: "Pygmalion in the Classroom."

Research into the nature of classroom interactions grew out of the study of the wider topic of teacher expectations. The key study of this body of research is undoubtedly "Pygmalion in the Classroom" by Rosenthal and Jacobson (1968). Teachers were told that a random sample of students had unusual academic potential. The chosen students showed significant academic improvement and Rosenthal and Jacobsen attributed this to the teachers' expectations of these randomly-chosen children. This phenomenon became known in the literature as the self-fulfilling prophecy.

The Pygmalion study elicited very strong reactions. It has been criticized on methodological grounds (Elashoff & Snow, 1971; Jensen, 1969; Thorndike, 1968), and its conclusions have never been duplicated with quite such startling results (Claiborn, 1969; Deitz & Purkey, 1969). However, it served to promote further research that demonstrated conclusively the impact of teacher expectations on student performance (Aspy and Roebuck, 1972; Baker and Crist, 1971; Dusek, 1975; Duseck and O'Connell, 1973; Hughes, 1973; Palardy, 1969). Such expectations, it was found, were related to a number of student characteristics such as sex, attitudes, achievements, race and social class (Clark, 1963; Rist, 1973; Rubovits and Maehr, 1973). They were also shown to be influenced by students' physical attractiveness (Clifford and Walser, 1973; Dion, 1972; Rich, 1975), by the teacher's knowledge of students' older siblings (Seaver, 1973) and by personality characteristics such as conformity, dependency and acquiescence, characteristics more

commonly associated with female students (Feshbach, 1969). All of this added fuel to the notion that boys' relatively poor performance compared to girls in elementary school resulted from the fact that they were males in the overwhelmingly female school world (Glick, 1972; Palardy, 1969) even though Brophy (1985) has noted that the differential in educational achievement patterns between boys and girls in North America existed when the majority of schoolteachers were men.

Teachers, then, have expectations of students. They vary in the

> expectations and achievement objectives they hold for themselves, their classes, and individual students; how they select and design academic tasks; and how actively they instruct and communicate with students about academic tasks. Those who do these things successfully produce significantly more achievement than those who do not (Brophy & Good, 1985, p. 370).

A number of models have been developed to explain how teacher expectations are communicated to students and how they potentially affect student achievement (Brophy & Good, 1974). Generally they suggest that teachers, when meeting students for the first time, form differential expectations of them and therefore treat them differently. Students, in turn, respond in ways appropriate to teachers' expectations and alter their performances accordingly, in a self-perpetuating cycle.

Teacher expectations and attitudes can affect student achievement (Brophy & Good, 1974, 1987; Cooper & Good, 1983). According to the model to explain differences in mathematics achievement suggested by Reyes and Stannic (1985), these attitudes and expectations are then passed to students at least in part, through classroom processes. The relationship between student achievement and classroom interactions became the focus of a

number of studies (Evertson, Anderson, Anderson, & Brophy, 1980; Evertson, Emmer & Brophy, 1980; Fennema & Peterson, 1987; Good & Grouws, 1979; Good, Grouws & Ebmeier, 1983).

2. Instrument of Measurement: Brophy-Good Dyadic Interaction Observation System.

Prior to 1970, a variety of observation instruments was used to examine classroom processes.[2] However, as interest in this area of research grew, so did the need for more accurate classroom observation instruments. In 1970, Brophy and Good (1970b) developed the Dyadic Interaction Observation System which has since become the most commonly used instrument in classroom interaction studies. The instrument was designed to quantify systematically the types of interactions in which teachers are involved with individual students. With this system, an observer using a checklist containing 43 behavioural categories records classroom interaction. It does not identify all classroom interactions but instead focusses on teacher interactions with individual students. These are coded in a number of specific categories such as procedural, discipline or work-related exchanges. The following behaviours are coded: type of contact, type of question, quality of student response and type of teacher feedback. The instrument also identifies the initiator of the interaction, whether student or teacher, and whether the interaction is public or private. In addition, by including the identification of teacher feedback to individual student responses, a knowledge of the sequencing of interactions is gained. In other words, it is possible to identify how teachers respond to specific student answers. Finally, it is possible to code each different part of the lesson separately and therefore identify interaction patterns during different instructional activities. The Brophy-Good Dyadic Interaction System and

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[2] Simon & Boyer (1970), list 79 systems which were developed in the United States for observing classroom behaviour.

its modifications, have been very extensively used in studies of classroom processes, including the majority of those reviewed in this chapter.

3. Interaction Studies until the Mid-Nineteen Seventies.

a. Sex Factors

Much of the research carried out before the mid nineteen seventies in student-teacher interactions was motivated by concern for boys' problems in reading and language arts in elementary school (See Good & Brophy, 1974). With the advent of the Womens' Movement in the early 1970's, the main focus of research started to shift to the relatively poorer performance of girls in mathematics and science, particularly in secondary school. At the same time, the need to obtain more detailed information with respect to classroom dynamics meant that studies became more extensive, more carefully controlled, and began to centre on the mechanisms of the interactional process (Brophy, 1985).

In mixed-sex classes in elementary school, boys apparently performed less well than girls, particularly in language arts (Maccoby & Jacklin, 1974). In addition, they appeared to be more likely than girls to be the recipients of disciplinary actions (Duke, 1976) and more of them, proportionately, attended learning assistance classes (Maccoby & Jacklin, 1974). It was further suggested that the difference in outcome of boys and girls elementary education was, at least in part, a result of unintentional differential treatment by teachers, the controllers of communication within classrooms (Brophy & Good, 1974). It was further thought that making teachers aware of the differences in how they treated students might eliminate such differences and thus equalize student performance.

The results of these early studies of the specifics of student-teacher interactions suggest that teachers vary considerably in the quantities of interactions they have with individual students (Jackson and Lahaderne, 1967). Notably, and with few exceptions,

boys receive a quantitatively higher proportion of contacts from teachers across subject areas (Berk & Lewis, 1977; Biber, Miller and Dyer 1972; Brophy & Good, 1970, 1974; Elliot, 1974; Etaugh & Hughes, 1975; Good, Sykes and Brophy, 1972; Meyer & Thompson, 1956; Sears and Feldman, 1966). Teachers initiate more contacts with boys than with girls and boys initiate more contacts with teachers (Brophy & Good, 1970; Lippitt & Gold, 1959). Teachers both criticized and praised boys more often than girls (Brophy & Good, 1970a; Serbin et.al., 1973).

Brophy and Good (1974), suggested that the greater quantity of teachers' interactions with boys was as much a result of the effect of students on teachers as that of teachers on students. Teachers must interact more with boys in class because boys are more conspicuous by their behaviour. According to these researchers, teachers are merely responding to the different behaviours and attitudes brought to school by boys and girls. For example, boys are found to be more assertive and disruptive than girls (Peterson, 1961; Samuels & Turnure, 1974). Teachers have to discipline boys more frequently because they misbehave more frequently (Jackson & Lahaderne, 1976; Maccoby, 1966). In other words, both students and teachers participate in, and are responsible for, the variation in the quantity and type of interactions. However, it should be pointed out that boys were disciplined more often and more harshly even when their behaviour was similar to that of girls (Etaugh & Harlow, 1975; Lippitt & Gold, 1959; Meyer & Thompson, 1963). Teachers' responses to such behaviour, then, helped maintain and reinforce gender-related differences in behaviour (Frazier & Sadker, 1973).

The research found that not only the quantity but also the quality of classroom interactions were differentiated by the sex of the student. Boys were more likely to be asked more complex, higher-order questions by teachers whereas girls were more likely to be asked simpler or lower-order questions than boys (Good, Sikes & Brophy, 1973).

Furthermore, when helping students with their work, teachers were more likely to ask a male student to finish the work himself after some assistance, but were more likely to complete the work for female students (Serbin, O'leary, Kent & Tonick, 1973). Although boys were more likely to be reprimanded in class, it was found that they were also more often likely to be praised (Brophy & Good, 1974a; Meyer & Thompson, 1956). Girls, on the other hand, received less praise even for correct answers (Brophy & Good, 1970). In addition, teachers responded differently to boys and girls with respect to the quality of their school work. Boys were more likely to receive praise on the academic quality of their work whereas girls more often received praise about its form and neatness (Dweck, Davidson et al, 1978).

b. Within-Gender Factors

In spite of the suggestiveness of the findings of such research, it should be noted that within-group differences in both the quality and the quantity of student-teacher interactions were also found.

i. Ability

A great deal of research has focussed on interactions between teachers and students who varied in achievement. In their review of twenty studies on academic interactions, Brophy and Good (1974) found that teachers tended to engage in more interactions with high-achieving students and with students for whom they had high expectations. Teachers varied their patterns of behavior with students for whom they held varying expectations: those considered by teachers as more highly able received a greater proportion of teachers' time and praise (Brophy and Good, 1970a) and less rejection and disapproval (Rist, 1970); those for whom teachers had lower academic expectations were given less praise and had

poorer performances accepted by their teachers (Good, 1970). More recent studies have found similar results (Gambrell, 1983; Leder, 1987, 1988; Lorenz, 1982; Maltby, 1984). Good and Brophy (1987) list a large number of studies indicating teachers' differential treatment of students who were classified as having differing academic abilities.

In addition, two distinct groups of boys receive proportionately more interactions. Firstly, a higher percentage of negative interactions are directed at a small group of disruptive boys who are frequently lower achievers. One study found that approximately a third of the interactions with such a group of boys involved criticism (Brophy & Good, 1970a). Secondly, a small group of high achieving boys frequently receive a disproportionate amount of the positive interactions (Brophy & Good, 1974; Croll, 1986; French and French, 1984).

Such differences in teacher contact with students of varying ability was most pronounced in mathematics classes in which, it was suggested, boys received better instruction (Brophy, 1985). Using two observation schedules, the Brophy-Good Interaction System and Rowe's instrument for measuring "wait time" (Rowe, 1974), Leder (1987) examined teacher-student interactions in mathematics and language classes with 97 grade 3 and 140 grade 6 students. The students were classified with respect to ability using the Operations Test in the Mathematics Profile Series and also with respect to teachers expectations of their abilities. This study found that teachers had more contact with high-achieving, high-expectation students at the grade six level but not at the grade three level. However, teachers tended to spend more time on interactions with low-achieving, low-expectation students at both grade levels.

In a similar study with a total of 359 students at the grade seven and grade ten levels, Leder (1988), found that although teachers spent less time interacting with the best students at both grade levels, at the grade ten level they called on the best students for particular types

of interactions such as higher order questions, and public ones. Top students at the grade ten level also initiated proportionally more questions than their less mathematically-able classmates. On the other hand, the best students at the grade seven level were involved in not only fewer but also shorter interactions with teachers. According to the teachers involved in the study, these differences possibly result from their greater concern about those grade ten students who plan to continue with mathematics. In grade seven, on the other hand, these teachers considered that all students should be given the benefit of the doubt and an equitable quantity of their attention.

ii. Race

In the nineteen seventies, the racial origin of students became the focus of a number of American studies of teacher-student interactions (Byalick & Bersoff, 1974; Hillman & Davenport, 1978; Yando et. al. 1979). In classes with a high proportion of black students, white teachers were found to give more attention, more praise and less criticism to white students than to black students (Rubovits and Maehr, 1973). On the other hand, in a similar study, teachers, both black and white, were found to give more reinforcement to children of different race to themselves (Byalick & Bersoff, 1974). Although this particular finding was not replicated by Hillman and Davenport (1978), they did find that black students and male students were involved in more classroom interactions, both positive and negative, than white students or females, regardless of the sex of the teacher. Using the Brophy-Good Dyadic Interaction System, Hillman and Davenport found that black students were involved in more interactions in the following categories: product questions from teachers, feedback from teachers, and student-initiated interactions. Boys were involved in significantly more interactions in twelve categories including product questions from teachers, teacher criticism and feedback, and student-initiated interactions.

By the mid 1970's, then, researchers had established that students' experience in classrooms varied with a number of student characteristics such as race, ability, sex, age, and teachers' expectations of them. Although teachers have been consistently found to have more interactions with boys than with girls, and with white students compared to black students, the noted inconsistencies in the literature may result from different patterns of interactions for students of different ages or from the types of interactions observed or from the different subject matter being taught. The research is further complicated by the fact that all of these student characteristics potentially interrelate with each other. In addition, it should be remembered that individual variation in both teachers' and students' behaviours also affects the interaction process.

1V. Interaction Studies since the Mid-Nineteen Seventies.

Recent research in student-teacher interactions in North America, Europe and Australia has generally confirmed the findings of studies completed in the 1960's and early 1970's.

a. Non-Subject-Specific Studies

The majority of these interaction studies have been general studies. That is to say, they have not been subject-specific. For example, in a study of over 300 kindergarten to grade twelve classes in Detroit, Hillman & Davenport (1978) used the Brophy-Good Dyadic Interaction System to identify the proportion of instructional time allocated to different groups of students. Although the main focus of this study was student race, a number of gender-related differences were also identified. All of the twelve gender-related variables of the Brophy-Good instrument for which significance was obtained favoured boys. These included the following teacher-initiated and/or student-initiated interactions:

> product question, students not volunteering, students do volunteer, student gives correct answer, student gives incorrect answer, teacher criticizes student answer, teacher asks a new question, teacher criticizes behaviour, student asks a question or makes a relevant response, student asks an irrelevant question or makes an irrelevant response, teacher doesn't accept a student question or response, and teacher gives feedback to a student question or response (Hillman & Davenport, 1978, p. 550-551).

In general boys were found to initiate more contacts with teachers than did girls, and teachers initiated more contacts with boys than with girls. The sex of the teacher was not found to affect the interactions.

In a study at the fourth and fifth grade level, Dweck, Davidson, Nelson and Enna (1978) observed differences between the academic feedback received by boys and girls from teachers. Their results indicated that boys received more praise for their academic performance and criticism of their conduct whereas praise for girls was more likely to focus on the form rather than the substance of their work and criticism was more likely to focus on the academic quality of their work. These striking findings suggested that teachers were more likely to attribute boys' academic problems to lack of effort and those of girls to lack of ability. Moreover, students were likely to reach the same conclusions and alter their efforts accordingly.

Student effort and persistence, important aspects of motivation to learn, are based, at least in part, on such attributions of success and failure as were found in the work of Dweck et al.. Later research has shown that boys and girls differ in their patterns of attribution of both success and failure in mathematics (Fennema & Peterson, 1985; Mura, 1987; Wolleat, Pedro, Becker, & Fennema, 1980). Girls are more likely to attribute their successes to their effort or to external causes whilst boys are more likely to attribute their successes to their ability. The opposite situation exists with respect to attribution of failure: girls are more

likely to think that their lack of ability is the cause while boys are more likely to attribute failure to external causes (Dweck & Elliott, 1983; Leder, 1986; Reyes & Stannic, 1988). However, the findings of Dweck et. al. with respect to teacher feedback have not been replicated (Blumenfeld et al., 1983; Eccles et. al., 1983; Eccles & Wigfield, 1985; Heller & Parsons, 1981) and this has cast serious doubts on their rather controversial conclusions.

Another study using the Brophy-Good Dyadic Interaction System was conducted by Brophy and Evertson, with Anderson, Baum and Crawford (1981). In 27 elementary classrooms taught by female teachers, it was found that 22 of the 73 variables measured were gender-related. As with the previous study, boys had more total contacts, including management-related, teacher-initiated and unsolicited call-outs than girls. Girls, on the other hand, were found to initiate more contacts with teachers. According to the authors, this was an indication that girls were more interested than boys in pleasing teachers. They suggested that the differences in classroom interactions were a result of student behaviour rather than teacher behaviour and were not, therefore, an indication of discrimination by teachers.

Similar results to those of both of these studies were found in a British ethnographic study of elementary school age children by French and French (1984). Their research can be criticized as impressionistic because they selected a single lesson which, according to the authors, "richly" demonstrated the differences in interactions between boys and girls. However, it is an example of a study that has attempted to go beyond simple documentation of patterns of interactions between teachers and boys and girls by providing examples of the types of behaviours employed by the former in gaining the teacher's attention. The study reinforces the conclusion previously noted that it is not a matter of all boys receiving more teacher contact, but, rather it is specific sub-groups of boys who dominate classroom activities.

The same finding was supported by Croll (1986), who suggested that the dominant subgroups of boys result from a greater proportion of male students being identified as learning disabled and behaviourally disordered, and this subgroup take up a higher percentage of teachers' time. The problem, then, in Croll's view, is more a matter of classroom management than one of sexist bias. No matter the reason, the boys manage to get the attention.

In 1985, Brophy, a prolific researcher in the area of classroom processes, reviewed the literature on sex differences in student teacher interactions. He concluded that, though small, there is a difference in classroom experiences for boys and girls. He suggests that this is, in part, a consequence of teachers' responses to differences in student behaviour resulting from the tendency of boys and girls to act differently. Thus teachers reinforce the differences in student behavior. Although the sex of the teacher was not found to have an effect on student-teacher interaction patterns, Brophy noted the importance of how teachers conform to the norm with respect to adoption of gender-role. This may crucially affect interactions. In addition, mathematics is generally perceived as a "male" subject and because of entrenched expectations and values in both teachers and students with respect to it, that subject may be an exception to Brophy's suggestion that interaction differences are a result solely of student behaviour.[3]

In the mid 1980's, two American studies by Irvine (1985, 1986) examined not only the effect of student sex but also of student race and grade level on teacher-student interactions. Both studies, using the Brophy-Good Dyadic Interaction System, focussed mainly on language arts instruction with about 15% of the observations taking place in mathematics classes. In the first study of 1450 students in 67 elementary classrooms, boys received a greater amount of the total interactions. They also "received more of the teacher's

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3. In a more comprehensive research program than the present one, teachers' conformity to the norm with respect to gender role would have to be considered.

attention for praise, negative feedback about behaviour, neutral feedback about procedure, and non-academic feedback" (p.342). When both sex and race of the student were taken into account, white girls were found to receive significantly less of the total commmunications than any of the the four groups studied (white males, white females, black males, black females). The author suggests that this may be a result of greater sex-role socialization of white girls compared to black girls (Lewis, 1975).

The second study of 1328 students in 63 kindergarten to grade five classes looked at the positive and negative behaviours initiated by students, teacher feedback statements to students, and frequency of response opportunities. Males were found to initiate more positive and negative interactions with teachers than did females. Again white females received the least teacher feedback of any of the four sex/race combinations and, furthermore, this percentage decreased as grade level increased. Female students received less negative and non-academic feedback from teachers than did male students. In addition, the opportunity for public response declined with grade level for black females. According to Irvine,

> Black female students present an active, interacting and initiating profile in the early grades but join their white female counterparts in the later grades in what appears to be traditional female sex role behaviours. (Irvine, 1986, p. 20.)

In their analysis of classroom talk in two British elementary schools, Swann and Graddol (1988), found that the more competitive students, generally male, took control in the classroom and dominated talk. They note that some types of children's talk in classrooms, such as participation in discussions, can be important to their learning. Their findings, then, that girls received fewer of the more challenging process questions which

could lead to discussions, and more of the simple questions requiring one word or yes/no answers, suggested to them an exclusion of girls from this aspect of learning.

To Swann and Graddoll, interactions in school are no more than a reflection of society at large. In general adult men talk more, interrupt more and exercise more control of topics in mixed-sex conversations (Coates, 1986, French & French, 1984; Spender & Sarah, 1988). In schools, because classroom management is one of the main concerns of teachers (Levy, 1974), both teachers and students accept the communication patterns of the wider society because they produce a manageable and stable classroom situation. This then, becomes the accepted norm and leads the girls, who are generally quieter, to be accepting of their lack of opportunity to interact. Girls who take verbal initiative, particularly in the form of challenging or questioning authority, are assessed differently from boys who demonstrate the same behaviour. In boys it is seen as demonstrating leadership abilities whereas girls are often described as aggressive or masculine (Spender & Sarah, 1988). This produces a more difficult situation for girls, particularly in adolescence when they are more concerned with popularity with their peers. A similar dilemma does not exist for boys with respect to role conflict. Swann and Graddol suggest that,

> girls may be nudged at an early stage of their academic careers, into topic areas in which they can succeed using other learning strategies (such as rote-learning, learning through reading)...which work well at elementary levels but which lead to poor achievement later in their academic careers. (Swann & Graddoll, 1988, p. 63.)

This conclusion agrees with the research that shows that differences in performance in mathematics between boys and girls do not begin to appear consistently until the beginning of high school (Armstrong, 1981; Fennema, 1987; Pallas and Alexander, 1983).

Similarly, French and French (1984), in their study of elementary classrooms, described situations in which dominant boys manipulated classroom talk in order to have more opportunities to talk themselves. They emphasize that children construct their social world through language and learn to interact with others in sex-appropriate ways at an early age. The acceptance of women's lack of prominence in classroom interactions and discussions, then, predisposes them to being underrepresented in such areas in society as politics and business, where being able to speak well is an asset.

Another ethnographic study of two Australian elementary schools examined not only teacher-student interactions, but also obtained detailed information of teachers' attitudes towards sexual stereotypes and their home and school lives (Evans, 1988). Over the eight classes observed, as in all the other studies reviewed, boys were involved in a greater proportion of the total interactions and received more teacher-initiated interactions (57%), including discipline. The findings of this study, as those of Brophy, Evertson et. al., (1981), differed from those of most other studies in that girls initiated more interactions with teachers than did boys. Evans cites another British study by Fuller (1979) that found similarly active West Indian girls. However, as in the Brophy et. al. study, the nature of these interactions was frequently to seek affirmation from the teacher about the correctness of work. Evans suggested that this may have resulted from either her research emphasis on student-initiated interactions or the age of the students concerned. Most studies which indicate that girls initiate fewer interactions with teachers involved older students. It may be that younger girls may be more likely than adolescent girls to assert themselves because they have less peer pressure to conform to sexual stereotypes.

As part of her research, Evans spent a great deal of time studying the lives and backgrounds of the teachers involved in her study. When the classroom interactions were examined for each individual teacher, a relationship was found between interactions and the

ideological positions of the teachers. Evans classified teachers with respect to their views on sex-role stereotyping and found that the more egalitarian a teacher, the more likely that girls would dominate in the classroom. On the other hand, girls in classes where teachers held strong sex-stereotypical views interacted less with the teachers.

The last study to be reviewed here examined the effect of the length of teacher service on the classroom communication process. Jones (1989) used a modified version of Brophy-Good Teacher-Child Dyadic Observation Instrument to find out if less experienced, possibly younger, teachers behaved differently from their older counterparts in the classroom. Of the 43 categories of classroom interactions observed, the familiar pattern occurred. Boys received significantly more management contacts, praise, questions and private contacts and they initiated more contacts with the teacher. The level of experience of the teacher was not found to be related to either the quantity or the quality of student-teacher interactions.

In summary, the findings of these non-subject-specific studies suggests that boys and girls have different experiences in classrooms. Boys nearly always receive more teacher attention than girls. Except in the few studies noted, they initiate more contacts with teachers and receive more criticism. Not only do they receive more praise but it is also, possibly, of a different quality than that received by girls. However, it is not a matter of all boys receiving more attention, but, rather, it is a small sub-group of boys who dominate classroom interactions. Although the sex of the teacher was not found to affect student-teacher interactions, the way in which teachers conform to the norm with respect to gender adoption may affect classroom communication. Finally, this limiting of girls during classroom talk, it has been suggested, mirrors the situation with respect to communication in society in general. Although the magnitude of the differences in teacher-student interactions

favouring boys is generally small, the hypothesis here is that their cumulative effect over a school year or, indeed, adult life is significant enough to be of concern.

b. Subject-Specific Studies: Mathematics

Since the mid 1970's, a number of studies have focussed on student-teacher interaction in specific subject areas and across subject areas. These can be divided into studies which focus on elementary students and those which examine interaction patterns between teachers and secondary school students.

i. Elementary

Leinhardt et. al. (1979) examined student-teacher interactions as a possible cause for the different performances of grade two boys and girls in mathematics and reading in the U.S. In the 33 classes that were observed, boys and girls received different treatment by teachers. Girls were involved in more academic contacts and received more instructional time than boys in reading, but boys were involved in more of both in mathematics. In addition, boys were involved in more management contacts. Because the sex differences in achievement that resulted at the end of the school year did not exist at the beginning of the year, Leinhardt et. al. assumed a relationship between instructional time and achievement. Although the significant difference in the amount of time spent with the boys in mathematics was small, the authors suggest that the cumulative effect of such treatment over the years of schooling may affect achievement.

In a similar study in Australia, Leder (1986) examined classroom interactions in one class of grade six students during mathematics, language arts and science lessons. This study was small, consisting of a total of eight hours classroom observation time. Although few sex-related differences were found across the subject areas, two significant differences

emerged within mathematics classes. Like Swann and Graddoll (1988), Leder found that girls received more product questions from teachers and boys received more of the higher level process questions. Again, the author suggests that the concern is the cumulative effect on female students of such difference in treatment.

However, defining and achieving equal treatment of boys and girls is not an easy task. In their in-depth study of a grade seven mathematics classroom, Stannic and Reyes (1987) point out a number of difficulties. One arises because teachers are trained to respond individually to students. In so doing, they may be more likely to treat boys and girls in sex-stereotyped ways. In other words, when dealing with an individual child, the teacher's beliefs about one sex may be ascribed to an individual of that sex. Secondly, it was noted that individual students responded differently to identical treatment by the teacher. In other words, equal treatment of students did not lead to equal outcomes. Finally, the authors found that when they, themselves, knew the teacher's intentions, this knowledge, in turn, affected their own interpretations.

More recently, other factors have been considered when examining interactions between students and teachers in mathematics classes. One such factor is student confidence in learning mathematics (Hart, 1989). Numerous studies have shown that students' performance in mathematics is related to a number of attitudinal characteristics including their attribution of success, their feelings about the usefulness of mathematics, their beliefs about the appropriateness of mathematics as a field of study and their confidence in learning the subject (Reyes, 1984; Reyes and Stannic, 1988; Fennema and Sherman, 1978; Meece, Parsons et. al., 1982).

The more certain people are of their ability to perform well in mathematics, the more effort and persistence they are likely to demonstrate and the better their performance is likely to be. Although sex differences in mathematics confidence have been reported among

children as young as grade 5 or 6 (Marsh, Smith and Barnes, 1985), they do not emerge reliably until grade seven or later (Fennema, 1987; Gilchrist, n.d.; Licht, Stader & Swenson, 1989). By about age 12, girls are less confident than boys in their ability in mathematics (Eccles, et. al., 1983; Fennema 1984; Meece et. al., 1982; Reyes 1984) and this lack of confidence persists even when there are no significant sex-related differences in mathematics achievement (Fennema and Sherman, 1978). In other words, by junior high school, boys perceive themselves as more able than girls in mathematics, despite having similar grades on standardized achievement tests (Meece, Parsons et. al., 1982). On these tests girls are more likely than boys to choose the "I don't know" option (Hudson 1986) and are more likely to omit questions, a possible indication of lack of confidence (Hanna, 1986). Thus girls tend to feel less adequate and have a greater tendency to underestimate their own abilities. Girls' lower confidence in their mathematics ability seems to be particularly overt when the task is unfamiliar or when there is less certainty of success (Dweck & Licht, 1980).

However, girls express confidence equal to that of boys when faced with familiar tasks (Licht, Stader & Swenson, 1989). This lack of confidence with the unfamiliar is one possible explanation for girls' relative success with classroom examinations compared to standardized tests (Kimball, 1989). In addition, it holds true even for very able female mathematics students as noted in another study dealing with student confidence in mathematics (Zigli, 1985).[4]

Hart (1989) compared interaction processes in a classroom of girls and boys who differed in their confidence in their ability to learn mathematics. Using the Brophy-Good

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4. In this study, top academic high school students were asked to rate their own intelligence in high school and in second year in college. Despite having higher grade point averages than their male counterparts, nearly five times as many female students as male students significantly lowered their estimation of their own abilities by the time they had spent two years in college.

Dyadic Observation system, the type of teacher-student interaction and the amount of time spent on task in mathematics was measured for a group of 93 high-achieving grade seven mathematics students who had been further identified with respect to high and low confidence level in mathematics. As in the other studies reviewed, boys were found to interact more with teachers than did girls, although the differences found were smaller than those found in earlier studies (See Becker, 1981, next section). Although there were no significant gender-related differences in private interactions, significant effects favouring boys were found for the following categories of public interactions: neutral teacher feedback, student call-outs, volunteer answers and incorrect student answers. In contrast to other studies reviewed, there were no sex-related differences in teacher management contacts or teacher praise. The author suggests that this may be a result of the fact that the sample consisted of high-achieving mathematics students.

Confidence level, however, did not have as great an effect on student-teacher interactions as did the sex of the student. However, students with low confidence were found to have a greater number of private interactions with teachers. In addition, there was a significant difference in the amount of time students with a high confidence level spent on mathematics. A further, more qualitative analysis of the data by Hart found a number of patterns. One noted a difference in the growth of student confidence, especially for boys, in those classes where girls interacted more with the teacher. Over a period of a year, these students' self-reports of confidence in mathematics increased more than did that of the students in classes where boys interacted more with the teacher. Another pattern suggested that teachers of classes in which boys had more interactions were more apt to sex-role stereotype students.

In conclusion, the findings of studies in teacher-student interactions in elementary mathematics classrooms seem to support those of the non subject-specific research with

respect to the difference in the experience of boys and girls in classrooms. Boys initiate more contact with teachers and teachers initiate more contact with boys. Boys also receive more criticism and more praise and are asked more higher-level questions while girls are asked more lower-level questions.

ii. Secondary

A number of the studies in teacher-student interactions in mathematics classes have focussed on the secondary school level. Stallings (1979), using the Brophy-Good instrument, observed high school algebra and geometry classes and found that boys received more of almost all kinds of interactions than girls. Both teacher-initiated and student-initiated interactions favoured boys, as did praise and feedback by the teacher.

On the other hand, in a study of upper elementary and secondary mathematics students, Parsons (1980), using the same instrument, found sex differences in only three of the 51 variables measured. Unlike the Stallings study, no sex differences were found, for example, in the quality or quantity of teacher questions to either sex. Those few differences which were found were related to the amount of criticism of boys and girls by teachers. Boys received more criticism, especially with respect to the quality and form of their work. However, this study did not support the controversial findings of Dweck et. al. (1978) in which girls received academic feedback which focussed more on the form of their work as opposed to the content.

Becker (1981), in a study of grade ten high school geometry classes, found greater differences than those reported by either Stallings or Parsons et. al. Using both quantitative (Brophy-Good instrument) and qualitative methods (interviews), Becker concluded that, on the basis of sex, teachers treated males more positively in the following categories:

> (a) afforded response opportunities, (b) open questioning, (c) cognitive level of questions, (d) sustenance and persistence, (e) praise and criticism, (f) encouragement, (g) individual help, and (h) conversation and joking (Becker, 1981, p.50).

Not only did boys receive more teacher attention and reinforcement, they were twice as likely as girls to call out in class. Becker noted that when students called out, teachers' attention was then directed to them. Sadker, Sadker and Thomas (1981) found that boys were eight times as likely as girls to call out in class. The greater differences found in this high school study compared to those of Stallings and Parsons et. al. may be a result of the difference in the age groups of the samples (junior high school versus senior high school), of the greater number of observations in the Becker study or of the difference in the ability level of the students. Because Becker's sample consisted of more mathematically-able students in geometry classes, it may be possible that gender-differences in teacher-student interactions increase as perceived mathematical ability increases.

A number of studies, spanning six years and involving several researchers were reported by Eccles and Wigfield (1985). Although these studies of upper elementary and junior high school mathematics classes found few gender-related differences in teacher-student interactions, they found that the patterns of interactions were influenced by teacher expectations. When junior high school age students were categorized by teachers as being more or less able with respect to teachers' expectations of their mathematical abilitiies, different interactional patterns emerged. Girls in both expectancy groups were criticized proportionately less and initiated proportionately more questions with teachers. Girls in the high teacher-expectancy group had less self-confidence in mathematics than their male equivalents. Low-expectancy boys received the most interactions and the most criticism of the four groups (Parsons, Kaczala and Meece, 1982). Although a significant relationship existed between teachers' expectations and student attitudes in mathematics, teacher

behaviours and student attitudes did not seem to be strongly related. Eccles and Blumenfeld suggest that teachers do not overtly cause sex-differentiated beliefs of students about sex-appropriateness of subjects but, instead, reinforce those beliefs that the students already possess.

In another more recent study of approximately 360 Australian students in grade seven and grade ten mathematics classes, Leder (1988) used both the Brophy-Good instrument and Rowe's (1974) instrument to monitor wait-time and time spent on interactions with individual students. Although the main focus of the study was student-teacher interaction patterns with students of varying mathematical ability, a number of gender-related differences in student-teacher interactions were also observed. Across grade levels, boys were found to dominate overall in both student- and teacher-initiated interactions and, more specifically, to be involved in more teacher-initiated product and process questions and discipline interactions.

However, a number of variations were found between the grade levels. Students were divided into two groups according to ability: the top 20% and the rest of the students. For the grade seven students, the top students were involved in fewer interactions, both overall as well as within specific interactional categories, than were the rest of the students. This was not the case with the grade ten level students. Although the top 20% were not involved in proportionally more of the overall interactions, they initiated more interactions, and were involved in significantly more higher-level process questions and discipline exchanges but fewer lower-level questions and work-related teaching exchanges in general.

Only one study on the topic of student-teacher interactions in the Third World was found. Its focus was the expectations of Togolesian women in secondary school (Biraimah 1982). Although the structural formality of classes in Togo permitted few student-teacher interactions, boys dominated in academic interactions in all subjects except art. Girls, on the

other hand were three times more likely to participate in chores in the classroom. Biraimah suggests that rather than discriminating against females, teachers interact with the male students who volunteer answers. When they did volunteer in class, girls were called upon by the teacher. According to the author, it is a matter of girls limiting their chances by opting out of the interactional process.

In conclusion, it is clear from this review of the literature that, in North America, Europe and Australia, it has been found on the whole that girls are less active in classes in all subjects and are also better behaved than boys. In general, they receive and initiate less total contact with teachers, and are the recipients of fewer questions, less praise and less criticism. These differences are particularly noticeable in mathematics classes, especially at the higher grade levels. Girls do not participate as fully in mathematics classes as do boys.

Much of the early classroom interaction literature reviewed, documented the existence of sex-linked inequities. While the findings of such studies provided a valuable base for further research, the explanation which they offered for these differences in educational outcomes is suspect, to say the least. The sources of girls' relative lack of interaction with teachers were often identified as arising from the fact that they were girls and, as such, were quieter, less assertive, and tried more to please the teacher. The role of the teacher was not identified as an important factor. In effect this is "blaming the victim" and does not provide a very satisfactory explanation for underachievement.

While some researchers continue to document inequalities in classroom interactions, a number have included the effects of individual student and teacher attributes on these interactions including such factors as teachers' length of experience, their expectations of students, student ability, their attribution of success and their confidence in learning mathematics. In this way, the role of the teacher as well as the attitudes and behaviours of

the student are seen to be part of the socially constructed world. In this case, girls' under-participation in classroom interactions was recognized, at least in part, as a consequence of the socialization process. No longer were girls solely to blame for their lack of participation in mathematics classes.

More recently, especially in Europe, and Australia, research into student-teacher interactions has focussed on the gendering of subjects within a patriarchal society. In other words, researchers have investigated the question of why mathematics has come to be perceived in Western capitalist societies as a "masculine" subject. To this end, teachers' beliefs about sex-roles have been an object of study and have been included when evaluating their interaction patterns with students.

More information is needed on why women are underrepresented in mathematics-related fields in some countries and not in others. The context in which girls are able to achieve in such subjects has not been examined. The majority of teacher-student interaction studies have been conducted in contemporary, industrialized, capitalist societies. It has been argued by Bishop (1988) and Popkewitz (1988), among others, that school mathematics is culturally bound and mathematics teaching is not value-free . It

> involves not only acquiring content; it involves participating in a social world that contains standards of reason, rules of practice and conceptions of knowledge. The social patterns of school conduct are not neutral but related to the larger society and cultural differentiation that exists in our societies (Popkewitz, 1988, p.221.).

The question arises, then, as to whether the patterns of teacher-student interactions are culturally specific or whether, given a different set of values or intentions, the degree of womens' success in mathematics classes could be increased.

Furthermore, few studies exist that compare differences in student-teacher interactions across specific subject areas. Of the two already reviewed, one, conducted by Leinhardt (1979) over ten years ago, found a relationship between teacher-student interactions in mathematics and language arts and student achievement in those subjects in grade two classrooms. The other one, conducted by Leder (1986) is a study of one class for a limited amount of observation time (eight hours), focussed on grade seven, the level at which sex differences in mathematics performance begins to appear. This study, however, found no significant differences across the subject areas: mathematics, language arts, and science. Given such inconclusive results and recent research which indicates differences in teachers instructional techniques for different subject areas (Stodolsky, 1988), the question of the differences in student-teacher interactions across subject matter requires further study.

The overall conclusions, then, from this review of the research are:

1. Boys and girls are treated differently in classroom interactions.
2. Rather than all boys, there are sub-groups of boys who dominate in classroom communication.
3. Student treatment in classrooms varies depending on a number of factors including grade level and subject taught. The pattern of male-dominated student-teacher interactions appears to be more prevalent in mathematics classes and becomes more pronounced as the grade level increases.
4. Differences in classroom experiences may lead to differences in achievement.
5. Communication patterns in classrooms mirror those of the wider society.

The specific questions proposed for this study are:

1. How do grade seven teachers differ in their interactions with boys compared to those with girls?

2. Are the interactions between teachers and girls and boys in mathematics different from those in language arts?

3. How do such interactions in both subject areas differ within the Canadian and Cuban samples?

This thesis will try to examine these questions by studying teacher-student interactions in grade seven mathematics and language arts classes in two cultures: one in the English- speaking part of the industrialized, capitalist country of Canada; the other in the socialist, Spanish-speaking developing country of Cuba.

CHAPTER II.

THE CUBAN EDUCATIONAL SYSTEM

> The education system is ... more than a school system, but as is the case with the school system and the individual school, it is also a socio-cultural phenomenon which has its roots in a particular socio-cultural system and is as such a subsystem of the socio-cultural milieu. (Vos. 1987, p. 34)

Cuba is located in the Caribbean Sea between North and South America. It lies at the entrance to the Gulf of Mexico, approximately 150 kilometres south of the Florida keys and consists of an archipelago of more than 1600 islands, islets and keys, the largest of which is the island of Cuba. The island is 1200 kilometres long, with a width varying from 30 to 190 kilometres. In 1989, the nation as a whole had a population of just over ten million with an ethnic composition of Hispanic, African and Mulatto. Between 30 and 40% of the population are black. The official language is Spanish, and Spanish is the language of schooling.

1. Pre-Revolutionary Education

As in most Latin American countries, education in Cuba in the Colonial period was modelled on that of Spain. Schools were directly controlled by the religious establishment and religious orders played a major role, not only in the promotion of education, but also in the design of the curriculum and in the manner of study. Access to education was restricted to the children of the upper class, consisting mainly of plantation owners and those in the upper ranks of government service. They were educated either at home, in private or religious schools, or sent abroad. The very small, predominantly urban, middle class,

consisting of professional men, salaried persons, and skilled workers had access to local private schools. The large lower class, consisting mainly of unskilled wageworkers and peasants, remained essentially uneducated. This situation continued up to and beyond the establishment of public education in the middle to late nineteenth century (Rudolph, 1985).

Increasing urbanization at the beginning of the twentieth century combined with the growing commercial influence of the United States swelled the numbers of professionals and skilled workers in Cuba. Following tradition, their children generally attended private institutions and consequently, the private system continued to expand. In 1953, 108 of the 129 secondary schools in Cuba were privately owned (MacGaffey & Barnett,1962). As a result of the investment in private schools, as well as local economic fluctuations, general global economic conditions, political turmoil and corruption within the system itself, the Cuban free public education system worsened in the three decades prior to the Revolution to the point that it was described in the 1950's as being in a "state of disquieting deterioration" (Mesa-Lago, 1971).

Corruption, administrative incompetence, and waste were endemic. Truslow, in 1951 describes the situation:

> The educational system suffers from bad traditions, unsuitable personnel, inadequate and badly-located equipment and plant and, above all, poor morale throughout. (Truslow, 1951, p. 405.)

Corruption permeated the entire system. Teachers had life tenure and received full salary no matter whether they performed their teaching duties or not. Consequently, the sale of teaching appointments was a common practice. "It would be difficult to overstate the

adverse effects of patronage practices and outright theft on educational standards and the morale of many dedicated teachers." (Mesa-Lago, 1971, p.383).

In addition, there was a severe lack of schools. Approximately 600,000 children were without (Eng 1985; Werthein, 1985). Prior to 1959, there were not enough classrooms to allow 35% of school age children to attend school (Zimbalist, 1988). Of those children who did attend school, few managed to complete even the elementary grades. One third of grade one students did not return for grade two (Truslow, 1951) and according to the 1953 census, only 3% of children who entered school completed grade six (MacDonald, 1985).

Differences in access to schooling between urban and rural areas was also a problem. In the country as a whole, school attendance for primary-age children was approximately 50% (Pérez, 1988). However, although more than half the population lived in rural areas, less than one third of their school-age children attended school (Mesa-Lago, 1971). This inequity was even more pronounced at the secondary school level. Although approximately 30% of teenagers in Havana attended school in 1953, only 7% of those in rural areas did so (Kirk, 1985).

A consequence of this educational neglect in the 1950's was the existence of a large population of illiterates. Prior to the Revolution, the illiteracy rate in the population ten years or older was 23.6% (Zimbalist, 1988), that is to say, based on the 1953 census, with a population of less than 7 million, Cuba had approximately one million illiterates. An additional one million people were considered almost illiterate (Azicri, 1988). According to the 1971 report by Hugh Thomas, the Latin American advisor to the British government, this situation was deteriorating because the percentage of illiterates in 1953 was increasing (Halebsky, 1985).

It would seem that, in the late 1950's, Cuba was a fairly typical underdeveloped country with the accompanying characteristics of foreign domination, a widely unequal distribution of wealth and an ineffective, inegalitarian, and impoverished educational system. This view is supported by a World Bank sponsored Report on Cuba:

> Thus, at the same time that Cuba ranked nearly last in Latin America in terms of the percentage of school-age children enrolled, only two or three Latin American countries 'spent' more public funds on education than Cuba (cited in Mesa-Lago, 1971 p. 382).

One exception to the generally held view that the education in Cuba was poor is that held by Werthien (1985) who claims that, in terms of education, Cuba compared more than favourably to other Latin American countries:

> education in Cuba was much more widespread than in all but two Latin American countries (Argentina and Uruguay). In 1958, about 75% of the Cuban population aged ten years or over had completed some primary or higher schooling, with only 25 percent not having attended any school; over one percent of the population had attended university. (Werthien, 1985, p. 1125)

2. Post-Revolutionary Education

Whether the revolutionary leaders "inherited a relatively well-educated population" (Werthein, 1985, p. 1125), or a country of near-illiterates, there is little doubt that significant changes have occurred in education since the revolution of 1959. Education was, and still is, one of the most important preoccupations of the revolutionary leadership. In his many speeches before and after the Revolution, including the famous "History Will

Absolve Me " speech at his trial in 1953, Fidel Castro clearly indicated that one of his goals was the removal of the deficiencies and inequalities in the educational system, a process which he saw as the key to the reconstruction of Cuban society. This priority stemmed not only from the need to reconstruct an inequitable educational system of generally poor quality but also from a government belief in education as a basic human right. In addition, an educated workforce was a necessity to develop the economy of the country. Schooling was also seen as a method of communicating the Revolution's value system including such themes as the promotion of a more egalitarian society, the elimination of sexism and racism and the development of a less urban-dominated society (Halebsky, 1985). Public education was seen as a means of promoting attitudes and values compatible with and capable of maintaining revolutionary policies.

Upon the victory of the Revolution, the educational system was revamped with the goal of providing free universally accessible education. High priority was given to the development of new programs and the building of new schools, particulary in rural areas where the need was greatest. As evidence of the government's commitment, huge amounts of money were invested in educational campaigns. In 1959, education was allocated 12 pesos per person; in 1980 that figure was 137 pesos per person (Eng, 1985; Leiner, 1985). The view of education as a sound investment continues.

However, problems persist. Although supporters see Cuban education as promoting the "creation of the new socialist man" (sic), critics claim that it is not only little more than indoctrination but also that, "it is clear from sources both inside and outside of Cuba that the educational system is beset with serious difficulties" (Pérez, 1977, p. 34). Within the country, it is generally acknowledged that, with respect to education, quality suffered in the rush to provide quantity, especially in the early years following the Revolution. This is indicated by the high percentage of students who had to repeat grades

and the numbers who dropped out of school. Nelson (as cited in Richmond, 1985) records a drop-out rate in the first five years following the Revolution years of more than 80% of students who started grade one by the time they reached grade six. A high drop-out rate continued into the early 1970's[5], an indication of the existence of problems within the educational system. In attempts to eradicate some of the problems, the curriculum was overhauled, the school system was reorganized and more emphasis was placed on the hiring and training of teachers. Despite the huge increase in the number of teachers, there is still a shortage of those who are fully-trained (Leiner, 1985). Present attempts to alleviate this situation include the hiring of more teachers and the encouragement of existing teachers to upgrade their qualifications, a relatively straight-forward task in a society such as Cuba, where enormous emphasis is placed on education as a life-long process[6].

However, twenty years after the Revolution, truancy rates, drop-outs from the educational system and delinquency problems had increased (Salas, 1979). As in many other parts of the world, problem students tend to be poor, urban, male youth. The educational system was partially blamed for these problems because of:

> the lack of adequate materials to meet rising enrollments; lack of qualified staff and inaccessibility of some schools, especially in rural areas; the demands placed on teachers' time; and discipline problems attributed primarily to the educational staff's lack of adequate training and experience (Salas, 1979, p. 51).

A further area of concern revolves around the government's efforts to promote economic development. In the early years of the revolution, a great number of Cubans left

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5 Less than 25% of students who entered first grade in 1965-66 finished high school (Richmond, 1985).

6 It is estimated that more than a third of the population are enrolled in some form of schooling (Leiner, p 27).

the country for the United States.[7] Because this group included many middle-class scientific and technical workers, it was necessary to replace them with foreign specialists. An immediate goal, then, became the training of Cuban technicians and scientists to replace these imported workers. This great need for skilled scientists and technicians has led to the creation of specialized schools for more talented students. Such schools are seen as an efficient way to produce the qualified personnel needed. Their existence, however, not only points to fundamental political contradictions but also poses a danger of creating a new technically-educated elite class.

One last criticism of Cuban education addresses the suggestion that it consists of little more than political indoctrination. In a country dominated by one political party which forms the basis of thought in all fields of cultural life, including education, not all educators feel that they have a say with regard to matters such as curriculum, educational, or research goals. As a result, the free critical enquiry necessary for original thought may be stifled.

Despite such problems, the successes in education in Cuba are notable. Even critics of the regime admit that there have been a great number of improvements since 1959. Education is now free and accessible to all. The costs of materials, books and, in some cases, lodging are covered by the State. The school day, which prior to the Revolution had been reduced to four hours and in some districts to two hours (Mesa-Lago, 1971), was lengthened thus increasing the number of hours spent in school (Pérez, 1988). In the first year after the Revolution, 10,000 classrooms were opened primarily in rural areas (Eng, 1985) and, between 1958 and 1968, the number of primary and secondary schools nearly doubled (Leiner, 1973). Elementary school enrolment grew from 56% of primary age children in 1953 to 88% in 1970 to almost 100% in 1986 (Azicri, 1988). Some of the initial increase in public school enrolment arose from the absorption of private schools into

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[7] It is estimated that, by 1969, more than half a million Cubans had left the country (Mesa-Lago, 1971).

the public sector but, as Salas has pointed out, at least part of the magnitude of the expanded enrolment is due to the greatly increased birthrate following the Revolution. This growth, however, is claimed to account for less than 13%, so, the figures remain impressive (Salas, 1979). The increase in the number of teachers in the system is also a source of national pride. In 1985, the teacher population of 250,000 is eleven times that of pre-Revolutionary times (Leiner, 1985).

Of the early educational successes, one of the best known is the 1961 Literacy Campaign which marked the inception of a number of government policies aimed both at introducing schooling to the adult population and at eradicating illiteracy in the country. A large number of voluntary teachers, "brigadistas", after a three month training period, left their homes in order to live and work with the people in the villages and remoter areas of the country. Sources differ but the numbers involved vary between 100,000 (MacGaffy & Barnett, 1962) and more than a quarter of a million people (Mesa-Lago, 1971). The majority of these workers were adults but some were students, including a number of traditionally-raised young women who joined this national campaign sometimes in defiance of their protective parents. To accommodate the participation of students in the campaign schools were closed for an eight month period (Pérez, 1988). At the conclusion of the campaign Cuban authorities claimed the new illiteracy rate was 3.9% (Zimbalist, 1988). The 1986 Statistical Yearbook for Latin America now puts the illiteracy rate at 2.15% for the population from 10 to 49 years.

Following the success of the Literacy Campaign, the government continued to mount new educational campaigns. The long-term nationwide programs such as "Battle for the Third Grade" and "Battle for the Sixth Grade" enabled over half a million adults to complete sixth grade by 1974 (Leiner, 1985) including over 300,000 housewives (Eng, 1985). The median level of education of the population went from two years of elementary

schooling in 1953 to a secondary level of schooling at present (Zimbalist, 1988). This emphasis on increasing the general educational level of the population continues to-day. In late 1989, the call was for the "Battle for the Ninth Grade" for the entire population.

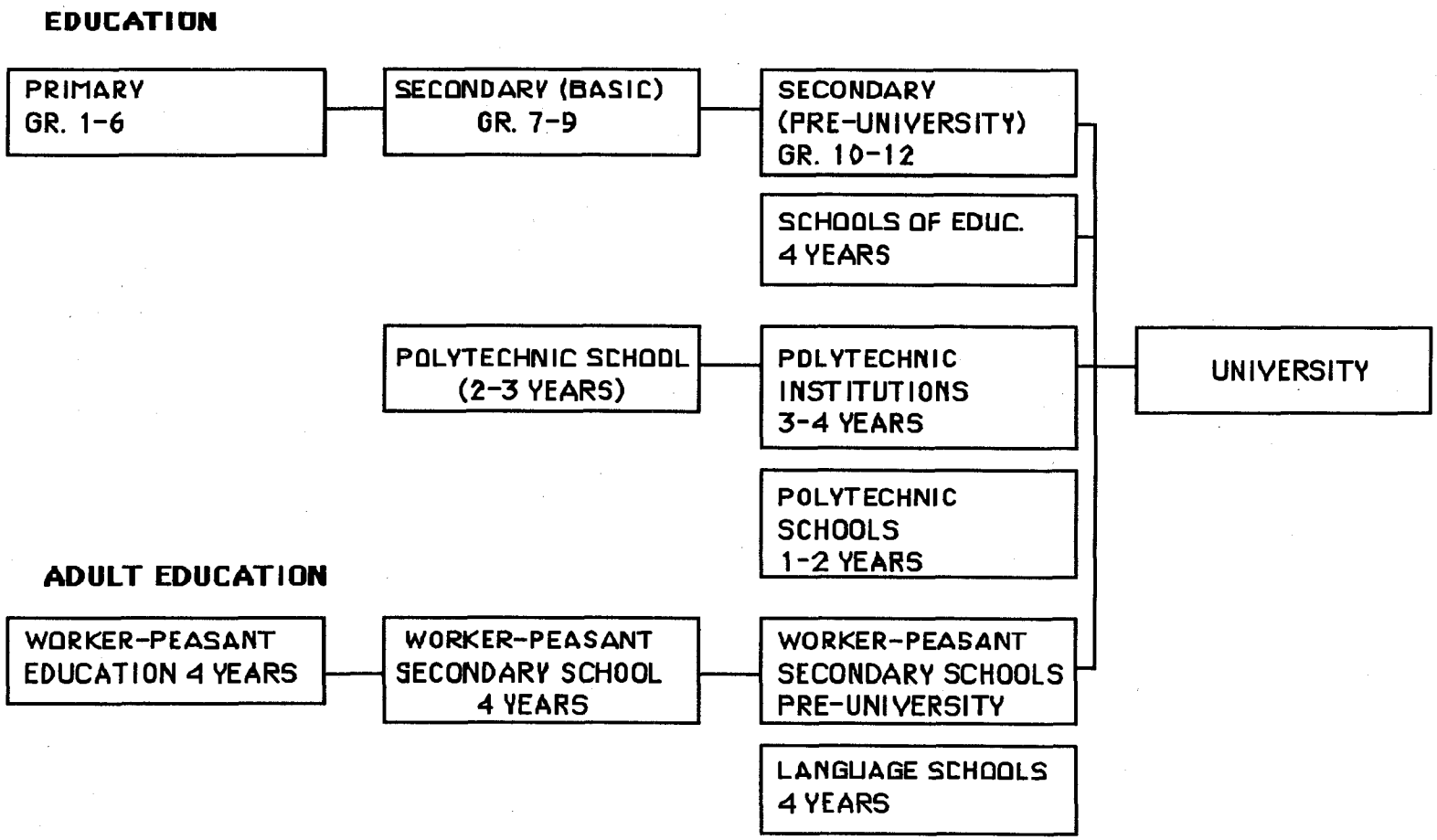
3. Structure of the Educational System

Education is the responsibility of the central government. The educational system is made up of a number of subsystems including, general, adult, technical, special and higher education, and teacher training (see table 1) (Azicri, 1988; Werthein, 1985). Up to age four children can attend "círculos infantiles" (day-care centres) followed by one year of pre-school. From primary school, which has six grades for children approximately aged 6 to 12, students move to basic high school for grades seven through nine. Beyond this point students have the option of continuing with three or four more years at upper secondary school, with vocational or polytechnic school or with pre-university education, depending on their abilities and interests. (Azicri, 1988; Eng, 1985; Rudolph, 1985).

The school year, which runs from September to June with approximately forty weeks of instruction, is similar to that in Canada. In Cuba every second Saturday is a work day for all workers and students also attend school on the mornings of these days. Although the individual organization of regular school days varies depending on the facilities, classes, in general, start early (at approximately 7:30 a.m.) and academic work is generally completed by noon. Afternoons (until about 4:30 or 5 p.m.) are taken up with tutorial assistance for academic work, electives, or manual labour.

TABLE 1

CUBAN EDUCATIONAL SYSTEM



A basic premise of the Cuban educational system is that academic work should not be considered superior to manual work. In order to teach children to value physical work and to respect those who work with their hands a variety of programs have been established which incorporate study and work. In some cases, for part of each school year (e.g. one month) the students are involved in some form of agricultural work. In other schools, students spend part of each day working on farms. This applies to all levels of education including day-cares where children help to prepare, grow and tend communal gardens, the produce of which is consumed in the daycare (Rudolph, 1985). In addition, a number of residential schools (Las Escuelas en el Campo) have been established in the country where students have the opportunity to receive an education while participating daily in agricultural work.

4. Mathematics in the Curriculum.

In the pre-Revolutionary era, educational emphases were mainly on the historically-popular humanities or in areas such as economics, administration or law, useful disciplines in a country dominated by foreign capital. Historically education had stressed the "man of letters" tradition and the intellectual in Cuba was a great orator. An indication of the nature of higher education in Cuba is given by the following statistics from the university of Havana.

> In 1952 the 6,560 lawyers represented ten times the total number of agricultural engineers and technicians. Of the 17,527 students enrolled in the University of Havana in 1953-1954, only 1500 were enrolled in civil engineering, agricultural studies, and pure science and mathematics (Pérez, 1988, p. 360).

After the Revolution, the need to support the new agricultural and industrial development led to greatly expanded technical and professional educational programs. This, in turn, required curriculum changes in favour of these scientific and technical subjects traditionally not favoured by Cubans. The speed of these changes is indicated by the increase from 59% to 90% in the overall numbers of students enrolled in technical programs at the University of Havana between 1959 and 1967 (Pérez, 1988).

To prepare students to enter these scientific and technical fields at the university, changes had to be made in the curriculum at the school level. Because mathematics was seen as fundamental to the areas required for future growth of the country, efforts were focussed on improving the mathematics program. Leiner (1973) interviewed Dr. Maria de Carmen Nuñez Berro, the national mathematics curriculum coordinator. She explained that, because of the lack of research capability in Cuba and the need to implement a program quickly, a new mathematics program was sought in other countries. In 1965, a number of different programs, including several in the United States and in Europe, were examined. The new East German mathematics program, which was being designed at this time, was chosen, partly because of the existence of professional interchange between the two countries. It was introduced into Cuban classrooms, one grade per year, from 1968 (Leiner, 1973).

In addition to upgrading the mathematics curriculum, the amount of time students spent in mathematics classes was also increased. Starting at the very early grades, mathematics was given high priority in that students spent more time in mathematics classes and in science classes than in any other school subjects. In 1981, although students spent the same amount of time in mathematics as in reading or Spanish up until the third grade, the difference in the percentage of time increased as the grade level increased so that, by high school, students had approximately twice as much instruction in mathematics as in any other

subject (Leiner, 1985). However, according to the head of the mathematics department at a specialized technical school in Holguín, this differential in percentage of instructional time now begins in grade one, with all students receiving twice as much instruction in mathematics as in other subjects. In grades nine through twelve, this percentage is increased to three times the amount of time spent on other subjects[8] such as geography, history or English.[9] Similarly, more instructional time was allocated to the physical sciences, chemistry and physics (twice the amount as other subjects) and to a lesser extent in biology (one and a half times).

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8 In Canada, students spend an equal amount of time in the academic subject areas

9 English was the only foreign language taught in all of the schools I visited.

CHAPTER III

CANADIAN AND CUBAN DATA

As noted in the review of the literature, small and/or subtle differences in everyday classroom practices may make a difference in student learning. Within the complex array of classroom practices, my research focusses on the area of student-teacher interactions. Specifically, it examines differences in the interactions of grade seven teachers with boys and with girls in mathematics and in language arts in Cuba and in Canada. The aim is to discover whether these interactions vary cross-culturally within the two different subjects and, if so, the extent of their variability. This chapter includes

-an outline of the procedures employed

-a description of the instrument used

-a description of the samples in Canada and Cuba

-a quantitative analysis of the data.

1. Methodology

a. Procedures

In each country, I observed eight different grade seven teachers during a one hour-long lesson, in both mathematics and language arts. For each teacher, the observations of both subject areas took place on the same day ensuring equal student attendance. Although the interactions in the classes in Burnaby were audio-recorded for later verification of the coded data, this was not permitted in Cuba. The Canadian data were collected during the early fall of 1989 and the spring of 1990. The Cuban data were collected during the fall of 1989.

As much as possible, I entered a classroom prior to the arrival of the students and sat in an unobtrusive position near the back and side of the room so that I was able to observe all students. Class lists were used to determine the number of boys and girls in each classroom. Observation time totalled 32 hours, 16 in each country. The total number of students present during class observations in Canada and Cuba was 212 and 262 respectively.

The coding of all lessons was done by me. I have had four years experience in the design and use of coding charts similar to the one designed for this study.[10] Using only one coder eliminated the problem of inter-observer agreement, but there remained the possibility of individual observer coding bias (McGaw, Wardrop & Bunda, 1972). Consequently, three randomly selected tapes of lessons were coded by two other experienced coders and the percentage agreement is given in Table 2.

Table 2

Percentage Agreement of Coding: Researcher and Two Other Coders

Tape number	% agreement	
	Coder1	Coder 2
1	92.2	89.0
2	96.7	93.8
3	93.1	90.7

10 As a Faculty Associate at Simon Fraser University, I have spent four years supervising student teachers.

b. Instrument

The instrument used for the observations of classroom interactions was based on the Brophy-Good Dyadic Interactional System (Brophy & Good, 1970). This instrument has been used in the majority of studies of student-teacher interactional patterns (Baker, 1987/88; Becker, 1981; Jordan Irvine, 1986; Leder, 1987). The system has already been described in detail in Chapter I, (2), Instrument of Measurement. However, in order to identify interactions with individual students and also repeat questions to the same student, the instrument was modified by incorporating a seating chart observation record (Acheson and Gall, 1980). This was necessary because of the impossibility in Cuban classroom of using either video or audio tapes to record this information. Hence a record was kept not only of total student-teacher interactions but also of those between teachers and specific students. Only interactions between teachers and individual students were recorded; those between teachers and the class as a whole and between student and student were not.

In order to apply the instrument, a seating chart consisting of square boxes to represent the location and sex of each student in each classroom was constructed (see Table 3 below). These could not be constructed before observations took place because of the variety of seating arrangements in the classrooms. If seating plans were not provided by the teacher, students' names were added to the appropriate box in the chart as they became apparent through teacher use. However, in Cuba, if a student was not called on by the teacher during the classes, that student's name had to be omitted.

Table 3

Example of Instrument

↑↑↑ Michelle (F)	↓↓ e e Bob (M)	↓↓ p p Jim (M)	cc Peter (M)	r Anty (F)
b Sara (F)	d Anton (M)	m Rala (F)	Maria (F)	Ian (M)
Joey (M)	Kayla (F)	Jenny (F)	Kerry (M)	Darrly (M)
Abraha(M)	Jenay (F)	Justin (M)	Rob (M)	Renata (F)
Selin (M)	Kerry (M)	Sonya (F)	Oji (M)	Studa (F)
Sam (M)	Tammy (F)	Josh (M)	Farah (F)	Nadia (F)

The direction of each interaction was noted with an arrow indicating whether the teacher or the student initiated the interaction. For example, Table 3 indicates that Michelle initiated three interactions with the teacher. If the teacher extended an interaction with a student, an "e" was coded beneath the line. Therefore, two "e"s below a line would indicate that there were two follow-ups of the initial interaction (see, for example, Bob).

The interactions were classified as academic, discipline or management [See definitions of terms, Chapter I, (4)]. Management interactions usually involved the teacher asking the assistance of a student for a class task. On occasion, students were asked to perform these tasks because they had been, or seemed about to become, involved in a discipline problem. The later use of the recorded audio tapes sometimes proved helpful in deciding into which of the two categories, management or discipline, these interactions should be placed. This checking was not possible with the Cuba data because, as mentioned, the use of audio tapes was not permitted.

Academic interactions were noted as product, process or other. Product type interactions were recorded by the use of a small line with no letter attached. All other interactions were coded by using the small line, with the arrow attached to show whether the teacher or the student initiated the interaction, and the following letters. Questions considered to be process questions were coded with a "p". Jim, in Table 3, was asked two process questions by his teacher. Not all academic interactions recorded followed the standard question and answer model. Unsolicited "call-outs" by a student to the teacher were coded as "c". For example, Peter, in Table 3, called out twice in class. The code "r" was used to identify students called upon to read in front of the class (Anty) and "b" was used to identify students called upon to work on the blackboard at the front of the class (Sara, in Table 3).

Lastly, discipline statements or questions used by the teacher in order to attract the attention of a student were coded as "d" (for example, see Anton). Students chosen for class management tasks such as those suggested earlier were noted using the code "m" (for example, Rala).

c. Description of the Sample

i. Canada

The total sample size was limited by the accessibility of classrooms in Cuba. Eight classes were observed in Cuba and, therefore, the same number was employed in Canada. The Canadian sample consisted of eight grade seven classrooms in schools in a single school district, Burnaby, in the Lower Mainland of British Columbia. The School Board of the district was approached by telephone for permission to conduct research in the schools. This was followed by an interview with School Board officials at the School Board Office in which the research proposal was discussed and approval was granted.

A list of the elementary schools in Burnaby was obtained. From this two types of grade seven classes were eliminated. Those considered as special classes either by the school or by the district were removed because they were not representative of average grade seven classes. Additionally, in order to minimize the numbers of variables involved in the study, it was decided that only those classes in which the same teacher taught both mathematics and language arts would be included. Therefore, a number of schools were eliminated because the grade seven teacher did not teach both mathematics and language arts to the grade seven students. A number of teachers at this level "platoon", that is, a grade seven teacher may teach one subject area to two different classes while a colleague teaches the other subject area to both groups. In this way, teachers are able to capitalize on their particular strengths and, at the same time, start to prepare students for the high school

teaching system in which different subjects are taught by different teachers. Also, either as part of their assignment or from personal or professional preference, a number of elementary school principals teach one subject, frequently mathematics, to one of the grades, usually grade seven.

After board approval and school selection procedures were completed, ten schools were randomly chosen from the abridged list. The extra two were included as insurance in case of unforeseen problems with school visits. In fact, one of these extras had to be used in place of one school where the regular teacher was ill and the temporary replacement, a first-year teacher, requested that she be excluded from the study. The principals and the grade seven teachers of the selected schools were contacted by telephone and meetings were arranged with each of the teachers to outline the purposes and procedures involved in the study and to arrange dates for classroom observations. These were conducted in September, 1989 and in January, February and March, 1990.

The following schools were included in the final study:

Aubrey Elementary, 1075 Stratford

Cascade Heights Elementary, 4343 Smith

Confederation Park Elementary, 4715 Pandora

Gilmore Avenue Community School, 50 Gilmore Ave

Lochdale Community School, 6990 Aubrey

Parkcrest Elementary, 6055 Halifax

Sperling Avenue, 2200 Sperling

Twelfth Avenue Elementary, 7622 12th Avenue.

The schools are located in neighbourhoods with varying socioeconomic characteristics from mainly working-class (Cascade Heights) to areas with populations consisting primarily of professional families (Aubrey).

Physically, Canadian elementary schools are more similar to those in the United States and Britain than to those in Cuba. Many of the older ones, such as Gilmore Elementary School built in 1915, are located in large three-storey brick buildings. These schools have large rooms of fairly equal size, with windows running along at least one wall. The tall ceilings in the rooms add a sense of airiness. The rooms seem distinctly independent of each other, a result, perhaps, of excellent sound-proofing. Noise from outside rarely interrupted the classroom activities.

Newer Canadian elementary schools, most of which were built in the population boom of the 1960's and 1970's, are generally one-storey wooden buildings, the width of which is the size of one classroom. Unlike the larger, older schools with the central stairways, students are frequently able to enter their own classrooms directly from the playground which surrounds the building. The classrooms are square, often with a student cloakroom running behind one partitioned wall and with large windows on the opposite wall. They are well-lit but may become very warm in the late spring and early summer because of the siting of the schools and the expanse of windows.

Standardized class sizes are set by the Burnaby School Board in consultation with the Burnaby Teachers' Union. In the 1989-1990 school year, the average class size in grade seven in Burnaby was 26.3 students. In this study class size in Burnaby varied from 24 to 31.

In general, Canadian classrooms are very colourful. There are a great number of decorations on the walls, doors and, even in one case, on the ceiling. These included professional, store-bought posters either with inspirational-type messages ("You can do it if

you try!"), or comical reminders or notes using animals from television shows. Also common were posters of famous sports stars and vacation spots such as Hawaii. Parts or all of some walls were dedicated to displaying student academic or art work, and parts contained teacher-made notices of classroom behaviour rules or academic rules for spelling, mathematics or grammar. Many classrooms had three-dimensional student-made art, such as paper-maché dinosaurs, suspended from the fluorescent lights or from the ceiling. In addition, many had plants, aquariums, small animals such as hamsters in cages and a number of "centres" such as "The Astronomy Centre" with materials and activities pertinent to an on-going class project. The impression overall, was of colour and activity. Students' desks or tables were either arranged in the classical two-by-two rows or, more frequently, in groups of 4 or 6 arranged irregularly around the room. Students did not sit in a sex-differentiated pattern.

The students in the Canadian classes showed varying interest in my presence in their classrooms. In some classes they ignored me while in others, they approached me to ask why I was there. As already mentioned, I entered a classroom prior to the arrival of the students and sat close to the centre in the rear. In some cases the teacher introduced me to the students (4 out of the 8) and in three of the classes observed after I returned from Cuba, the teacher asked if I would talk to the students about that country after the observations were completed.

On the whole, the relationship between students and teacher seemed friendly. Many teachers had a brisk and business-like attitude towards their material but also, most were seen to joke with students both during the active teaching part of the lessons and later, while students were working on their own. Most of the teachers admitted to having at least one student in the class who was a discipline problem and many warned me of the situation

before I began the observations. Teachers were consistent in following a pre-arranged timetable which was often displayed on the wall.

ii. Cuba

Collecting data in Cuba proved to be much more difficult than in Canada. Prior to departure from Canada, the Centre for Cuban Studies in New York was contacted, as were nine authors and researchers on Cuban education, with the intention of obtaining the names of contact people in Cuba (see Appendix A for list of contact names). Without exception, they claimed that it was almost impossible, as a single scholar, to try to pre-arrange activities such as school visits while in Cuba. It was suggested that ICAP (The Cuban Institute of Friendship with the Peoples) would be able to arrange school visits upon arrival, if forewarned. I was very fortunate that Simon Fraser University had a Latin American Field School to Cuba arranged for the fall of 1989. I therefore enrolled as a graduate student and felt confident that with the agreement that existed for cooperation between the University of Havana and Simon Fraser University, plus the contacts with ICAP which partly organized our visit, I would have no difficulty in arranging classroom observations. My plan was to identify a number of schools in a suburb of Havana using similar random sampling techniques to those employed in Canada.

However, at the end of the five-week stay in Havana I had not observed a single classroom despite numerous requests both to ICAP and to the representatives of the University of Havana. In the third week, in despair, I approached several schools by myself. I was given a tour of one school but told that classroom observation was impossible without official sanction. At each of my official requests to visit schools, I was told that this would be much easier to arrange during our tour of the provinces but the

situation did not change when we arrived in Santiago de Cuba on the first leg of a four-week tour.

At this point, and as a last desperate attempt, the Director of the Field School approached a nearby school with me and arranged an interview with its *Directora.* To our astonishment, an observation was quickly arranged for the same day.[11] This process, increasingly well-honed with practice, was repeated successfully for the rest of the tour of the island. At each city, the Director and I went very early in the morning to the school nearest to our hotel. We introduced ourselves, explained the nature of my research and arranged classroom observations for that day. Outside of Havana, no school refused to allow me to observe classes.

However, this method, successful in the Provinces, proved only partially successsful on our return to Havana where I was able to visit only one elementary school. At this point in the tour's itinerary, we were located at "El Abra" a campground one hour's drive from La Habana. While there the previous day, the Director had approached the principal of a school in the city and arranged for a classroom observation to take place. After a 6 a. m. taxi ride costing $30 U.S., we arrived at the school, only to be told categorically that classroom observation was impossible in the absence of official permission. When the persuasive powers of the Field School Director failed, she made a number of telephone calls to various officials at the Ministry of Education, ICAP and the Department of External Relations of the University of Havana. Finally, I was very reluctantly allowed to observe one class but only under the supervision of the vice principal.

At this point I had seven observations of grade seven mathematics and language arts classes. On the strength of ICAP promises of more school visitations in Havana, I stayed

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11 I feel certain that, without the help of our Field School Director, I would not have observed in a single classroom.

an extra ten days beyond the end of the field school but, in this period, managed to see only one additional school.

Other difficulties were involved in trying to observe in classrooms in Cuba. For example, in Sancti Spíritus, the week-long break given to all elementary students in November meant that I could not observe classes. In Trinidad, observations were impossible because the students had departed for the annual "month in the country" of agricultural work. Also, as in Canada, classroom observations were cancelled when a teacher became ill or when some school activity usurped the normal schedule for that day. However, in Cuba, it was impossible to re-schedule the observation because the Field School tour continued and we stayed only one or two days in a town. The itinerary of the tour is included in Appendix B.

The method used for finding schools, while not following formal random sampling procedures as in Canada, did ensure not only a locational randomness but also freedom from political influence. An important aspect was the level of preparation made by the schools for my formal visits. In Cuba, in school observations arranged by ICAP, as well as on the occasions when I was invited to return to a school, it was obvious that the classes had also been prepared for my visit. However, the grade seven data to be used in this study consist only of observations which took place on the day of our unannounced arrival at a particular school.

In total, I was able to visit 12 schools and to observe in 25 classrooms from grade 2 to grade 12. The data to be used in this study consist of the 16 hours of observations of grade seven teachers in classes of mathematics and language arts. Except possibly for one specialized group of budding ballerinas, all of the classes consisted of students of average ability. The schools were located in the cities of La

Habana, Santiago de Cuba, Camagüey, Holguín and Bauta, and thus provided fairly good geographical coverage of the country.

The following schools were observed in Cuba:

#68, José Ignacio Martí, Santiago de Cuba
Dalquís Sánchez Pupo, Santiago de Cuba
José Martí, Holguin
Raúl Gómez García, Holguín
Luis Durán, Camagüey
E. S. B. U. Capitán Silverio Blanco Núñez, Camagüey
Orlando Pantoja, La Habana
Escuela en el Campo "Batalla de Jigüe", San Antonio de los Baños

The schools varied from inner city schools in large urban centres such as La Habana and Santiago de Cuba, to a residential school in the small town of Bauta. They included small schools located in converted colonial mansions (Santiago de Cuba) to large recently constructed two-storey concrete ones (Camagüey).

Cuban elementary schools are different from Canadian schools in a number of ways. Many of them are situated in converted mansions that, before the Revolution, had housed wealthy families. In the post-1959 rush to educate the population, the conversion of these buildings to schools involved mainly the construction of a number of interior walls to divide up the large rooms. For example, what had once been a salon may now be three or four classrooms. As the walls did not reach the tall ceilings in most cases, this meant that the beautiful ornate ceiling friezes, though often not well-maintained, were still visible. In some

cases, original lighting fixtures, stained glass windows and wrought iron work remained. Overall, these elementary schools appeared old and very grand if, perhaps, a bit shabby on closer inspection.

From a non-esthetic point of view, the conversions of houses to schools often produced difficulties. Frequently, students had to walk through one or two other classrooms in order to reach their own. Apart from the interruptions which occurred as a result of students moving through the rooms, partitioned dining rooms also often meant that it was possible to listen to two classes simultaneously. Although I found this annoying at times, no teacher ever complained about it to me. Also, given these conditions, it is obvious that the setting of standardized class sizes would be very difficult. The numbers varied widely, in part, as a result of the variety in room sizes. The classes in the sample varied in size from 15 to 45 students. Those in the secondary school were much larger and showed less variability in size, between 45 and 50 students. No matter the size of the class or the grade level, students sat in same-sex paired rows at wooden tables on metal chairs.

On the whole, all secondary schools and the newer elementary schools were situated in large, post-Revolutionary, rectangular concrete buildings. What these two or three-storey structures lacked in aesthetics was compensated for by an airiness and openness appropriate for the climate. An open-air corridor ran the length of each floor and each classroom had wood-louvred windows on both sides admitting a cross breeze, a necessity in a country where the average daily temperature is about 30 degrees Celsius. My concern about what happened during a winter storm ("El Norte") was answered when I arrived for a school visit during one. All of the students had stayed home because it was too wet and too cold (20 degrees Celsius).

Compared to those in Canada, classrooms in Cuba are bare. There are few decorations on the walls. Classrooms I observed had, on average, two or three small

posters, usually photographs of Che Guevara or Fidel Castro or a teacher-made drawing accompanied by newspaper clippings which emphasised some political point. The writing on the one small blackboard at the front of each classroom took several minutes to become visible because either the chalk, the blackboard or both were of rather poor quality. The appearance of the rooms and the students' responses to their teachers, as they stood at attention beside their desks, reminded me of my own school experiences in Scotland thirty years ago.

If such an historical reference paints rather a bleak picture in the minds of North American readers, nothing could be further from the truth. As was stated in Chapter II, education, along with health, has been given top priority by the government of Cuba and students, and indeed the entire population, consider it of the utmost importance. Almost everyone I met, regardless of educational background, was involved in some type of educational upgrading. Education is a serious and important endeavour in Cuba and this is obvious from the respect shown to teachers and from the number of students encountered whose ambition was to become teachers. Although school work was treated seriously, in the classes I observed, the teacher's relationship with the students was warm and friendly. Students were often referred to as "mi amor" or some dimunitive pet name and teachers hugged and touched students in a way that is now only a memory to most teachers in Canada. When a student was asked a question his or her chin was gently raised up so that the teacher was looking directly into the student's face. The students were encouraged to participate in discussions and "called out" only if they were fairly certain that the teacher had made a mistake at the blackboard. No student was observed being rude to a teacher.

The response to my visit at each school was courteous, curious, and friendly. As mentioned previously, my system of gaining entry into a school meant that I arrived unannounced. However, I was always made more than welcome in the classrooms with

smiles, nods and much rushing around to find me a comfortable seat. The Cuban habit of kissing the cheek on greeting was extended by teachers to their students on arrival at class and this courtesy was often extended to me, especially if I spent more than one day in a school.

It would be difficult to exaggerate the openness and friendliness of Cuban children. Their curiosity might be seen by Canadians to verge on rudeness if it were not so obviously harmless. They were keen to answer questions even if the response elicited giggles from surrounding friends. In the playground they were as boisteous and noisy as children anywhere but in class they were, to a Canadian observer, extremely quiet. Somehow they avoided scraping their metal chairs across the bare floors. This was most notable on my introduction to a class when students always rose and stood to attention at the sides of their desks. After the compulsory "Buenos días", one student led the class, in unison, in a well-rehearsed recital that was accompanied by military-type stances. The students in their school uniforms, the colour of which, blue, mustard or maroon indicated the grade level, and wearing their bright red "pionero" scarves similar to those worn by Chinese school children, stood at attention when the lead student said "One". They then repeated together:

Con el ejemplo de Camilo y Ché, los pioneros de séptimo grado

- triunfando en el estudio
- combatiendo lo mal hecho
- elevando las banderas del socialismo y Fidel.

(Following the example of Camillo and Che, the pioneros of the seventh grade, triumphant in their studies, working on unfinished tasks, raise the flags of socialism and of Fidel.)

On "Two", the students stood at ease and on "three" they sat down in unison. This was repeated at my introduction to each class.

On leaving each school I was always presented with gifts such as books and home-made bookmarks by teachers and students and these were usually accompanied by profuse apologies about their insignificance. On repeat visits to schools, it was obvious that a great deal of effort had been extended the night before in order to find a more appropriate gift for me.

2. Data Analysis

In this section the analysis of the data of each unit (Canada and Cuba) will be reported. It should be re-emphasisized that this is a pilot study and, therefore, the quantity of collected data may seem limited.

Even so, a large volume of data was collected. In the 32 classes observed, (eight classes each of mathematics and language arts in both Canada and Cuba) a total of approximately 2,000 student-teacher interactions were recorded. In addition, as already mentioned, the quality of the data was limited by the use of a prespecified coding system, the skills of the coder, and the impossibility of recording the data for later checking. The underlying assumption of the study is that, within each class, all other conditions being equal, boys and girls should have received a percentage of the interactions with the teacher proportional to their numbers. The Canadian data will be presented, first for mathematics and then for language arts, followed by the Cuban data, following the same order.

a. Canada:

i. Mathematics.

The breakdown, by school, of the numbers of boys and girls in each class, the total numbers of interactions in each mathematics class, the quantity of observed interactions by student sex, and the quantitities of interactions that would have been expected, prorated for the numbers of boys and girls in each class, are shown in Table 4 below.

An overall total of 681 interactions were recorded in the eight Canadian mathematics classes each of which was one hour long. As can be seen from Table 4, although girls constituted approximately 50% of the total sample (107 girls, 105 boys), they accounted for only 45% of the interactions (309 out of 681). Girls were involved in more than 50% of the interactions in only one of the eight classes observed (school #8). In the other seven classes, boys were consistently involved in more interactions than would have been expected proportional to their numbers. These figures reinforce those of the majority of studies reviewed in Chapter 1.

TABLE 4

Canada Data: Mathematics

School #	#of boys	#of girls	Total inter-actions	#observboys O-f	#expect boys E-f	#observgirls O-f	#expect girls E-f
1	17	14	85	50	47	35	38
2	9	15	114	54	43	60	71
3	12	16	68	34	29	34	39
4	9	15	56	28	21	28	35
5	15	14	58	32	30	26	28
6	10	13	107	58	47	49	60
7	19	6	83	69	63	14	20
8	14	14	110	48	55	62	55
Total	**105**	**107**	**681**	**372**	**335**	**309**	**346**

The data was then divided into teacher-initiated and student-initiated interactions. As can be seen from Table 5 below, teachers, as expected, initiated many more interactions than students. In this case, teachers initiated almost 8 times as many interactions as did students.

Table 5

Teacher-Initiated Versus Student-Initiated Interactions:

Mathematics, Canada

Total interactions	Teacher-initiated	Student-initiated
681	602	79

Within teacher-initiated interactions, product questions were evenly distributed between boys and girls, as noted in Table 6 below.[12] However, this was not the case with both process questions and extended interactions. Boys were asked more than twice as many process questions as were girls (68% versus 32%) and were involved in almost twice as many extended interactions (64% versus 36%). These results generally confirm the findings of Becker (1981), Good, Sikes and Brophy (1973), Leder (1986) and Swann and Graddoll (1988). On the other hand, and in contradiction to the findings of this study, Leder found that in mathematics classes, girls were asked more product questions than boys. These differences may result from the differences in sample size. Leder's study involved only one class of students. In addition, it should be noted here that, both in this study and in that by Leder, the number of both process questions and extended interactions was very small (approximately 7% and 6% respectively) compared to the number of product questions.

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12 Data by school is listed in Appendix C.

The other two categories of teacher-initiated interactions which were coded were: students reading aloud (in mathematics, this usually involved reading the question out to the class) and blackboard work by students (a method often used by teachers to instruct the whole class). As can be seen from Table 6 below, the distribution of students being asked to read in front of the class was even between boys and girls but more than twice as many boys as girls were asked to complete mathematics questions at the blackboard. (See note below) Again, it should be pointed out that these involved a very small percentage of the overall total of teacher-initiated interactions (2% and 3% respectively).

Table 6

Teacher-Initiated Interactions: Mathematics. Canada.

	Total	Boys	Girls
Product	460	234	226
Process	38	26	12
Extended	34	22	12
Blackboard	11	8	3
Reading aloud	15	7	8
Total	**558**	**297**	**261**

A sex-related pattern was also found when teacher-initiated management and discipline interactions were examined. (See appendix C for data by school.) Twice as many girls as boys were called on by teachers for classroom management tasks such as paper distribution or errand running. This finding agrees with that of Biramaih (1982). In

addition, as in all of the studies reviewed in Chapter 1, boys were disciplined more often than girls. In this study the percentages were 76% and 24% respectively (19 and 6).

Table 7

Management and Discipline: Mathematics. Canada

	Total	Boys	Girls
Management	19	6	13
Discipline	25	19	6

As noted previously, a comparatively small percentage of the total interactions were initiated by students (see Table 5. See also appendix C). Table 8 below demonstrates that, by far, the greatest proportion (67%) of these involved student call-outs, of which 43 out of the total of 53 came from boys. This is more than the percentage found by Becker (1981), but less than that found by Sadker, Sadker and Thomas (1981). Of the other two types of student-initiated interactions, girls asked more product questions of teachers (14 to 4), while boys asked more process questions (5 to 3). Again, the small number of these interactions should be emphasised.

The method of collecting data made it possible to record the quantity and type of interactions with individual students (See Table 3). The data reveal that a number of students neither received nor initiated contact with the teacher during the mathematics lesson. Of the 105 girls in the sample, 28 made no verbal contact whatsoever with the teachers during the lessons. The corresponding figures for boys were 107 and 17 respectively. In only one of the eight Canadian classes did all students interact verbally at

least once with the teacher and in another class, 6 of the 15 girls present had absolutely no verbal interaction with the teacher.

In addition, the data indicate that a small number of students receive a large proportion of the interactions. For example, in school #1, of the 31 students in attendance, 3 boys and 1 girl were involved in 38% of the total interactions. In school #8, this pattern of distribution of interactions was even more marked. Of the 28 students in the class, two boys were involved in 40.3% of the total interactions. After the class, the teacher voluntarily commented on the domination of the class by her "very bright" boy and her "most difficult student." These findings lend support to those of Croll (1985), Evans (1988), French and French (1986) and Good and Brophy(1987) and raise the question of whether teachers control classroom interactions or are only responding to classroom events.

Table 8

Student-Initiated Interactions: Mathematics, Canada

	Total	Boys	Girls
Product	18	4	14
Process	8	3	5
Call-out	53	43	10
Total	**79**	**50**	**29**

ii. Language Arts.

The language arts data are displayed in the same way as the mathematics data. The number of boys and girls in each class, the total number of interactions in each

language arts class, the quantity of observed interactions by student sex, and the quantities of interactions that would have been expected, prorated for the numbers of boys and girls in each class are shown in Table 9 below.

The overall total of student-teacher interactions (517) in the eight language arts classes was approximately 75% of the total in mathematics classes (681). Slightly more than half (53%) of these involved girls. However, although girls were involved in slightly more interactions overall, no gender-related patterns within classes were identified in language arts classes. In other words, boys were involved in more of the overall total interactions in some classes and girls were in others.

Table 9

Canada Data: Language Arts

School #	#of boys	#of girls	Total inter-actions	#observ boys O-f	#expect boys E-f	#observg irls O-f	#expect girls E-f
1	17	14	79	43	43	36	36
2	9	15	92	28	34	64	58
3	12	16	72	33	31	39	41
4	9	15	53	25	20	28	33
5	15	14	52	24	27	28	25
6	10	13	54	19	23	35	31
7	19	6	54	45	41	9	13
8	14	14	61	27	31	34	30
Total	**105**	**107**	**517**	**243**	**250**	**274**	**267**

In language arts classes, teachers initiated approximately four times as many interactions as did students (85% to 15%) as noted in Table 10, below. This ratio varies slightly from that found in mathematics classes which was 88% to12%.

Table 10

Teacher-Initiated Versus Student-Initiated Interactions:

Language Arts, Canada

Total interactions	Teacher-initiated	Student-initiated
517	439	78

With respect to teacher-initiated interactions, Table 11 below, shows that girls were asked considerably more product questions than were boys (64% as compared to 36%) but, as in mathematics classes, boys were involved in more of both process questions and extended interactions (66% and 69% respectively). These results corroborate those found by Leinhardt et al (1979) but not those of Leder (1988). The deviation between these results and those of Leder may again result from the difference in the sample size. In the two other categories of interactions collected in this study, approximately the same percentage of boys and girls were called on to read in front of the language arts classes and the few students who were called on to work at the blackboard were girls. Again, however, the reader must be cautioned that the numbers involved for reading and blackboard work were very small (2% and 1% respectively).

Table 11

Teacher-Initiated Interactions: Language Arts, Canada

	Total	Boys	Girls
Product	309	111	198
Process	50	33	17
Extended	29	20	9
Blackboard	4	0	4
Reading aloud	10	4	6
Total	**402**	**168**	**234**

As can be seen in Table 12 below, approximately the same number of boys and girls were asked by teachers to assist in classroom management tasks in language arts classes. However, as in the mathematics data and in agreement with all other studies, boys were disciplined almost three times as often as were girls.

Table 12

Management and Discipline: Language Arts, Canada

	Total	Boys	Girls
Management	14	6	8
Discipline	23	17	6

Student-initiated interactions, as in mathematics classes, overwhelmingly involved unsolicited call-outs. Table 13 below shows that boys called out more than twice as often as did girls (35 to 16). Again this confirms the findings of a number of studies reviewed. Neither sex dominated in the few student-initiated process questions. However, unlike the situation in mathematics classes, boys initated more than twice as many product questions as did girls (12 to 5). Finally, the numbers of students who had no contacts with teachers during language arts classes, 14 boys and 19 girls, were smaller than their equivalents in mathematics classes (17 boys and 28 girls).

Further examination of the data indicates that, as in mathematics classes, and as found by Croll (1985) and French and French (1986) a small group of students, mainly boys, dominate classroom communications. In addition, it is the same students who dominate in classes in both subjects. For example, the three boys and one girl who dominated in mathematics class in school #1, accounted for 29% of the total interactions in the language arts class, while the two dominant boys in school #8 accounted for 31% of the total interactions in their language arts class.

Table 13

Student-Initiated Interactions: Language Arts, Canada

	Total	Boys	Girls
Product	17	12	5
Process	10	4	6
Call-out	51	35	16
Total	**78**	**51**	**27**

iii. Summary

In summary the findings for total interactions in mathematics classes and language arts classes in Canada generally confirm those of Leinhardt et. al. (1979). In other words, boys had more teacher contact in mathematics while girls had more in language arts. This same pattern was repeated for teacher-initiated interactions. When the data were analyzed further, it was found that, in both subjects, boys were asked more process questions and were involved in more extended interactions with teachers. Boys were asked more product questions in mathematics, whereas girls were asked more of them in language arts. Unlike Leder (1986), this study did not find that teachers initiated more product questions in mathematics with girls. It did confirm, however, that teachers initiated more process questions with boys in that subject. Girls were asked more often to assist in classroom management in mathematics classes but this was not the case in language arts classes. In both subjects, and in agreement with all studies reviewed in Chapter 1, boys were involved in more disciplinary interactions.

With respect to student-initiated interactions, there were no differences between mathematics and language arts classes for student-initiated process questions, which were few, but boys initiated more product questions in language arts whilst girls initiated more in mathematics. Boys called-out more often than girls in both types of classes but, as noted, it was not a matter of all boys being involved in more interactions than all girls but rather that a small group of boys frequently dominated classroom interactions.

b. Cuba

i. Mathematics

Unlike the Canadian sample, in which almost exactly half the students were girls, the Cuban sample showed an imbalance in favour of girls. Of the total 272 students in

Cuban classes, 136 were girls and 126 were boys. All of the following figures, therefore, have been prorated to account for this difference. In each case, the expected numbers of interactions was calculated based on the assumption that boys and girls should receive a quantity equivalent to their proportion in the class. The observed quantities were then compared with those expected. Therefore, interaction figures are given as a percentage above or below that which would have been expected given the ratio of boys and girls in the classes. As an example, of the total 361 interactions in Cuban mathematics classes, 59% involved girls who constituted 52% of the sample (see Table 14 below). Girls, then, received approximately 10.5% more of the interactions than would have been expected if there had been an equal number of boys and girls in the classes and each group had received a proportional amount of the interactions. Thus, in mathematics classes in Cuba, girls were involved in proportionally more of the overall student-teacher interactions. This pattern, repeated in six of the eight classes observed, was most notable in schools numbered 5 and 8. These findings point to a dissimilar situation from that found by a number of researchers in North America, Europe and Australia (Becker, 1981; Croll, 1985; French and French, 1986; Leder, 1987; Leinhardt et al, 1979).

Table 14

Cuba Data: Mathematics

School #	#of boys	#of girls	Total inter-actions	#observboys O-f	#expect boys E-f	#observgirls O-f	#expect girls E-f
1	24	18	60	38	34	22	26
2	4	11	30	7	8	23	22
3	5	12	48	18	14	30	34
4	22	23	39	13	19	26	20
5	19	20	45	15	22	30	23
6	17	21	19	7	8	12	10
7	19	18	45	19	23	26	22
8	16	13	75	32	41	43	34
Total	**126**	**136**	**361**	**149**	**169**	**212**	**191**

Table 15 below shows that when the overall total was broken down into teacher-initiated and student-initiated interactions, teachers initiated almost 6 times as many interactions as did students.

Table 15

Teacher-Initiated Versus Student-Initiated Interactions: Mathematics. Cuba

Total interactions	Teacher-initiated	Student-initiated
361	309	52

Overall, in Cuban mathematics classes, girls were involved in more teacher-initiated interactions than were boys. As can be seen from Table 16 below, the only category of interaction in which boys were proportionately more involved was that of reading aloud in front of the class. In mathematics, this generally involved reading out the mathematics question to the class from the textbook. In all the other teacher-initiated interactions, girls were involved in proportionately more interactions than boys. This is most notable in the case of extended interactions in which girls were involved in approximately 36% more than would have been expected. This is in direct contrast to the findings of Leder (1987).

Table 16

Teacher-Initiated Interactions: Mathematics, Cuba

	Total	Boys	Girls
Product	192	86	106
Process	17	7	10
Extended	41	12	29
Blackboard	23	9	14
Reading aloud	17	10	7
total	**290**	**124**	**166**

In Cuban mathematics classes, few interactions involved classroom management or discipline. Table 17 below shows that together both categories amount to only 19 out of the total 361 student-teacher interactions. Within this small number, boys were disciplined slightly more than girls, and girls were called on more frequently than would have been expected for classroom management tasks.

Table 17

Management and Discipline: Mathematics, Cuba

	Total	Boys	Girls
Management	11	3	8
Discipline	8	5	3

Within the student-initiated interactions in Cuban mathematics classes, the number of unsolicited call-outs was distributed fairly evenly between boys and girls. Again this is in contrast to North American, European and Australian research. In addition, as can be seen from Table 18 below, girls initiated 65% more product and 56% more process questions than would have been expected given their numbers. These findings contrast with most research in North America, Europe and Australia with a few exceptions. Evans (1988) for example, also found that girls initiated more interactions with teachers and suggested that this may have resulted from either her research emphasis on student-initiated interactions or the age of the students concerned. Most studies which indicate that girls initiate fewer interactions with teachers involved older students. According to Evans, younger girls may be more likely than adolescent girls to assert themselves because they have less peer pressure to conform to sex-stereotypes.

Table 18

Student-Initiated Interactions: Mathematics, Cuba

	Total	Boys	Girls
Product	14	2	12
Process	15	3	12
Call-out	23	12	11
Total	**52**	**17**	**35**

As previously noted, the seating chart method of collecting data allows for the identification of students who had no verbal contact whatsoever with teachers. In

mathematics classes in Cuba, 26 girls and 33 boys had no verbal contact with their teachers. These numbers represent approximately 19% of the girls and 26% of the boys.

The data also indicates that a small group of students dominated the interactions. In Cuba, this small dominant groups consisted almost entirely of girls. For example, in school number 1, with 42 students, 3 girls were involved in almost 35% of the interactions. A similar, though less extreme pattern was repeated in all of the classes. (See Appendix C).

ii. Language Arts

The breakdown by school of the numbers of boys and girls in each class, the total numbers of interactions in each language arts class, the quantity of observed interactions by sex, and the quantitities of interactions that would have been expected prorated for the numbers of boys and girls in each class, are shown in Table 19 below.

There was approximately the same number of total interactions in both mathematics and language arts classes in Cuba (365 to 361). In language arts classes girls in Cuba were involved in very slightly fewer interactions than would have been expected of this total. As can be seen, in all but one of the eight classes (school #8), boys were involved in more interactions than would have been expected.

Table 19

Cuban Data: Language Art

School #	# of boys	# of girls	Total inter-actions	#observ boys O-f	#expect boys E-f	#observ girls O-f	#expect girls E-f
1	24	18	86	56	49	30	37
2	4	11	41	12	11	29	30
3	5	12	34	10	10	24	24
4	22	23	48	25	23	23	25
5	19	20	25	14	12	11	13
6	17	21	21	11	9	10	12
7	19	18	48	31	25	17	23
8	16	13	62	28	34	34	28
Total	**126**	**136**	**365**	**187**	**173**	**178**	**192**

Table 20, below, indicates that teachers initiated approximately six times as many interactions as did students (85% to 15%). This ratio is similar to that found in mathematics classes (86% and 14%).

Table 20

Teacher-Initiated Versus Student-Initiated Interactions:

Language Arts. Cuba

Total Interactions	Teacher-Initiated	Student-Initiated
365	311	54

As in the mathematics classes, Cuban teachers distributed product questions fairly evenly between boys and girls. However, boys received more of both process questions and extended interactions (31% and 48% respectively). These results differ widely from

those found in Cuban mathematics classes. Few students were called on to read in front of the class but boys were called more often than would have been expected. In all of the language arts classes observed, only a total of two students were asked to work at the blackboard and both were boys.

Table 21

Teacher-Initiated Interactions: Language Arts, Cuba

	Total	Boys	Girls
Product	227	109	118
Process	19	12	7
Extended	38	27	11
Blackboard	2	2	0
Reading aloud	12	7	5
Total	**298**	**157**	**141**

As in Cuban mathematics classes, there were few management and discipline interactions in Cuban language arts classes. Table 22 below indicates that teachers called on boys as frequently as they called on girls in both of these interaction categories.

Table 22

Management and Discipline: Language Arts, Cuba

	Total	Boys	Girls
Management	7	3	4
Discipline	6	2	4

The data for student-initiated interactions in language arts classes in Cuba are recorded in Table 23, below. The observed number of product questions volunteered to teachers was approximately the same as would have been expected given the proportion of boys and girls. As they did in Cuban mathematics classes, girls initiated more process questions (34%). However, unlike the situation in mathematics classes, girls did not initiate more product questions than did boys. Boys, on the other hand, called out 26% more often than expected. The numbers of students who had no verbal contact with teachers during language arts classes in Cuba, 21 boys and 35 girls, were in a similar proportion to those in mathematics classes.

The data indicate that a small group of students dominated in classroom talk in language arts. These consisted mainly of a number of boys although a few of the girls who were dominant in the mathematics classes were also included. For example, in school #1 with 42 students, 2 boys were involved in 15% of the total interactions. Of the three girls who dominated the mathematics class, one was involved in less than 2% of the total interactions whereas the other two were involved in almost 10%.

Table 23

Student-Initiated Interactions: Language Arts, Cuba

	Total	Boys	Girls
Product	12	5	7
Process	11	2	9
Call-out	31	18	13
Total	**54**	**25**	**29**

iii. Summary

In summary, Cuban boys had more overall contact with teachers in language arts classes whereas girls had more contact in mathematics classes. Teachers initiated more interactions with girls in mathematics classes but more with boys in language arts classes. In addition, girls were involved in more extended interactions in mathematics whereas boys were involved in more of both process questions and extended interactions in language arts. Few students were disciplined in classes in either subject (14 interactions out of a total of 726) and the majority of these involved students being chastized for laying their heads on their desks. In mathematics classes, more girls were called on by teachers to assist in classroom tasks.

In terms of student-initiated interactions, girls initiated both more product and more process questions in mathematics and they initiated more process questions in language arts. Boys and girls called out in class at about the same rate in mathematics while boys called out more frequently in language arts.

A small group of students dominated classroom communications in both subjects. However, a gender-related difference existed between the two subjects. Whereas the

dominant group in mathematics classes consisted almost entirely of girls, the dominant group in language arts classes was made up of boys.

CHAPTER IV

CONCLUSION: A COMPARATIVE ANALYSIS OF STUDENT-TEACHER INTERACTIONS IN CANADA AND CUBA.

The comparison of the Canadian and Cuban data on student-teacher interactions in mathematics and language arts classes, indicates some interesting differences between the classes observed in the two countries. The main one is that, in Canada, boys interact more with teachers in mathematics than they do in language arts. The reverse situation was observed in Cuba.

When the interactions were divided into teacher-initiated and student-initiated, further differences were found. In Canada, teachers initiated more process questions with boys and had extended interactions more with boys than with girls in both types of classes. In Cuban mathematics classes, although teachers did not initiate more process questions with girls, they were involved in more extended interactions with them. The opposite was true in language arts classes. In Canada, boys were disciplined more frequently than girls in both subjects, whereas in Cuba, in general, few students were disciplined. Of those who were, the difference was slightly in favour of boys.

Student-initiated interactions also showed gender-related differences. In Canada, boys initiated more product questions in language arts whereas girls initiated more in mathematics. No differences were found with respect to process questions. In Cuba, girls initiated more product questions in mathematics and more process questions in both subject areas.

Unsolicited student call-outs were also found to vary between the two countries. In general, boys called out more frequently than girls in Canada than in Cuba. In addition,

there were differences in the quality of the call-outs between the two countries. In Canada, students, most frequently boys, called out usually as a result of, or in reaction to, a disciplinary action from the teacher. All of the call-outs observed in Cuba were related to academic matters. For example, when a teacher made an error while working at the blackboard, one or more students called out to correct it.

In both types of classes in both countries a small group of students dominated classroom communications. In Canada, this group was consistent across subject area and was composed primarily of male students. In Cuba, however, the dominant group varied with the subject. A small number of girls dominated interactions in the mathematics classrooms whereas a small number of boys dominated interactions in the language arts classrooms.

A striking differences between the Canadian and Cuban data related to the quantity of total teacher-student interactions as recorded in Table 24 below. The total interactions in Cuban mathematics classes was approximately half of that in Canadian mathematics classes (53%) while the total interactions in Cuban language arts classes was approximately 70% of that in Canadian language arts classes.

Table 24

Total Interactions: Canada Versus Cuba

	Mathematics	Language Arts
Cuba	361	365
Canada	681	517

These results are more surprising when the different teaching methods of the two countries are taken into account. In both mathematics and language arts classes in Canada, the teacher generally lectured the class as a whole for only 15 minutes or less and students subsequently worked by themselves with individual help from teachers. During the rest of the hour, the whole class was occasionally brought back together for a few minutes while the teacher explained a question or a common problem to them. Questions not finished by the students in class time were generally assigned as homework.

In the sixteen Cuban lessons, on the other hand, students were never observed to work independently. The teacher worked at the blackboard with each class for the full hour and then assigned extra book questions for homework, usually after the end of the class. Therefore, although Cuban mathematics teachers worked with the class as a whole for the full hour, there were fewer interactions per class compared to Canadian classes where teachers instructed the whole group for fifteen minutes or less. The reasons for this difference may include the different teaching styles in the two countries.

A number of differences in classroom teaching styles were observed. For example, a technique commonly employed by teachers in Canada is to ask a rapid series of short-answer questions of a large number of students, particularly at the begininning of a lesson as a warm-up, or as a review at the end of a lesson. In Cuba, on the other hand, a question was asked of an individual student and then the teacher and the class waited while the student concerned thought about the answer. This delay may result from the fact that, in Cuba, a student was generally required to accompany an answer with a justification, particularly in mathematics classes. For example, when a student was asked: "What is x if $2x + 4 = 10$?", he stood at attention at the side of his desk and thought, for what, to a Canadian observer, seemed an embarrassing amount of time. Eventually the student

responded: "If 2x + 4 = 10 then x must be 3." After each correct response, the teacher always replied, "Correct. Now Explain." The student continued,

> "In order to check my answer, (and this was stated for every example) if x equals 3 then the left hand side of the equation would become 2 x 3 + 4 or 10 and this is the same as the right hand side. Therefore I am correct."

Similarly, when a student was asked for the answer to 12x - 9x, she responded, "3x because 3x + 9x = 12x.". Frequently, a statement such as "The basic rule here is 9 + 3 = 12" was added. In every case of this type, the reverse operation was given as part of the answer. In geometry, propositions and rules were quoted as the explanations for solutions. This generally proved to be a rather lengthy process especially if the question was at all complicated. This system of asking students to rationalize an answer in mathematics was observed in classes from grade two to grade twelve.

Another difference in teaching styles in the two countries was observed when a student gave a wrong answer. In Canada, teachers were frequently observed to redirect the question to another student or, on occasion, another student would call out the correct answer to the class. Neither situation was observed in Cuba. If a student gave the wrong answer or the wrong reasoning for the answer, the teacher stayed with that particular student until the difficulty was clarified, despite a few pleas of "Profe, yo" (Me, teacher) and the raised arms of other students. These extended interactions often involved long periods of silences while students were allowed to think about the error that had occurred. As Table 16 indicates, mathematics teachers in Cuba were involved in many more of these types of interactions with girls than with boys (29 to 12).

As in mathematics classes, lengthy answers were also given by students in language arts classes. In this case, a distinct difference was observed between boys and girls. Boys exhibited a great deal more confidence than girls when talking in front of the class. When asked to explain a line of poetry or the meaning of a passage in a story, boys stood at attention at the sides of their desks, thought for a few moments and then started to talk. Responses fifteen to twenty sentences long were not unusual. The student was not rushed nor encouraged to be brief. When finished, boy students were frequently cautioned by teachers in the use of "um" or "y" (and) or the dropping of final consonants or 's's, common phenomena in Cuban speech. The main focus of the teacher seemed to be on fluidity and clarity in speech. Content was commented on less frequently.

This was not the case with girls who were much more shy when talking in front of the class. Many of them stood at the sides of their desks, but not at attention, and spoke very quietly whilst moving their bodies from side to side and fingering the hems of their skirts in what appeared to a Canadian observer, as a stereotypical shy pose. They were not encouraged to speak up and were never observed being told to speak more clearly or to avoid using hesitating speech effects. In addition, girls' answers were considerably shorter than those of boys. Teachers often followed up on answers from boys, thereby producing other lengthy responses but rarely did so with girls. Table 21 shows that boys were involved in 27 such extended interactions with teachers whereas girls were involved in only 11. Furthermore, the majority of the follow-up questions which did involve girls occurred during the grammar parts of the language arts lessons and were, therefore, of shorter duration.

Such differences in teaching styles are possible explanations for the striking differences between the numbers of total student-teacher interactions in Cuban compared to Canadian classes. Thus, despite the shorter direct teaching time, Canadian teachers were

involved in a great many more interactions with individual students than were Cuban teachers.

Finally, the sample teachers in both countries were asked informally if there were any differences between boys' and girls' abilities in mathematics and language arts. All of the Canadian teachers agreed that there were no differences in abilities in language arts. However, almost half of them (3 out of the 8) suggested that, although girls were neater and worked harder, boys had superior skills in mathematics. On the other hand, although all 8 of the Cuban teachers claimed that there were no differences between boys and girls with respect to language arts, 6 out of the 8 responded that girls were superior at mathematics.

To conclude, it should be re-emphasized that this was a pilot study of teacher-student interactions in grade seven mathematics and language arts classes in Canada and Cuba. Its intent was not to produce generalizations about the totality of mathematics education in Canada or in Cuba. Rather, the objective was to answer the specific questions raised with respect to teacher-student interactions within the sample populations.

The purpose of this study was to examine whether gender-differences existed in student-teacher interactions in grade seven classrooms; whether interactions were different in mathematics compared to language arts classes; and whether there were differences in interactions between the sample classrooms studied in the two countries, Canada and Cuba. Sixteen classes were observed in each country - eight each of language arts and mathematics - yielding a total of approximately 2 000 interactions. The results of the study confirm the findings of many other researchers that boys and girls are treated differently in classroom interactions. The results of the Canadian sample reflect those of most interaction studies conducted in North America, Europe and Australia in that boys consistently received more teacher attention than girls in mathematics classrooms. The Cuban results were extremely different from those in Canada with respect to cross-subject interaction patterns. In other

words, in Cuba, girls were more dominant in classroom interactions in mathematics classes while boys were more dominant in language arts classes. In both sets of data, a small group of students were seen to dominate classroom communications: A group of boys in both Canadian mathematics and language arts classes; a group of girls in Cuban mathematics classes and a group of boys in Cuban language arts classes.

It is being inferred here that there is a relationship between classroom processes and student achievement. However, a consideration of achievement data for the students in the sample classrooms in each country has not been included primarily because of the difficulty of collecting this type of information in Cuba. In a fuller study, the link between classroom interactions and student achievement would have to be investigated more thoroughly.

Schools are microcosms of the societies in which they exist. Inequalities which exist in the larger society are manifested in the schools. The results of this study suggest that adolescent girls can and do achieve in mathematics if they live in a society in which this is the accepted norm. In other words, social values and attitudes towards achievement in a subject can decide how well students perform in it. This study suggests that student achievement in mathematics education is at least partially pedagogically and hence culturally determined. The question of why women are underrepresentated in mathematics-related fields in the industrialized world is complex but this study indicates that it is related both to the way in which different forms of knowledge are gendered and to women's place in society.

> In revolutionary institutions where participation in a wide range of activities is encouraged, behaviour is frequently modified even when there is no official change in attitude. Such behavioral changes may lead in turn to new ways of perceiving and evaluating the world, and thus a permanent nexus for relating the two types of change is established. In short, participatory activity - not in itself dependent on the

> internalization of new norms - may eventually lead to very basic changes in the value and belief systems of those who are swept into participation (Kaufman Purcell, 1973, p. 269).

As noted in the limitations of this study, there were a number of difficulties in obtaining large, comparable samples in both countries. Nevertheless, the results at least hint at differences between the two countries in this area which merit further research. Firstly, would the same results be sustained in a more scientifically-rigorous, larger-scale study? Secondly, do the findings in grade seven classrooms in Cuba apply at all grade levels there? Thirdly, are mathematics-related occupations held in the same esteem and similarly rewarded in the two countries? Finally, are the differences in teachers' attitudes, as well as the differences observed in teaching styles in mathematics and language arts in the two countries truly representative?

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APPENDIX A

Pre-Research on Cuban Education.

The following people were contacted by letter or telephone prior to my departure for Cuba.

Maurice Berube, Old Dominion University, Norfolk, Virginia

Leone Burton, Thames Polytechnic, London, England

Centre for Cuban Studies, New York, N. Y.

Eliselia Días, ICAP, La Habana, Cuba

Vivian Griffiths, University of Sussex, Brighton, England

Gila Hanna, The Ontario Institute for Studies in Education, Toronto

Evelyn F. Keller, University of California, Berkeley, California

Ann Hibner Koblitz, The Kovalevskaia Fund, Seattle, Washington

Arthur Powell, Rutgers University, New Jersey

Mark Richmond, Humberside College of Higher Education, Hull, England

Michele Solá, "Radical Teacher", New York, N. Y.

APPENDIX B

Itinerary of the Simon Fraser University

Latin American Field School

Sept.-Dec. 1989.

Sept. 27 - Nov. 2. La Habana

Nov. 3 - Nov. 6. Santiago de Cuba

Nov. 7 - Nov. 10. Holguín

Nov. 10 - Nov. 12. Camagüey

Nov. 12 - Nov. 14. Sancti Spíritus

Nov. 14 - Nov. 16. Trinidad

Nov. 17 - Nov. 20. Cienfuegos

Nov. 21 - Nov. 28. El Abra

Nov 29 - Dec. 11. La Habana

APPENDIX C

Data Listed by School

Teacher-Initiated Interactions by School
Mathematics: Canada

Sch.#		1	2	3	4	5	6	7	8
Prod.	b	28	49	16	8	24	36	33	40
	g	34	34	21	18	21	34	22	42
Proc	b	2	6	3	3	0	2	6	4
	g	0	2	0	2	1	2	3	2
Exten	b	2	3	2	4	4	2	3	2
	g	0	3	2	1	0	3	2	1
Bl/bd	b	2	2	1	2	1	0	0	0
	g	0	0	1	2	0	0	0	0
Rdg.	b	1	0	1	2	2	1	0	0
	g	2	0	0	2	0	2	1	1
Mngt.	b	1	0	2	2	0	1	0	0
	g	2	1	3	0	2	2	2	1
Disc.	b	3	1	4	3	0	4	3	1
	g	1	0	2	1	0	0	0	2
No	b	2	3	2	3	0	1	4	2
Contc	g	3	6	4	4	0	4	3	4

Student-Initiated Interactions by school
Mathematics: Canada

Sch#		1	2	3	4	5	6	7	8
Prod.	b	0	0	0	0	1	1	0	2
	g	2	4	4	2	0	0	1	1
Proc.	b	0	0	1	0	1	0	1	0
	g	1	0	1	0	1	2	0	0
call-	b	4	7	3	3	0	11	6	9
out	g	0	2	1	1	0	4	0	2

Teacher-Initiated Interactions by School
Language Arts: Canada

Sch#		1	2	3	4	5	6	7	8
Prod.	b	12	15	17	10	15	11	16	15
	g	27	35	30	24	19	24	18	21
Proc.	b	8	6	4	3	5	2	4	1
	g	6	4	0	1	3	1	2	0
Exten	b	5	3	2	3	2	0	2	3
	g	1	0	0	2	1	1	3	1
Bl/bd	b	0	0	0	0	0	0	0	0
	g	1	1	0	2	0	0	0	0
Rdg.	b	0	1	1	0	0	0	2	0
	g	1	3	0	2	0	0	0	0
Mngt.	b	0	2	0	1	0	0	1	2
	g	3	2	1	2	0	0	0	0
Disc.	b	3	1	5	0	1	3	1	3
	g	0	1	2	0	1	0	0	2
No	b	1	2	1	3	1	1	4	1
contc	g	3	5	3	4	1	0	2	1

Student-Initiated Interactions by School
Language Arts: Canada

Sch#		1	2	3	4	5	6	7	8
Prod.	b	3	0	2	1	1	0	2	3
	g	0	0	1	1	0	1	0	2
Proc.	b	0	2	1	0	1	0	0	0
	g	1	2	1	0	0	1	0	1
Call-	b	6	9	3	0	2	7	2	6
out	g	2	5	2	1	1	3	1	1

Teacher-Initiated Interactions by School
Mathematics: Cuba

Sch#		1	2	3	4	5	6	7	8
Prod.	b	12	4	6	12	8	3	16	25
	g	13	11	19	18	15	5	12	13
Proc.	b	1	2	2	0	1	0	1	0
	g	3	1	1	0	2	0	0	3
Exten	b	4	1	1	0	1	1	2	2
	g	6	3	4	2	2	5	2	5
Bl/bd	b	2	0	1	1	2	0	0	3
	g	2	0	2	0	3	1	4	2
Rdg.	b	3	1	1	2	0	1	0	2
	g	1	0	2	0	2	0	0	2
Mngt.	b	0	1	0	0	1	1	0	0
	g	2	0	1	0	1	0	2	2
Disc.	b	2	0	0	0	1	0	0	2
	g	0	0	0	1	0	0	1	1
No	b	3	1	1	4	3	6	3	5
contc	g	6	2	1	5	6	7	4	2

Student-Initiated Interactions by School
Mathematics: Cuba

Sch#		1	2	3	4	5	6	7	8
Prod.	b	0	0	1	0	0	0	0	1
	g	1	2	2	0	2	0	2	3
Proc.	b	0	1	0	0	1	1	0	0
	g	3	3	2	0	0	0	1	3
Call-	b	3	0	2	1	1	0	2	3
out	g	2	0	1	2	2	1	0	3

Teacher-Initiated Interactions by School
Language Arts: Cuba

Sch#		1	2	3	4	5	6	7	8
Prod.	b	32	6	15	17	7	9	13	10
	g	21	19	10	18	8	5	19	18
Proc.	b	1	1	2	0	2	2	1	3
	g	0	2	0	0	2	1	0	2
Exten	b	6	4	2	0	2	3	4	6
	g	4	3	0	1	1	0	1	1
Bl/bd	b	1	0	0	0	0	0	0	1
	g	0	0	0	0	0	0	0	0
Rdg.	b	2	0	1	1	0	0	0	3
	g	2	0	1	0	0	0	0	2
Mngt.	b	0	1	0	1	1	0	0	0
	g	1	0	0	0	0	0	2	1
Disc.	b	0	0	0	1	0	0	0	1
	g	1	0	1	0	0	0	0	2
No	b	2	0	1	3	4	4	3	4
contc	g	5	1	1	4	7	8	3	6

Student-Initiated Interactions by School
Language Arts: Cuba

Sch#		1	2	3	4	5	6	7	8
Prod.	b	2	1	0	1	0	0	1	0
	g	1	1	0	1	0	0	2	2
Proc.	b	1	0	0	1	0	0	0	0
	g	2	1	0	1	0	1	2	2
Call-	b	5	2	1	3	1	0	2	4
out	g	4	0	1	2	1	0	1	3