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GENDER DIFFERENCES IN COMPUTER EDUCATION: A COSTA RICAN CASE STUDY*

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ABSTRACT

A time allocation study was designed to determine how two types of teachers spend their time in a primary school computer lab in Costa Rica. As a group, teachers of both types were found to allocate more of their time to boys than to girls. Moreover, boys were found to monopolize the primary teaching resource (the formally trained lab teacher), leaving girls to seek assistance from the secondary resource (their regular classroom teacher). Results of the study have important implications both for the anthropology of education and for Costa Rican society at large.

INTRODUCTION

Student attitudes toward computers and computing have been the subject of considerable research in a variety of international contexts. One of the most salient findings of this research involves gender differences: male students usually like computer-related activities more, are more confident computer users, and experience less anxiety than do their female counterparts [1-3]. Research on students at a Costa Rican primary school conducted by the first author in 1990 is consistent with these general findings. Gender differences in Costa Rican student attitudes toward computers were found to be related to a number of factors including: 1) prevailing cultural attitudes in which computing is generally seen as a "male" activity, 2) competition rather than cooperation in lab activities, 3) boys

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hindering girls from participating fully in lab work, and 4) boys having more extracurricular experience with computers than girls [4].

During this previous research, preliminary observations suggested that primary school teachers provide more assistance to boys than to girls in the computer laboratory, which also apparently results in more positive attitudes by boys. The current study was designed to test this hypothesis using formal methods of time allocation and time frame analysis. Research was undertaken in 1992 at a different Costa Rican primary school, Escuela Pérez,[1] to systematically address this issue.

LOGO programming is taught in Pérez's computer lab by a two-person team consisting of the students' regular classroom teacher and a formally trained laboratory teacher. In most cases, the laboratory teacher leads the class, with the regular teacher assuming a supporting role. Time allocation methods were used to determine how both types of teachers spend their time with students (1st through 6th graders) in the computer lab. Results confirm that, although lab and regular classroom teachers allocate their time in the lab somewhat differently, teachers as a group spend considerably more time with boys than with girls. Lab and regular classroom teachers seem to perform complementary roles, however. The frequency of interactions initiated by lab teachers and regular classroom teachers are inversely correlated, for example, with one teacher taking a more proactive role with students and the other a more reactive one. In most cases, boys are more aggressive in initiating interactions with the teacher taking the "primary" role in leading the class (typically the lab teacher), leaving girls to interact more frequently with the teacher taking on the "secondary" role.

Results of the study have important implications both for the anthropology of education and for Costa Rican society at large. It is clear that teacher-student interactions in the lab are strongly influenced by pervasive gender-linked stereotypes, attitudes, and social patterns embedded in Costa Rican culture. Moreover, education in Costa Rican computer labs may be helping to maintain the country's gender status quo. If Escuela Pérez's computer lab is typical of other such educational settings in Costa Rica, boys are receiving disproportionately more computer-related instruction. As a consequence, more boys than girls can be expected to enter fields where knowledge of computer applications is important, such as economics, educational administration, engineering, the natural sciences, and business. It is from such fields that Costa Rica's economic and political leaders are most often recruited.

From a practical educational standpoint, results of this research suggest that teachers should be aware of the possibility that they may be allocating more of their time to male than to female students in computer labs. If such differential interaction is in fact occurring, several strategies could be used to increase

[1] Pseudoynms are used for the schools, their teachers, and students.

contacts with girls while maintaining the same level of assistance to boys, which would result in greater gender equity in the educational process.

In this article, we provide an overview of Costa Rica's primary school educational computing program and the cultural context in which it is embedded. We follow this by a discussion of the methodology used to assess how both lab and regular classroom teachers allocate their time in the computer lab at Escuela Pérez. The focus is on the total amount of time teachers allocate to girls and boys and the frequency with which students and teachers initiate interactions with one another. The article concludes with a summary of the major findings and the more general practical and social issues raised.

COSTA RICA'S *PROGRAMA DE INFORMÁTICA EDUCATIVA*

The number of schools, teachers, and students has risen dramatically in Costa Rica during the past fifty years. In this small Central American nation of approximately three million people, most children now regularly complete nine years of schooling. Many new public and private schools and universities with modern facilities are also currently operating in both rural and urban areas. At the present time, Costa Rica has a 93 percent literacy rate, assigns a sizable proportion of its national budget to public education, and engages 27 percent of its population as teachers and students [5-10].

Costa Rica drafted a plan to establish computer labs in nearly 200 of its public primary schools after Oscar Arias Sanchez became president in 1986. The educational computing program,[2] known as the Programa de Informática Educativa, is coordinated by the private non-profit Fundación Omar Dengo (FOD). This program is supported by Costa Rica's Ministry of Education and financed through private enterprise and national and international agencies. Initially, it was under the tutelage of Seymour Papert, a leading figure in educational computing, and the developer of LOGO.

In 1988, labs with twenty IBM computers each were established in sixty primary schools. An additional seventy labs were in operation by 1990. Thirty more are scheduled for the near future. When the third set of laboratories is in place, computers will be located throughout the country and be accessible to 134,500 students, some 32 percent of the elementary school population.[3] The

[2] In addition to introducing computers into primary schools, the Programa de Informática Educativa currently offers courses to the general public. Program personnel are also developing or plan to develop educational software, a network linking schools to information databases, and educational computing programs for secondary schools and universities [13].

[3] There are minor differences between Fonseca's [13] and Harper's [14] figures. Also note that eighty laboratories were originally scheduled to be created during the third phase of this program's implementation. Only thirty are now planned.

scope of this educational computing program is without precedent in Latin America [11-15].

Research was undertaken for ten weeks during the summer of 1992 at Escuela Pérez, a public primary school located in a predominantly working and middle-class neighborhood in the city of Heredia. Heredia, with a population of approximately 79,500, is one of three small cities surrounding San José, the capital of Costa Rica [16]. Approximately 1163 students attend this school in morning and afternoon sessions. Although the school has a male principal, the three computer laboratory teachers and the overwhelming majority of the regular classroom teachers are women.

Escuela Pérez's computer lab was inaugurated in 1990. Since that time, students have been using the Spanish version of LOGOWRITER (Version 2.01), which has both programming and word processing capabilities. Nearly all of the students' time in the computer lab involves working with LOGO. The older, most talented students create fairly sophisticated projects with color graphics, animation, and text. Examples of such projects are greeting cards embellished with figures for Father's Day, a spacecraft flying from star to star, and a mountainous landscape with a house, flag, and sun that changes colors. Younger, less experienced students create simple geometric shapes, flowers, boats, cars, etc.

Lab teachers encourage all students, regardless of their grade level, to incorporate into their LOGO projects ideas that were previously introduced in their regular classrooms. It is hoped that in the course of working on LOGO projects, students will develop new reasoning and problem-solving skills, acquire positive attitudes toward science and technology, become familiar with computers and some of their applications, and better understand mathematics, the natural and social sciences, and Spanish. Learning to program in LOGO is seen as a means to achieve these goals rather than as an end in itself [13, 17-19].

Students in the computer lab work with their regular classroom teacher and one of three formally trained lab teachers. Typically, the lab teacher suggests ideas for lab projects and introduces new LOGO commands to students during the initial five to ten minutes of class. Students generally take notes on the lecture while seated on the floor at the front of the lab. During this time, the student's regular classroom teacher often sits on a small bench near the entrance of the lab. After this initial lecture, students take their seats in front of their computers, enter their passwords, and begin working. In general, the thirty to thirty-five lab students work in same-sex pairs. While students are programming, both teachers circulate among them, attend to their questions, and offer their own unsolicited suggestions and comments. A diagram of the lab is found in Figure 1.

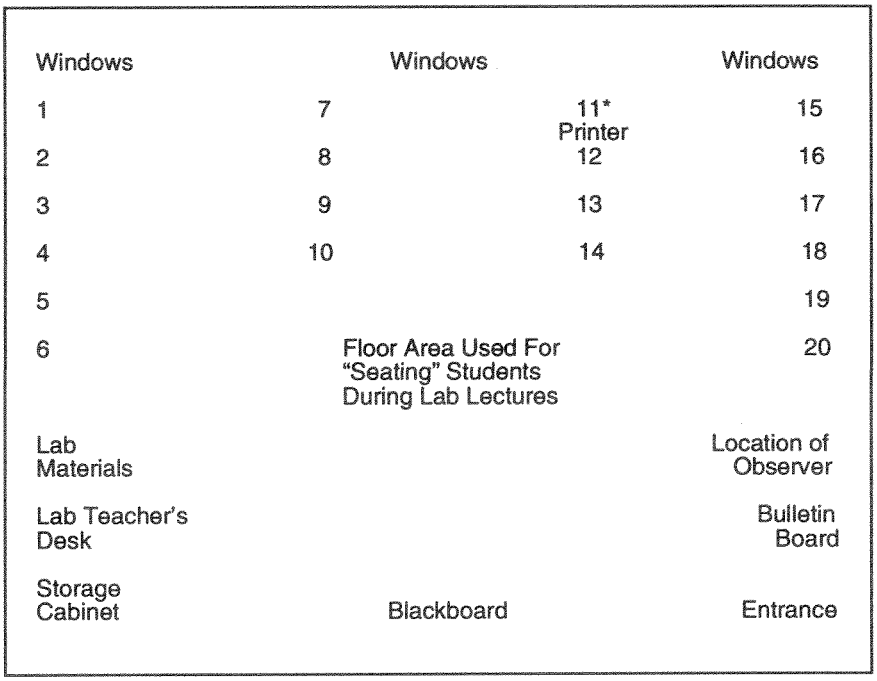

Figure 1. Escuela Pérez's computer lab.
*All of the computers with the exception of #11 are used by students. Computer #11 is for lab teacher use only. All of the computers are linked to #11, forming a computer network.

GENDER ROLES IN COSTA RICA: THE SOCIOCULTURAL CONTEXT

Lab interactions at Pérez can be better understood within the broader context of pervasive gender-linked stereotypes and social patterns found both at this school and in Costa Rican society at large.[4] In Costa Rica, male and female roles and relationships are strongly influenced by what is commonly called the *machismo-marianismo* complex. Machismo is the belief that males will excel in intellectual matters and dominate social relationships involving the opposite sex. Males are often characterized as dominant, authoritative, rational, independent,

[4] For a more detailed discussion of this point, see [4].

and interested in politics, sports, mathematics, and science. Marianismo refers to female submissiveness and superiority in spiritual and moral matters. Characteristics frequently attributed to females include being soft, sweet, obedient, intuitive, interested in the home and child care, compassionate, pious, decent, and pure [6, 20, 21].

These gender stereotypes are transmitted in many ways. Men and women are often portrayed in a stereotypical fashion in Costa Rican radio programs, television shows, commercials, popular magazines, and programs and materials developed by governmental and non-governmental agencies. Of particular relevance to this study is the prevalence of gender stereotypes in Costa Rican primary school textbooks [22-24], and in computer magazines available for sale in Costa Rica [4, 25-29].

The machismo-marianismo complex is related to occupational choices and political office. From 1953 to 1986, between 91 and 98 percent of the fifty-seven deputies in the Legislative Assembly were men. The tendency toward male office holding is also found in Costa Rica's political parties, municipal councils, and community associations [21, 30, 31]. Most of the Costa Rican women classified as economically active (i.e., female wage earners) in 1980 worked in personal services as cooks, maids, waitresses, janitors, seamstresses, etc. or were employed as primary and secondary school teachers, nurses, typists, secretaries, beauticians, or hairdressers [21, 22, 31-34].

A similar pattern is found in Costa Rica's educational system. Most preschool (98%), primary school (79%), and secondary school teachers (54%) are women. However, the higher paying and more prestigious positions in the educational system, such as university professors and administrators, primary and secondary school principals, and regional directors are typically filled by males [20, 22, 33].

Gender also helps to shape enrollment patterns for Costa Rican students. More men than women pursue advanced degrees at Costa Rica's major universities. Men predominate in the natural sciences, law, engineering, economics, business, and educational administration, while women tend to major in the social sciences, arts and letters, nursing, and education [31, 35-37].

Most (54 to 70%) of the 1992 graduates of computer science programs at the Universidad de Costa Rica, the Universidad Nacional, and the Instituto Nacional de Aprendizaje were male [35, 38-40]. It also appears that enrollment patterns in these computer science programs reflect a division into a higher status tier dominated by men and a lower status tier with a greater proportion of women.

Although the formal school curriculum is generally the same for males and females in Costa Rican primary and secondary schools, gender differentiation and gender segregation are both common [21, 22, 41]. Costa Rica's Ministry of Education has a dress code that requires boys in primary and secondary schools to wear shirts and pants and girls to wear blouses and skirts. At Escuela Pérez, the physical education teacher often forms same-sex basketball teams and may have

girls and boys play against each other. Teachers also give blue report cards to boys and pink cards to girls.

Sex segregation in Pérez's lab (and in most classrooms) is encouraged by both regular and lab teachers. Teachers transferring students between their regular classroom and the lab have students form two lines, one of boys and another of girls. As a consequence, when students enter the lab and seat themselves on the floor, girls generally sit together as a group apart from boys. Students working in pairs at their computers virtually always are of the same sex. Furthermore, boys often work at the computers on one side of the room while girls work on the other.

In sum, both the students and teachers of Pérez live in a society that perceives males and females to have very different personal characteristics and abilities. These perceptions encourage males to hold political and administrative posts, work outside the home, and acquire advanced scientific and technical training. Computer science is thought to be primarily a "male" field of endeavor.

RESEARCH METHODS

Data Collection

A formal time allocation study [42] using time frame analysis was designed to determine how lab and regular classroom teachers at Escuela Pérez spend their time in the computer lab. We used an instantaneous scan sampling or "spot sampling" technique, in which behavior at a moment in time is recorded, in combination with a continuous monitoring of the entire stream of behavior in the lab. Time frames of five minutes were established, and teacher interactions at a predetermined instant within each frame were recorded. Continuous monitoring of behavior in the lab provided data on, among other things, the identity of the initiators of teacher-student interactions. With the instantaneous scan sampling technique, the number of times an activity is recorded is used as a proxy for the actual time spent in that activity. The following section discusses the methodology and sample design in greater detail.

Escuela Pérez is similar to many other public Costa Rican primary schools in that the school day is divided into two sessions. When research was undertaken at Pérez in 1992, first, second, and third grade students attended school in the morning on Mondays, Wednesdays, and Fridays, and in the afternoon on Tuesdays and Thursdays (Session 1). Fourth, fifth, and sixth graders attended school on Monday, Wednesday, and Friday afternoons, and Tuesday and Thursday mornings (Session 2). There are five sections of each of these grades at Escuela Pérez. In addition to these thirty groups, there were five sections of kindergarten students who attended school from 7:00 A.M. to 10:40 A.M. Monday through Friday.

All three of the computer lab teachers are also regular classroom teachers, influencing the scheduling of computer lab meetings. Ana Maria, who teachers a sixth-grade class during Session 2, tends to meet with first- through third-grade classes in the lab during Session 1. Grace tends to meet with fourth through sixth graders in the lab because she teaches a second-grade class during Session 1. Milena's lab schedule is different from those of the other lab teachers because she teaches a kindergarten class. Since Milena's kindergarten classes end at 10:40 A.M., she is able to work in the lab during parts of both sessions and meet with most grade levels.

As can be seen in Table 1, each lab teacher meets with ten different groups of students in the lab. However, note that lab teachers meet with second through sixth graders once each week for eighty minutes. Those working with first graders meet with each section for forty minutes twice each week.

Four fifth-grade sections and five sections each of first, second, third, fourth, and sixth-grade classes were observed in the lab. In general, observations of each group were made over a period of eighty minutes. The first observation for each group occurred one to five minutes after the beginning of the lab period. The time of the first observation was randomly selected. Thereafter, lab observations were made exactly every five minutes. A total of 388 observations were made for twenty-nine classes. One class, 5D, was not observed. Two classes, 4C and 6A, were observed over a forty-minute period instead of the usual eighty-minute one.[5]

Coding sheets were used to record observations. Variables included the date, time, grade, and section, and, for each teacher interaction, the name of the teacher, whether she was interacting with students or with another teacher, and the identity of the individual who initiated the interaction. If the teacher was interacting with students, the number and sex of the students were noted as was the number corresponding to the particular computer(s) being used. If any students were out of their seats during the predetermined instant of observation, their number and sex were also recorded.

A student was credited with initiating an interaction with a teacher only if the student: 1) raised his or her hand, 2) called out to a teacher, or 3) walked up to a teacher. In cases where it was clear that none of the above behaviors had occurred, the teacher was credited with initiating the interaction. Sometimes the initiator of an interaction could not be unambiguously determined because a teacher or student blocked the investigator's field of vision. When this occurred, the initiator of the interaction was coded as missing.

[5] Class 5D was not observed because the regular classroom teacher did not bring her students to the lab for three consecutive weeks. The reasons for this are not known. On another occasion, 5D's lab teacher attended an administrative meeting and canceled the lab meeting. Two classes were observed for only forty minutes each because the regular classroom teachers used the other half of the lab period for other classroom activities.

Table 1. Escuela Pérez's Lab Schedule

Class	Session	Day	Period	Lab Teacher
1A	1	Monday	7:00 - 7:40	Ana Maria
1B	1	Monday	7:50 - 8:20	Ana Maria
2E	1	Monday	8:30 - 9:50	Ana Maria
—	1	Monday	10:00 - 11:20	Free Period
1D	1	Monday	11:30 - 12:10	Milena
4C	2	Monday	12:20 - 1:40	Grace
4B	2	Monday	1:50 - 3:10	Milena
5A	2	Monday	3:20 - 4:40	Milena
—	2	Monday	4:50 - 5:30	Free Period
6E	2	Tuesday	7:00 - 8:20	Ana Maria
6C	2	Tuesday	8:30 - 9:50	Grace
4A	2	Tuesday	10:00 - 11:20	Grace
—	2	Tuesday	11:30 - 12:10	Free Period
2A	1	Tuesday	12:20 - 1:40	Grace
2D	1	Tuesday	1:50 - 3:10	Ana Maria
3C	1	Tuesday	3:20 - 4:40	Ana Maria
—	1	Tuesday	4:50 - 5:30	Free Period
1A	1	Wednesday	7:00 - 7:40	Ana Maria
1B	1	Wednesday	7:50 - 8:20	Ana Maria
3D	1	Wednesday	8:30 - 9:50	Ana Maria
1C	1	Wednesday	10:00 - 10:40	Ana Maria
—	1	Wednesday	10:50 - 11:20	Free Period
1D	1	Wednesday	11:30 - 12:10	Milena
5D	2	Wednesday	12:20 - 1:40	Grace
6A	2	Wednesday	1:50 - 3:10	Milena
5B	2	Wednesday	3:20 - 4:40	Milena
—	2	Wednesday	4:50 - 5:30	Free Period
6B	2	Thursday	7:00 - 8:20	Grace
4D	2	Thursday	8:30 - 9:50	Grace
5C	2	Thursday	10:00 - 11:20	Grace
—	2	Thursday	11:30 - 12:10	Free Period
3A	1	Thursday	12:20 - 1:40	Milena
3B	1	Thursday	1:50 - 3:10	Milena
3E	1	Thursday	3:20 - 4:40	Milena
1E	1	Thursday	4:50 - 5:30	Milena
2C	1	Friday	7:00 - 8:20	Ana Maria
2B	1	Friday	8:30 - 9:50	Ana Maria
1C	1	Friday	10:00 - 10:40	Ana Maria
—	1	Friday	10:50 - 11:20	Free Period
1E	1	Friday	11:30 - 12:10	Milena
6D	2	Friday	12:20 - 1:40	Grace
4E	2	Friday	1:50 - 3:10	Grace
5E	2	Friday	3:20 - 4:40	Milena
—	2	Friday	4:50 - 5:30	Free Period

Interpretation

Escuela Pérez has a policy of assigning a similar number of students to each class. However, a few students from each class were generally absent during any given lab period either due to illness or to participation in other school activities. Nevertheless, the number of students observed working in the lab varied very little from group to group. Twenty-nine different groups of students were observed during thirty-four lab meetings. (Recall that the 5 first-grade groups meet twice each week.) With the exception of 5E, which had twenty-four students[6] on the day it was observed, class size only ranged from twenty-nine to thirty-six. The mean class size was 32.5, with a standard deviation and coefficient of variation of only 2.3 and .07 respectively.

Escuela Pérez's policy of assigning an equal proportion of boys and girls to each class also seems to have been effective. The thirty-four class meetings observed had means of 16.2 (SD = 1.8) for boys and 16.3 (SD = 1.5) for girls. A t-test for difference between these means is not significant. Overall, 1105 students were observed during thirty-four lab meetings: 551 boys and 554 girls. Therefore, if teachers allocate their time evenly, they would be expected to spend very nearly the exact same amount of time interacting with boys and girls.

RESULTS

General Considerations

The overwhelming majority of time allocation studies in education focus on one or more specific type(s) of teacher and student behaviors (e.g., teacher provides praise or criticism, student asks question or calls out answer). Relatively few researchers report the total amount of time teachers actually spend with students in instructional activities or the frequency with which teachers and students initiate interactions with one another. To the extent that such information exists, we include it in the discussion below.

As previously mentioned, the percentage of *times* teachers were observed engaging in different activities was used as a proxy for the percentage of *time* they spend in those activities. Table 2 illustrates how the computer lab teachers spend their time. It suggests that lab teachers allocate approximately one-eighth of the lab period to lecturing to the whole class. Lectures generally occur during the initial five to ten minutes of the period. It also appears that lab teachers spend a total of 55 percent of their time interacting with same-sex pairs of students and with students working individually.

[6] Most of the students who were absent were attending a band practice.

Table 2. Individuals with Whom Lab Teachers are Interacting

Individual(s)	Frequency	Percent	Valid Percent	Cum Percent
Girl	19	4.9	4.9	4.9
Boy	34	8.8	8.8	13.7
Two or more girls	67	17.3	17.3	31.0
Two or more boys	93	24.0	24.0	55.0
Girl and boy	9	2.3	2.3	57.4
Larger mixed sex group	18	4.6	4.7	62.0
Whole class	48	12.4	12.4	74.4
Classroom teacher	19	4.9	4.9	79.3
Other	8	2.1	2.1	81.4
No interaction	72	18.6	18.6	100.0
	1	.3	Missing	
Total	388	100.0	100.0	

Table 2 also suggests that lab teachers spend nearly one-fifth of their lab time (approximately 15 minutes of an 80 minute period) interacting with no one at all. Teachers use some of their time away from others to print out student projects, to move from one student pair to another, and to perform other tasks necessary to keep the computer lab running smoothly. This finding is consistent with research undertaken by Fagot [43] and Rosenshine [44]. Fagot found that preschool teachers spend approximately 13 percent of their classroom time away from children, preparing new materials or food. Rosenshine found that second and fifth-grade teachers spend almost 20 percent of their in-class time in non-instructional activities (waiting after finishing an assignment, transitions between activities, etc.).

Table 3 examines how the regular classroom teachers allocate their time in the lab. Note that they spend very little time interacting with the whole class, and that they spend more than one-third of their time interacting with no one at all. Regular classroom teachers also spend somewhat less time (46.4%) than lab teachers interacting with same-sex pairs or individual students.

These findings are not surprising, since lab and regular classroom teachers perform different roles in the lab. Lab teachers are trained for two weeks by the FOD prior to their teaching LOGO. Officially, a lab teacher is known as "la encargada del laboratorio," literally "the [teacher] in charge of the laboratory." This formal title recognizes the lab teacher's special expertise and indicates that there is an expectation that she will lead and take an active interest in the lab.

Table 3. Individuals with Whom Regular Classroom Teachers are Interacting

Individual(s)	Frequency	Percent	Valid Percent	Cum Percent
Girl	25	6.4	6.4	6.4
Boy	31	8.0	8.0	14.4
Two or more girls	58	14.9	14.9	29.4
Two or more boys	66	17.0	17.0	46.4
Girl and boy	10	2.6	2.6	49.0
Larger mixed sex group	14	3.6	3.6	52.6
Whole class	5	1.3	1.3	53.9
Lab teacher	19	4.9	4.9	58.8
Other	21	5.4	5.4	64.2
No interaction	139	35.8	35.8	100.0
Total	388	100.0	100.0	

In contrast, the regular classroom teacher or "maestra del aula" does not receive any formal training in LOGO. As a consequence, regular classroom teachers are less knowledgeable about and participate less in computer-related activities. Consider the following observation of 3B. Milena, the lab teacher, missed the beginning of the lab period. As a result, the regular classroom teacher was forced to decide between leading computer lab activities herself or returning her students to the classroom. She hesitated for a moment but eventually,

> . . . told the students they could enter [the computer lab] anyway. [She told the students they] could play and make whatever they wanted. [She] also told [them] that there were many things [about LOGO] that she didn't know, but that . . . they should enter the lab . . . , and sit with the same person they always did.[7]

The FOD instructs lab teachers to encourage regular classroom teachers to actively work with students in the lab and to help coordinate lab and regular classroom activities. This ideal, however, is not fully realized in practice. Some regular classroom teachers do not really enjoy working in the lab. One teacher said,

[7] This passage, and similar ones that follow, are extracts from the first author's field notes.

> her students like LOGO but that LOGO bored her. I asked her why. She said that three years of watching students make designs was boring. She also pointed out that it was hot and that the lab's air conditioner didn't work well.

A few regular classroom teachers use the lab period to catch up on other school work or use it as a free period. In Grace's 4E it was observed that, "[t]he regular classroom teacher graded [her students' math] notebooks most of the period. She would occasionally attend to a student's request for assistance [but only] if the student was persistent."

The above observations and the results displayed in Tables 2 and 3 are consistent with the regular classroom teachers' role as a "secondary" or "back-up" computer lab teacher. Regular teachers are less likely to lecture or interact with students in the lab because of their lack of formal training in LOGO.

A number of researchers working in traditional classrooms have found that the amount of interaction a student has with a teacher partly depends upon where the student sits. "Action zones" are often T-shaped; students seated in the front and center rows of the class participate in more interactions with the teacher than those seated along the sides or in the back [45-48]. Less frequently reported is a triangular action zone that extends across the front row and ends at the middle seat in the middle row [49]. Evidently, students in action zones interact more frequently with teachers because they are in the teacher's immediate view and because students can use verbal and nonverbal cues to indicate to teachers that they wish to participate in class discussions. Some researchers who have looked for action zones, however, have not found them in some of the classrooms they have observed [47, 50, 51].

No clear action zones were found in Escuela Pérez's computer lab, possibly because teachers "circulate" more frequently than they would in an ordinary classroom. Initially, we hypothesized that teachers would interact more frequently with students seated at the two center rows of the lab because of their more convenient location. However, while Table 4 suggests some trend in this direction, results are not statistically significant ($t = 0.77$, $p < .55$, one-tailed).

Hypothesis 1: Teachers Spend More Time with Boys than Girls

To our knowledge, no investigator has systematically examined the amount of time teachers spend with male and female students in computer labs in the United States, Costa Rica, or elsewhere. However, there are many studies of the time allocation of teachers working in classrooms and labs where computers are not used (see [52, 53] for reviews of this literature). Researchers working in preschools [54], elementary schools [55-61], middle schools [48, 59, 60, 62, 63], high schools [48, 51], and colleges [64-67] have all found that teachers generally allocate more of their time to male than to female students (see also [68] study of

Table 4. Frequency with which Lab and Regular Classroom Teachers Interact with Students at their Computers

Computer	Lab Teachers Frequency	Regular Classroom Teachers Frequency
1	14	16
2	7	8
3	10	4
4	18	8
5	4	6
6	16	12
7	3	2
8	14	12
9	10	11
10	14	9
11	—	—
12	15	9
13	15	11
14	17	10
15	4	7
16	4	13
17	11	4
18	7	16
19	11	7
20	12	14
	206	179
Missing cases	0	

K-12th grade teachers). The findings of still other studies of teacher-student interaction are consistent with this view [69-78].

There are very few exceptions to the general trend noted above. Three studies support the view that there is no significant difference in the amount of time secondary and post-secondary teachers allocate to male and female students [79-81]. One researcher has reported mixed results in which high school teachers participated more frequently in certain kinds of interactions with boys and in others with girls [82]. However, the total time spent with each sex was not

examined in this study. Biber, Miller, and Dyer [83] found that teachers allocate more instructional time and Field [84] found that they allocate more play time to preschool girls than boys. However, we know of no study that found teachers allocating more of their total classroom time to female than male students.

Apparently this gender disparity in education exists regardless of the sex of the teacher. That both male and female teachers allocate more of their time to boys has been reported by a number of scholars [60, 62, 68, 69, 72]. These studies were undertaken in kindergarten, elementary, junior, and senior high school settings. However, several researchers have suggested that the disparity is somewhat less or eliminated when the teacher is a woman [65, 66, 73, 80]. Although Whyte does not provide data on the total amount of time allocated, she does report that male teachers interact more with boys while female teachers interact more with girls [85]. These patterns may be reversed in higher education, however. Boersma and her colleagues report that male college students tend to interact with female teachers more than do female students, while female students tend to participate more than male students in male-taught classes [79].

Based on the above findings, we hypothesized that education at Escuela Pérez would conform to the prevailing pattern in which teachers spend more time with boys than with girls. Tables 5 and 6 examine interactions involving lab teachers and regular teachers with individual and same-sex pairs of students. Table 5 shows that nearly 60 percent of the lab teachers' interactions are with boys and 40 percent with girls. This disparity is statistically significant using the chi-square one-sample test [86], a non-directional test of statistical significance ($\chi^2 = 7.90$, $d.f. = 1$, $p < .005$). If the sex of students with whom lab teachers interact is considered as a binomial event, the normal curve may be used as an approximation to the binomial, allowing a one-tailed parametric test for statistical significance (Z test). Again, results are significant ($Z = 2.81$, $p < .003$).

Table 6 suggests that regular classroom teachers also interact more with boys in the lab than with girls. However, the tendency is much less marked, and in fact is

Table 5. Lab Teacher Interactions Involving Individual and Same-Sex Pairs of Students

Student(s)		Frequency	Percent	Valid Percent	Cum Percent
Girls		86	40.4	40.4	40.4
Boys		127	59.6	59.6	100.0
	Total	213	100.0	100.0	
Valid cases	213	Missing cases	0		

Table 6. Regular Classroom Teacher Interactions Involving Individual and Same-Sex Pairs of Students

Student(s)	Frequency	Percent	Valid Percent	Cum Percent
Girls	83	46.1	46.1	46.1
Boys	97	53.9	53.9	100.0
Total	180	100.0	100.0	
Valid cases 180	Missing cases 0			

not statistically significant ($\chi^2 = 1.09$, *d.f.* = 1, *n.s.*; $Z = 1.04$, *n.s.*). However, when both types of teacher interactions are considered, hypothesis 1 is supported: boys experience more overall interaction with teachers than girls ($\chi^2 = 7.7$, *d.f.* = 1, $p < .01$; $Z = 2.77$, $p < .003$). These findings are discussed further below.

Hypothesis 2: Male Students Initiate More Interactions with Teachers

The literature on possible gender biases in student-initiated interactions with teachers is much less uniform than the literature on gender biases in overall teacher time allocation. Many researchers report that male students initiate interactions more frequently with teachers than do female students. This pattern has been reported by scholars working in elementary schools [57, 59], middle schools [48, 59, 62, 63, 87], high schools [48, 88], and colleges [89]. Hillman and Davenport also found that K-12 boys as a group initiated more interactions with their teachers than did female students [68]. In addition, research undertaken by Constantinople [64], Jones and Wheatley [72], Sadker and Sadker [60], and Tobin and Garnett [77] is consistent with the work cited previously, although summary measures for all of the different kinds of interactions students initiate with teachers were not reported.

Other scholars find no significant sex differences in student-initiated interactions with teachers. This pattern is reported for preschool [76], elementary school [56], high school [69], and college students [79, 90]. Good, Slavings, Harel, and Emerson did not investigate all types of student-initiated interactions, but they did find an interesting trend in "question asking" behavior in their study of kindergarten through twelfth-grade students [91]. Boys begin school asking many more questions than girls. Girls gradually begin to catch up with boys, and by the seventh grade, they actually ask more questions than boys. This reversal, however, is short lived, so that by high school, boys again ask more questions than

girls. By this point, however, participation rates are quite similar. Mixed results were also reported for high school students, but again, no summary measures for all kinds of student-initiated interactions with teachers were reported [82, 92].

Finally, there are two studies that found girls initiating more interactions with teachers than boys. Good, Cooper, and Blakey [93] and Eccles and Blumenfeld [58] report this pattern for elementary school and junior high school students, respectively.

Very few researchers have cross tabulated student-initiated interactions with teachers by the sex of the teacher, but the results are mixed. Hillman and Davenport examined student-initiated interactions with teachers (K-12) and found that the sex of student/sex of teacher interaction was not significant [68]. The Boersma team reports similar findings for college students [79]. Sikes found that junior high school students of both sexes initiate more contacts with female teachers than with male teachers [87]. The opposite pattern occurred in a college experimental setting in which computers were used. No significant differences were found in the frequency with which male and female college students ask research assistants questions. Also, it was found that the sex of student/sex of research assistant interaction was not significant, although students as a group asked male research assistants more questions than they did female research assistants [94].

In our study, the sex of the teacher is controlled for, since all observed teachers were women. Based on the above-cited studies, and previous research in Costa Rica, we hypothesized that male students would initiate more interactions with teachers at Escuela Pérez. This hypothesis was confirmed, although with some qualifications.

Table 7 shows that boys are nearly twice as likely as girls to initiate interactions with their laboratory teachers. This finding is statistically significant ($\chi^2 = 6.44$, $d.f. = 1$, $p < .025$; $Z = 2.54$, $p < .006$). That boys more actively seek their lab teacher's assistance is corroborated by observations of students who left their seats while working on a computer. Although students vacate their seats for a number of reasons (e.g., to leave the lecture area in order to take their seats in front of their computers, to collect computer printouts, to view the projects of other students, and to go to the rest-room), their primary reason for leaving their seats is to seek the assistance of their teachers, especially their lab teachers. The mean number of boys out of their seats was compared to that of the girls. Since cases where students were being lectured to or were moving as a group from the lecture area to their computers were excluded from this analysis, it can be assumed that students were working at their computers at the time they left their seats. The mean number of boys out of their seats was 1.24 ($SD = 1.59$). The mean for girls was 0.90 ($SD = 1.24$). This difference is statistically significant ($t = 2.57$, $p < .006$, one-tailed).

Though boys are more likely than girls to actively seek out their lab teacher's assistance, it would be a mistake to conclude that girls desire less assistance from

Table 7. Initiator of Interactions Involving Lab Teachers

Initiator	Frequency	Percent	Valid Percent	Cum Percent
Girl	36	9.3	11.0	11.0
Boy	61	15.7	18.7	29.8
Lab teacher	140	36.1	42.9	72.7
Classroom teacher	14	3.6	4.3	77.0
Other	3	.8	.9	77.9
No interaction	72	18.6	22.1	100.0
	62	16.0	Missing	
Total	388	100.0	100.0	

them than do boys. One of the statements on a questionnaire administered to 262 third- through sixth-grade students at Pérez was "I would like the lab teacher to orient me a little bit more [in the computer lab]." A 5-point scale was used, with low numbers representing a greater desire for assistance. While both sexes desired somewhat more lab teacher assistance, the mean for girls (1.93, $SD = 1.05$) indicated greater desire than that for boys (2.30, $SD = 1.25$). This difference is significant ($t = 2.57, p < .006$, one-tailed). Recall that lab teachers allocate more of their time to boys than to girls. This occurs, in large part, because boys initiate many more interactions with them. As a result, girls are more likely to desire more guidance from their lab teachers.

Table 8 suggests that girls turn to their regular classroom teachers, a secondary resource, to meet some of their unmet demand for lab teacher assistance. It indicates that girls are slightly more likely than boys (10.9% vs. 8.7%) to initiate interactions with regular classroom teachers. Combining information from Tables 7 and 8 into a two-by-two contingency table cross-tabulating sex of student by student-initiated interaction with either lab or regular teacher, we find that the results are statistically significant ($\chi^2 = 5.26$, $d.f. = 1$, $p < .025$). Table 9 suggests that there is indeed a difference by sex in whether students seek help from the lab or the regular teacher: boys are much more likely to seek out the primary resource (lab teacher) while girls rely on the secondary resource (regular teacher) more than boys do.

Hypothesis 3: Teachers Initiate More Interactions with Male Students

Some scholars who have found teachers spending more time with male students have also discovered that teachers tend to initiate more interactions with male than

Table 8. Initiator of Interactions Involving Regular Classroom Teachers

Initiator	Frequency	Percent	Valid Percent	Cum Percent
Girl	35	9.0	10.9	10.9
Boy	28	7.2	8.7	19.6
Lab teacher	12	3.1	3.7	23.4
Classroom teacher	96	24.7	29.9	53.3
Other	11	2.8	3.4	56.7
No interaction	139	35.8	43.3	100.0
	67	17.3	Missing	
Total	388	100.0	100.0	

Table 9. Cross-Tabulation, Initiator of Interaction by Type of Teacher

Count			
Individual(s)	Lab Teacher	Regular Teacher	Row Total
Girls	36	35	71
Boys	61	28	89
Column Total	97	63	160

with female students. This has been found by researchers working in elementary school [56, 57], middle school [62, 63, 78, 87], and high school settings [69, 78]. Fennema and Peterson's [95], Long's [67], and Tobin and Gallagher's [48] studies of elementary, middle school, and college teachers are also consistent with these findings.

Not all researchers report similar results, however. Three studies have reported that teachers are equally likely to initiate interactions with female students as they are with males. This has been found to be the case for preschool [96], first grade [97], and college teachers [79]. In addition, Baker [82], Honig and Wittmer [98], and Jones and Wheatley [92] report mixed findings. Preschool and high school teachers more frequently initiate some kinds of interactions with boys and other kinds with girls. Again, these studies examined only a limited subset of the total range of teacher-initiated interactions with students.

Karp and Yoels report that the sex of the teacher is related to the frequency with which teachers initiate interactions [66]. Male college teachers initiated a greater amount of interactions with male than with female students. Female teachers showed no such bias. Finally, there is one study that found that teachers initiate more interactions with girls than boys. Fagot found this to be the case in two middle-class preschools [43]. Both had fewer than twenty students enrolled.

Segregation of Escuela Pérez's computer lab by sex, a common practice, could increase the likelihood that teachers will spend more time with boys than girls [59]. Imagine the following scenario. A teacher begins working with a boy in the boy's section of the lab. After the teacher provides assistance to this student, she initiates interactions with other students nearby. Since many of these students are boys, the net effect would be for the teacher to spend more time with boys. However, Tables 10 and 11 suggest that this is not the case, at least for the lab teachers.

Table 10. Interactions Initiated by Lab Teachers with Individual and Same-Sex Pairs of Students

Student(s)	Frequency	Percent	Valid Percent	Cum Percent
Girl	9	12.7	12.7	12.7
Boy	10	14.1	14.1	26.8
Girls	25	35.2	35.2	62.0
Boys	27	38.0	38.0	100.0
Total	71	100.0	100.0	
Missing cases 0				

Table 11. Interactions Initiated by Regular Classroom Teachers with Individual and Same-Sex Pairs of Students

Student(s)	Frequency	Percent	Valid Percent	Cum Percent
Girl	6	9.4	9.4	9.4
Boy	9	14.1	14.1	23.4
Girls	18	28.1	28.1	51.6
Boys	31	48.4	48.4	100.0
Total	64	100.0	100.0	
Missing cases 0				

Table 10 shows that lab teachers are about equally likely to initiate interactions with boys as with girls. From this it can be concluded that the major reason lab teachers spend more time with boys than with girls is because boys more actively seek their assistance. In light of this finding, the results presented in Table 11 are especially interesting. This table examines interactions initiated by regular classroom teachers that involved individual and same-sex pairs of students. Since regular classroom teachers initiated these interactions, it can be assumed that student demand for their assistance was relatively low at the time and that they were comparatively free to interact with students of their choice. Note that there is a strong tendency for them to initiate interactions with boys rather than with girls ($Z = 2.00$, $p < .003$). In order to accurately interpret this finding, it is necessary to examine the interactive styles of teachers in light of their complementary roles in the lab.

Teacher Interactive Styles

Observations of computer lab interactions revealed that the lab teachers had different interactive styles which influenced classroom interaction. As can be seen in Table 12, Milena clearly spends the least amount of time in the lab interacting with students. The combined time she spends with students in the lab (44.9%) is about the same as the time she spends interacting with no one at all (40.9%). The following observation of Milena working with students in 4B, a class that meets from 1:50 P.M. to 3:10 P.M., is not uncommon.

> Milena began [the lab period] with a lecture. She explained that students could make cards for Father's Day or [they] could finish the projects they had [previously] started. She also said they could print out the cards at the end of class as long as they didn't try to do so at the same time . . . Milena left [the lab] right after the lecture. She certainly hasn't been in the lab much since I began my observations [of her lab periods]. She left at 2:05 P.M. and didn't return until 2:30 P.M.

Compared to other lab teachers, Milena also spends considerably more time interacting with the regular classroom teachers that assist her. Consider the observations of her talking with the teacher of 5E.

> Both [Milena and her regular classroom teacher] spend about twenty minutes talking with each other near [computer] #11. The class is comparatively quiet. Compared to other classes, the students call out "niña"[8] very infrequently.

[8] "Niña" (literally "girl") is used widely by Costa Rican students to address female primary school teachers. "Maestro" (teacher) or "Profesor" are used by students to refer to male primary school teachers. The analogous form, "niño" is not used.

Table 12. Cross-Tabulation, Allocation of Time by Lab Teacher

Individual(s)	Count / Col Pct	Lab Teachers: Milena	Grace	Ana Maria	Row Total
Girl		2 1.6	8 7.0	9 6.2	19 4.9
Boy		10 7.9	9 7.9	15 10.3	34 8.8
Girls		15 11.8	22 19.3	30 20.5	67 17.3
Boys		13 10.2	38 33.3	42 28.8	93 24.0
Girl and boy		2 1.6	6 5.3	1 .7	9 2.3
Mixed sex group		6 4.7	7 6.1	5 3.4	18 4.7
Whole class		9 7.1	7 6.1	32 21.9	48 12.4
Classroom teacher		13 10.2	3 2.6	3 2.1	19 4.9
Other		5 3.9	1 .9	2 1.4	8 2.1
No interaction		52 40.9	13 11.4	7 4.8	72 18.6
	Column Total	127	114	146	387 100.0

Number of Missing Observations: 1

Some of the time Milena spends with regular classroom teachers is devoted to planning lab activities. In addition, Milena was somewhat ill during a few of her lab periods and this accounted, in part, for her leaving the lab from time to time. However, Milena's time allocation is also consistent with her overall teaching strategy. She encourages students to work out problems on their own and explicitly discourages students from seeking her help for minor problems. One afternoon when Milena was finishing a brief lecture to students in 5B, it was noted that "Milena tells the students they should ask questions now if they have any. She

says they shouldn't ask her questions so frequently when they are working on their projects. Instead they should think for awhile." In contrast, Grace, and especially Ana Maria, are almost always engaged with students in the lab, lecturing, answering questions, and offering assistance.

Ana Maria differs from both Grace and Milena in that she spends much more of her time in the lab interacting with the class as a whole. Her greater emphasis on instruction to the entire class is partly due to the fact that many of her students are first graders. She evidently feels that they need more guidance than older students since they are being introduced to many programming commands for the very first time. The exercise Ana Maria used in 1A to introduce a new LOGO command was repeated in all of her first grade sections. It took approximately ten to fifteen minutes to complete.

> [At the beginning of the lab period, Ana Maria] asked for volunteers who weren't afraid to talk. Three boys and one girl [raised their hands]. She sought more girls but no more wanted to volunteer. She took the four students outside of the lab and put masks on them: a cat [mask, and masks representing] a dog, a duck, and a pig. When they returned to the lab they told the [other] students [in unison], "Good day. Tomorrow is a holiday." Then Ana Maria had [the class] guess who the students wearing the masks were. [Finally], Ana Maria told them that just as students can wear masks, so can the [LOGO] turtle be disguised. [The LOGO turtle is the default cursor symbol that students normally use to "draw" figures on the screen. This symbol can be "disguised," i.e., changed.]

Table 13 illustrates yet another difference in the interactive styles of the lab teachers. Of the three lab teachers, Ana Maria is by far the most likely to initiate interactions with students and other individuals in the lab. (Read across the "Lab Teacher" row.) Ana Maria typically moves quickly from one computer to another. Students are evidently accustomed to her high activity level since girls and boys also initiate a relatively large proportion of interactions with her.

Continuous monitoring of the lab showed that Grace tends to spend more time at each computer station than Ana Maria. She also tends to move in a very systematic way from one computer to an adjoining one rather than from one part of the lab to another. Consider the following observations of 6B, a group she has from 7:00 A.M. to 8:20 A.M.

> When 6B arrives, they recite the Lord's Prayer. There was a very short lecture (3 minutes) before the students took their seats at the computers . . . When students don't interrupt Grace, she tends to move from pair to adjacent pair [of students]. Often, she asks a student to give her his or her chair [so she may sit down in front of the computer]. She may be with a [student] pair [for] five to ten minutes [at a time].

Table 13. Cross-Tabulation, Initiator of Interaction by Lab Teacher

Individual(s)	Count / Col Pct	Lab Teachers: Milena	Grace	Ana Maria	Row Total
Girl		8 6.7	11 14.1	17 13.3	36 11.0
Boy		15 12.5	22 28.2	24 18.8	61 18.7
Lab teacher		36 30.0	29 37.2	75 58.6	140 42.9
Classroom teacher		7 5.8	3 3.8	4 3.1	14 4.3
Other		2 1.7	0 0.0	1 .8	3 .9
No interaction		52 43.3	13 16.7	7 5.5	72 22.1
	Column Total	120	78	128	326 100.0

Number of Missing Observations: 62

Despite their having different interactive styles, it is worth noting that: 1) boys initiate considerably more interactions with each of the three lab teachers than do girls, and 2) each lab teacher spends more time working with boys than with girls at their computers. The last point is clearly illustrated in Table 14. This table examines those cases where the lab teachers are interacting with individual or same-sex pairs of students.

Tables 15, 16, and 17 examine the interaction patterns of the regular classroom teachers who accompany each of the three lab teachers. Note that the regular classroom teachers who accompany Grace and Ana Maria allocate their time among boys and girls relatively equitably. This can be most clearly seen in Table 16. Thus, it can be concluded that the regular classroom teachers as a group are not biased in favor of assisting boys in the lab ($Z = 1.04$, *n.s.*), only Milena's teachers are ($Z = 2.11, p < .018$).

It should not come as a surprise that the way lab teachers allocate their time affects the way in which regular classroom teachers allocate theirs. For example, Table 15 shows that regular classroom teachers who accompany Ana Maria, the

Table 14. Cross-Tabulation, Allocation of Time to Individual and Same-Sex Pairs of Students by Lab Teacher

Individual(s)	Count / Col Pct	Lab Teachers: Milena	Grace	Ana Maria	Row Total
Girls		17 42.5	30 39.0	39 40.6	86 40.4
Boys		23 57.5	47 61.0	57 59.4	127 59.6
	Column Total	40 18.8	77 36.2	96 45.1	213 100.0

Number of Missing Observations: 0

most socially interactive lab teacher, spend the greatest amount of time (47.9%) interacting with no one at all in the lab. On the other hand, classroom teachers who accompany Milena, the least interactive lab teacher, are the most likely to be engaged with students in the lab. Thus, lab teachers and the regular classroom teachers who accompany them can be seen to be performing complementary roles in the lab.

There are additional examples of these teachers undertaking complementary roles. Table 17 shows that girls initiate nearly twice as many interactions with Grace's classroom teachers as do boys. It would appear that girls tend to seek out Grace's teachers for assistance rather than Grace herself. Girls rely upon a secondary teaching response because boys are much more likely to gain Grace's assistance. Boys initiate twice as many interactions with Grace as do girls (Table 13), and Grace spends a greater proportion of time interacting with boys than do the other two lab teachers (Table 14).

Table 17 also shows that Milena's classroom teachers use a greater proportion of their time in the lab initiating interactions (37.5%) than do Grace's (25%) and Ana Maria's (27.2%). This is to be expected in light of the fact that Milena is far less likely to initiate lab interactions than Grace and Ana Maria (see Table 13). In this case, however, the fact that lab and regular classroom teachers have complementary roles may have a less than desirable outcome. Note that girls and boys seek assistance from Milena's regular classroom teachers in equal proportion. Thus, the reason Milena's teachers are much more likely to assist boys is because they are more likely to initiate interactions with them. In the case of the boys, regular classroom teachers may be undermining Milena's strategy to have students resolve problems on their own.

Table 15. Cross-Tabulation, Allocation of Time by Classroom Teacher

Individual(s)	Count / Col Pct	Classroom Teachers Assisting: Milena	Grace	Ana Maria	Row Total
Girl		8 6.3	12 10.4	5 3.4	25 6.4
Boy		13 10.2	11 9.6	7 4.8	31 8.0
Girls		16 12.6	17 14.8	25 17.1	58 14.9
Boys		28 22.0	15 13.0	23 15.8	66 17.0
Girl and boy		6 4.7	2 1.7	2 1.4	10 2.6
Mixed sex group		2 1.6	8 7.0	4 2.7	14 43.6
Whole class		3 2.4	1 .9	1 .7	5 1.3
Lab teacher		13 10.2	3 2.6	3 2.1	19 4.9
Other		3 2.4	12 10.4	6 4.1	21 5.4
No interaction		35 27.6	34 29.6	70 47.9	139 35.8
	Column Total	127	115	146	388 100.0

Number of Missing Observations: 0

DISCUSSION

The main findings of this article are as follows. Teachers of both types, as a group, allocate more of their time to boys than to girls. However, lab and regular classroom teachers do so for different reasons. The primary reason lab teachers spend more time with boys is because boys seek them out much more frequently. Lab teachers initiate interactions with students of both sexes almost equally. The fact that regular classroom teachers allocate more time to boys occurs in part

Table 16. Cross-Tabulation, Allocation of Time to Individual and Same-Sex Pairs of Students by Classroom Teacher

Individual(s)	Count / Col Pct	Classroom Teachers Assisting: Milena	Grace	Ana Maria	Row Total
Girls		24 36.9	29 52.7	30 50.0	83 46.1
Boys		41 63.1	26 47.3	30 50.0	97 53.9
	Column Total	65 36.1	55 30.6	60 33.3	180 100.0

Number of Missing Observations: 0

Table 17. Cross-Tabulation, Initiator of Interaction by Classroom Teacher

Individual(s)	Count / Col Pct	Classroom Teachers Assisting: Milena	Grace	Ana Maria	Row Total
Girl		10 9.6	18 19.6	7 5.6	35 10.9
Boy		11 10.6	11 12.0	6 4.8	28 8.7
Lab teacher		9 8.7	0 0	3 2.4	12 3.7
Classroom teacher		39 37.5	23 25.0	34 27.2	96 29.9
Other		0 0	6 6.5	5 4.0	11 3.4
No interaction		35 33.7	34 37.0	70 56.0	139 43.3
	Column Total	104	92	125	321 100.0

Number of Missing Observations: 67

because one subgroup of teachers, those who accompany one particular lab instructor (Milena), initiate interactions much more frequently with boys. The regular classroom teachers who accompany Grace and Ana Maria allocate their time more equitably. Girls are somewhat more likely than boys to initiate interactions with regular classroom teachers as a group. This is because boys are monopolizing the primary teaching resource (lab teacher), leaving girls to seek assistance from the secondary resource (regular teacher).

Other results are that lab and regular classroom teachers perform complementary roles in the computer lab: 1) the more time lab teachers spend with students, the less time regular classroom teachers allocate to them, 2) the greater the frequency of lab teacher-initiated interactions with students, the lower the frequency of classroom teacher-initiated interactions, and 3) when boys initiate interactions more frequently with a lab teacher, girls initiate interactions more frequently with their regular classroom teachers.

The findings presented in this article have a number of implications. From a practical point of view, teachers working in computer labs should be made aware of the possibility that they may have a tendency to allocate more of their time to male than to female students. Although, as products of their cultures, some teachers may feel that this imbalance is appropriate, others may wish to divide their time more equitably. In any case, it is possible to increase contacts with girls without necessarily decreasing contacts with boys [99]. All of the teachers at Escuela Pérez spend a significant portion of their time in the lab interacting with no one at all. At least some of this time could be reallocated toward increasing contacts with girls. Also, receptive teachers could initiate more interactions with girls in situations where the student demand for assistance is low.

Regardless of the strategies that are implemented, teachers might consider monitoring their allocation of time to students in computer labs. Observations by an outsider would be the most effective in this regard, since Whyte [85] found that teachers' perceptions of their own classroom interactions are often unreliable. For example, in situations where girls are equally likely to speak up in class as boys, teachers often feel as if they are being unfair to boys.

Research results also have practical implications for team-taught classes. Members of teams should coordinate their activities if their goal is to promote equity in an effective manner. At Pérez, lab and regular classroom teachers play complementary roles. If lab teachers increased their contacts with girls, boys would probably increase their contacts with regular classroom teachers.

At the beginning of this article, it was argued that lab interactions are strongly influenced by gender-related stereotypes, attitudes, and roles found both at Escuela Pérez and in Costa Rican society more generally. Unless some change occurs, there is a strong likelihood that computer labs like Pérez's will play a role in helping to maintain and reproduce Costa Rica's gender status quo (see also [100, 101]). When fully implemented, Costa Rica's computerization program will reach one-third of this country's public school children. If the patterns found at

Pérez are common in Costa Rica, male students will be receiving much more computer-related instruction from teachers than girls. As a result, boys can be expected to gravitate toward educational programs in which knowledge of and training in computer applications are important: computer science, engineering, economics, business, the natural sciences, and educational administration. These are exactly the sorts of programs that will allow young Costa Rican men to attain influential positions in government, private enterprise, and universities. Since computer culture is remarkably similar throughout the world, this situation could also occur in many other locations.

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