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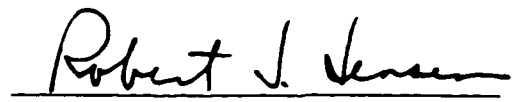
Academic Help Seeking and Peer Interactions
of High School Girls in Computer Science Classes

By

Paul S. Oberman
Master of Arts Degree

Division of Educational Studies



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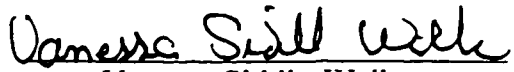

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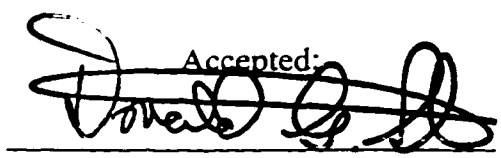

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Academic Help Seeking and Peer Interactions of High School Girls in Computer Science Classes

By

Paul S. Oberman
B.A., Drew University, 1988

Adviser: Robert Jensen, Ed.D.

An abstract of
A thesis submitted to the Faculty of the Division of
Educational Studies of Emory University in partial fulfillment of
the requirements for the degree of
Master of Arts

2000

Abstract

Through interviews and classroom observations, this study investigated the academic help-seeking and interactions of high school girls with their computer science classmates. This study investigated these behaviors in both a private school and a public school setting. The study explored six aspects of this help-seeking interaction: a) females as a gender minority in computer science, b) determinants of peer interaction, c) resolving conflicting solution approaches, d) teacher versus peer assistance, e) factors detracting from willingness to assist peers, and f) preference for group interaction. A key finding in this study was that physical proximity was an important determinant of help-seeking behaviors in a high school computer lab. Another finding was that girls in the sample studied often asked their peers for help even when they preferred the teacher's help and believed that the teacher was more knowledgeable. One particularly counter-intuitive finding in this study was that most girls preferred to work individually in a setting in which there was already substantial peer interaction. One implication of this study is that teachers should be wary of applying the general finding that girls prefer group work to every girl in the class and should instead respect the preference of the individual. If the findings obtained in this study are found in other settings, then a recommendation might be that in order to maximize help-seeking, talented programming students should be evenly distributed throughout the classroom.

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Statement of the Problem

The underrepresentation of girls and women in computer science classes, computer-related majors, and technological careers has been a concern since the origin of the field of computing (Bunderson & Christensen, 1995; Hoyles, 1988; Temple & Lips, 1989). Researchers have reported that females feel less comfortable with and seem to fear computers more than do males (e.g., Shashaani, 1997). Females have been described as less confident than men in dealing with computers, more anxious about computers, less excited about computers, and less eager to learn about computers than men (Colley, Gale, & Harris, 1994; Shashaani, 1997).

Evidence exists, however, suggesting that previous experience with computers partly accounts for these differences (Bunderson & Christensen, 1995; Miura, 1987; Shashaani, 1997; Wilder, Mackie, & Cooper, 1985; Yelland, 1995). Shashaani indicated that training and experience improved female attitudes, but warned that females must acquire this experience before they reach college. Miura noted in particular that completion of a high school computer programming course was the most important predictor of computer self-efficacy for females. Wilder, Mackie, and Cooper showed that, as opposed to more general introductory computer courses, only courses in which students learned a programming language increased females' sense of competence with computers.

This underrepresentation of females in computer science courses has been a concern for at least three reasons. One reason is the basic issue of fairness. Are high school girls avoiding computer science because they feel inadequate and unprepared or simply because they are attracted to other academic subjects (Temple & Lips, 1989)? If the former is the reality, then high school computer science programs may be systematically unfair to girls. The second concern is that for the United States to be competitive internationally, it should produce the finest computer science students it can of both genders. If girls are being denied representation in computer science fields, then the United States may not be as competitive internationally in this field as it could be because it is not tapping the intellectual resources of half the population. The third concern is that the female perspective may be notably absent in computer science classes. Without this perspective, we may be restricting the breadth of computer science understanding of all current computer science students. For example, an increased female presence in high school computer science classes could possibly shift the focus away from individual assignments towards group assignments; this is actually closer to the model employed by computer consultants in the field than the working-alone model is.

Because most classroom interactions take place among students rather than between a student and the teacher (Webb & Lewis, 1988), particularly in computer labs (Schofield, 1995), peer interaction in the computer science class has become an active area of research interest. Schofield in fact went so far as to distinguish between the classroom and the computer lab as two different learning environments. She claimed that students prefer the computer lab because of both a changed relationship with the teacher and a changed relationship with classmates. In the computer lab that Schofield observed,

teachers were less strict in enforcing rules that limited students' freedoms, such as staying in one's seat and not talking to peers. In her study, over 75% of students interviewed claimed that more peer help was evident in computer science classes than in other classes. The teacher was also frequently busy, so getting help from peers was an efficient method of problem solving.

Although a great deal of interaction exists among students in the computer lab, evidence suggests that females who learn programming have been less enthusiastic than males about the environment (Huber & Schofield, 1998). Furthermore, Schofield (1995) has suggested that because females anticipate being in the minority in a computer science class, they may be more reluctant to enroll in these courses.

Because teachers of computer science have often been busy helping individual students (Damon, 1984), much of the peer interaction that takes place has involved help-seeking behaviors among students themselves. Typically, females have been more likely than males to seek help (Nadler, 1991), and they chose peer helpers based on such factors as expertise, friendship, willingness to help, and gender (Nelson-Le Gall & Glor-Scheib, 1985; Newman, 1998). A distinction has also been made between instrumental help-seeking, in which a student has sought to acquire only the help necessary to proceed in solving the problem, and executive help-seeking, in which a student has attempted to have the problem completed by a helper (Nelson-Le Gall, 1981).

Traditionally, research on help-seeking has relied on students' self-reports. Motivation theorists have called for direct observation of classroom interactions and interviews of students to address the rich complexities of the classroom environment (Schunk, 1991). Following the line of inquiry on academic help-seeking established by

Nelson-Le Gall and Newman, and in keeping with the recommendations of motivation theorists, the present study used observations and interviews to investigate the academic help-seeking and peer interactions of girls in a computer science classroom. The purpose of the study was to discover the factors that influence how and why girls engage in academic help-seeking and interact with their classmates in high school computer science courses. For example, do girls in high school computer science classes ask questions of only their most capable classmates? Do girls in high school computer science classes prefer to work in groups, or do they prefer to work alone? Do these girls perceive a difference between the assistance given by the teacher and the help given by their peers? Not only might answers to these questions help guide researchers, but they might also assist classroom teachers in making educated choices in setting up their classrooms to encourage successful peer interaction.

Review of Literature

In seeking answers to the questions posed above, the literature must be gleaned from a number of areas. A plethora of research exists in such areas as females in computer science and resolving conflicting solution approaches, but considerably less direct data exists on the determinants of peer interaction and the factors detracting from a willingness to assist peers. There has also been some study of the style of teaching of both teachers and peers and students' preference for group interaction, but little in the area of computer science in particular.

Females as a Gender Minority in Computer Science

Researchers have determined that males are more likely than females to enroll in optional computer courses (Hoyles, 1988). Furthermore, activities such as programming

are frequently perceived as inappropriate for females because they are viewed as being in the male domain of math and science (Bunderson & Christensen, 1995; Hoyles, 1988). This may be one reason that males have more experience than females with computer science in particular (Temple & Lips, 1989). Collis (1985) pointed towards a fascinating perception of females concerning computer ability that is deemed the "We can but I can't" paradox. This is the belief that females in general are just as capable computer users as males, but that females view themselves individually as less capable with computers than males.

Schofield (1995) observed females in the second course of a sequence of two high school computer science courses. In each of the two classes she observed there were only two females. Only one of these four broke out of a pattern of social isolation, and none established any form of continuous working relationship with classmates. The two females in each class rarely spoke, on either a social level or as related to class projects. Schofield discovered continuous teasing of the females in one of these classes, which was serious enough to be labeled sexual harassment.

Resolving Conflicting Solution Approaches

Jean Piaget's model of peer learning stems from the idea of socio-cognitive conflict (Barbieri & Light, 1992). This is essentially the belief that when students have different opinions, this contradiction will push the students to restructure their understanding of the material in question. Researchers have suggested that peers may be a particularly good source for generating cognitive conflict for a number of reasons, including the easily understandable level of conversation and the directness of the exchange (Damon, 1984). Damon found that children learned the most when moderate

debate took place and when students supplied verbal explanations, rather than merely expressing disagreement. In this vein, Cronin (1989) suggested encouraging students to think out loud at the computer, so that other students in the group might successfully integrate these explanations into their own understanding of the problem being faced.

The importance of argument justification has found support in the literature (Jackson, 1994; Kumpulainen, 1996), although there is also some belief that disagreement in and of itself is an adequate source of cognitive conflict (Nelson & Aboud, 1985). There seems to be general acceptance of the concept that disagreement incites more change than does agreement (Nelson & Aboud, 1985).

Determinants of Peer Help-Seeking

In research that did not involve computers, a consistent finding in student group interactions has been that the most capable students give the most help to the members of their group (Webb, 1982). Less consistently, the least capable students seem to receive the most explanations from members of their group. In the studies reviewed by Webb, ability was measured either as general ability or mathematical ability. Schofield (1995) observed that on occasion less capable students helped their peers in the computer science classroom.

Aside from a peer's ability, another factor that may influence a student's choice of a classmate with whom to interact is the relationship of the students, particularly the friendship status (Barbieri & Light, 1992). Nelson and Aboud (1985) determined that when placed in pairs, friends tended to give more explanations to each other and to criticize each other more than non-friends did. Students also choose peer helpers based on

such factors as willingness to help and gender (Nelson-Le Gall & Glor-Scheib, 1985; Newman, 1998).

Schofield (1995) categorized two patterns of giving assistance in the computer science classrooms she observed. The first pattern was reciprocal help between friends. These friends were often of the same race and gender, and conversations between friends transitioned easily between socializing and working on the programming task. The second pattern was help given by one talented programming student to a wide variety of others. Often these helpers were known as "wizards," and they were almost always male.

Factors Detracting from Willingness to Assist Peers

Jackson (1994) noted that in his study of peer interaction some students within a group were torn between helping their partners and trying to achieve a high grade. He also noted that some of the weaker students actively tried to avoid their jobs within the group. Webb (1984) specifically organized groups in her study so that students of similar experience levels were placed together, because she feared that more experienced students would become frustrated with those of less expertise. She also suggested the possibility that students who asked for help were often interested only in completing the task rather than learning from the explanation. This would help to explain the negative correlation between "receiving an explanation" and "knowledge of basic commands."

Schofield (1995) noted that in her study teachers expressed disapproval of students doing the work for others. Students on the other hand were upset only if their programs were copied without permission or acknowledgment. If these conditions were met, however, students condoned the copying of portions of code.

Teacher Versus Peer Assistance

Researchers have suggested that for certain material students may be more effective than teachers in communicating with other students (Damon, 1984; Ellis & Rogoff, 1982; Webb & Lewis, 1988). According to Johnson and Johnson (1987), "the interaction that most influences students' performance in instructional situations is student-student interaction" (p. 2). This may be due to the use of a common language level and perspective, the directness of the approach, or because students working on the same problem may be more attuned to the difficulties of the project (Chandler, 1984; Damon, 1984; Ellis & Rogoff, 1982; Webb & Lewis, 1988). Sullivan and his followers also suggested that the sharing of ideas, the goal of consensus, and the willingness to compromise differentiate peer interaction from adult-child interaction (Damon, 1984).

Another important consideration is that as regards computers, teachers may not have the traditional edge in expertise over children (Light & Blaye, 1990). Furthermore, researchers have noted that peer collaboration frees the teacher of the demand to help a great number of students simultaneously (Damon, 1984; Diem, 1986). Certainly the report of children helping each other on the computer is a common one (Clements, 1987; Light & Blaye, 1990). Sheingold and others have indicated that computer science students in particular are likely to identify their classmates as potential helpers (as cited in Chandler, 1984). Schofield (1995) noted that students felt free to discuss and evaluate the help of peers. Some students preferred peer help to teacher assistance because they were able to understand a helper with a similar level of knowledge or manner of speaking.

Researchers have discovered differences between the teaching of adults and that of peers (Ellis & Rogoff, 1982). Students tend to help through demonstration and

modeling, whereas adults depend more on verbal instruction (Ellis & Rogoff; Webb & Lewis, 1988). Ellis and Rogoff also observed that in their study adults allowed for more learner participation than did peer instructors, and learners tested better when taught by adults than by peers. They suggested that the cognitive and social demands may have been too much for the peer instructors, and that the particular task taught may not have been a good match for the peer teaching style. Additionally, peer teachers focused more on actually completing the task than on the teaching of general rules.

Damon (1984) made a clear distinction between peer tutoring and peer collaboration. He suggested that peer tutoring is helpful for the transmission of information and that peer collaboration is more suited for intellectual discovery. Damon also advised that children should be of roughly the same age and ability level when engaged in peer collaboration. Other researchers have observed that in peer interactions, specific information is exchanged much more often than explanations (Webb, Ender, & Lewis, 1986). This specific planning is contrasted with the abstract planning promoted in interactions with the teacher. Webb and Lewis (1988) emphasized that student discussions of "chunks" of a program were of more learning value than discussions of a single line of code.

Preference for Group Interaction

Although males tend to prefer to work alone while programming, females seem to prefer collaboration (Barbieri & Light, 1992). Researchers have also noted that individuals in groups at a computer have consistently learned as much or more than individuals working alone (Barbieri & Light; Light & Blaye, 1990). However, Colbourn and Light (1987) have warned that in their research even children working alone on a

computer had access to other children and in fact talked almost as much as those working in groups of four. Diem (1986) concurred, observing students interacting immediately despite teacher insistence that students work alone. Diem suggested that students rely on each other more as the complexity of the assignment increases.

Bunderson and Christensen (1995) found that as classes at a university moved from lower level to higher level, students seemed to place more value on interacting with their peers. They also suggested that some females might not perceive computer science as being people-oriented. In fact 19% of former computer science majors in their study claimed that they had changed majors in order to pursue a major that was more people-oriented.

Sheingold and others have made clear that students are reluctant to work in a group with someone who might dominate the computer interaction, even if that student is quite knowledgeable (as cited in Chandler, 1984). Huber and Schofield (1998) observed that one student in a pair often controlled the keyboard. Jackson (1994) noticed tension within groups when more experienced computer users had exclusive use of the keyboard. Light and Blaye (1990) however have insisted that students do not seem to learn less because of reduced keyboard access.

Some teachers nevertheless seem to sense a certain difficulty with students working in pairs. In a study conducted by Huber and Schofield (1998), one of the observed teachers stated that the only pairs that functioned well were those pairs which were composed of friends. When the pairs were not friends, the teacher noticed that only one student of the two worked on the project.

Summary

Researchers have suggested that peer interaction and help-seeking behaviors in the classroom are complex phenomena. There is every indication that peer interaction and help-seeking are in fact increased in the computer lab. In this research study, there is less of a distinction between the classroom and the computer lab, because classes are held primarily in the computer lab. Thus the distinction might be one of merely classifying certain times as "lab times."

Because there is such a great deal of student interaction in the computer lab when students are learning computer science, there are many aspects of this interaction that beg further study. One of the less explored areas in the research, for example, has been ascertaining whether students would prefer to work on projects in a structured group or whether they would prefer to work alone, both within the confines of the substantial amount of interaction already taking place in the computer lab. Another limitation of the research is that most of the work on cognitive conflict has not been done in a naturalistic scenario, but rather in artificially paired groups of students (e.g., Barbieri & Light, 1992; Kumpulainen, 1996; Nelson & Aboud, 1985).

There has been much study concerning females in computing. However, many of the issues have not been examined in terms of effect on female students in particular. For example, of the research mentioned in this study on resolving conflicting solution approaches, only Barbieri and Light (1992) explicitly separated gender as a variable. Perhaps something of value can come of determining why females ask particular classmates for help. For example, it is possible that a simple change in the physical classroom setup might increase female enrollment.

This research was undertaken to extend the research on the naturalistic computer science classroom, with a particular focus on female participation. To accomplish this goal, I examined the following questions:

Research Questions

Research Question 1: How do girls in selected high school computer science classrooms respond to being in the gender minority in the classroom?

Research Question 2: How do girls in selected high school computer science classrooms resolve conflicting solution approaches?

Research Question 3: Which peers do girls in selected high school computer science classrooms ask for help, and why?

Research Question 4: What reasons (if any) do these girls provide for not giving help to classmates seeking their assistance?

Research Question 5: Do these girls see a distinction between peer help and teacher help, and if so which do they prefer?

Research Question 6: Would these girls prefer to work alone or in traditional groups, with the classroom environment held constant?

Methodology

Yin (1993) suggested that qualitative study is particularly appropriate when the event being examined is intertwined with its context and when "how" and "why" questions are being investigated. McCracken (1988) suggested that an interview can help the researcher to enter the "mental world of the individual . . . to see and experience the world as they do themselves." The intent of this study was to discover the factors that influence how and why girls engage in academic help-seeking and interact with their

classmates in high school computer science courses. Therefore qualitative methodology is appropriate for this study.

Participants and Setting

School A was a 1000 student Catholic school in the southeastern United States. This school was composed of grades 7 through 12. School A was primarily a sample of convenience, as I was a computer teacher at this school from 1994–1998. Thus the setting and many of the students and faculty were familiar to me, and access was facilitated by these connections.

School B was an ethnically diverse 1100 student public school. The school, also in the southeastern United States, was composed of grades 9 through 12. School B was purposefully selected based on the fact that it is an ethnically diverse public school whose students generally come from a lower socioeconomic status than the students at School A, and also on the basis of a classroom visit, which confirmed that the functioning of the class was similar in many ways to that at School A.

Certain distinctions set apart the "average" classroom from the computer labs in which the computer courses were taught at School A. First, there were three contiguous computer labs that were all connected by doorways. The labs on the ends were used for computer classes, and the lab in the middle was used by any teacher in the school, on a signup basis. Each lab was set up in three clusters of eight computers. Each cluster was composed of two connected rows of four computers each, making a total of 24 computers per classroom. Each classroom also had a SmartBoard, a device that allowed the projection of a computer screen onto a larger surface so that the entire class could see the screen. Finally, across the entire top half of the back of the lab was a wall of windows,

which meant that the other two computer labs were always visible from the lab in which the class was being taught. There were two printers in each of the computer labs.

The computer lab at School B was set up in four rows of between seven and nine computers each. The outer two rows faced the walls, and the inner two rows faced each other. There was a whiteboard at the front of the classroom, and the only entrance was also at the front of the classroom. The two printers were at the front of the classroom.

There were a total of five girls in all of the computer science classes at School A. All of them participated in my study, and they were all given pseudonyms to protect their anonymity. They were enrolled in four different computer science classes, each taught by the same male teacher (see Tables 1 and 2). This teacher was 31 years old, married, tall, athletic, and in his eighth year of teaching.

There were a total of 20 girls in all of the computer science classes at School B. The parents of two of the girls enrolled in the introductory classes declined to sign permission forms granting me interview access. All of the girls were given pseudonyms to protect their anonymity. These 20 girls were enrolled in three computer science classes, all taught by the same teacher (see Tables 1 and 2). This teacher was 31 years old, married, and in his ninth year of teaching. He had a ponytail and often discussed computer games with his students.

Data Collection

I observed each of the seven computer science classes (see Table 1) on four occasions, for a total of 28 hours of classroom observations. Each observation lasted the duration of the class period, and detailed field notes were taken on the behavior of female class members. Field notes were coded inductively, consistent with the recommendation

of Yin (1993). As Merriam (1998) suggested, these observations allowed me to observe occurrences that participants no longer noticed. These observations also allowed me to understand the context, and provided me with refined, probing interview questions. Observations also allowed participants to become more familiar with me, and gave them time to return the interview permission form. Finally, observations allowed me to triangulate interview findings. Observations spanned a period of one month and were approximately weekly, beginning with the second week of school. I intentionally visited classes on different days of the week, so that I would not merely see typical behaviors for any one day of the week.

Each of the females in all of the fall term computer science classes, and a parent or legal guardian, were asked to sign an informed consent form (see Appendix B) to grant an interview. Each of the females was then interviewed over a three week period, using the attached interview guide (see Appendix A), in a semi-structured interview format. As Merriam (1998) explained, the semi-structured interview focuses on issues without being restrained by an exact, predetermined order of questions or specific wording of questions. Merriam indicated that "this format allows the researcher to respond to the situation at hand, to the emerging worldview of the respondent, and to new ideas on the topic" (p. 74).

The interview guide was developed by reading the literature on peer interaction and academic help-seeking, especially as it relates to computer classes, and by classroom observations, including those of an introductory programming class at School A done during a pilot study in early 1999. Broad categories emerging from these two sources were (a) giving and receiving help from classmates, (b) choosing with whom to interact,

and (c) preference for interaction. Attempts were also made to formulate the questions into the four major categories suggested by Merriam (1998): hypothetical, devil's advocate, ideal position, and interpretive questions. Every effort was also made to avoid the types of questions that Merriam warned interviewers to shun: leading questions, multiple questions in a single interrogative, and yes-or-no questions. Fellow doctoral students examined the interview guide, and the guide was piloted using one fellow student as a sample subject. This followed the suggestion of Merriam, who strongly encouraged researchers to conduct a pilot interview to experiment with the effectiveness of the questions. Much of this guide was also given a trial run during my pilot study in the spring of 1999. Finally, members of my thesis committee validated the content of my interview guide.

Data Analysis

After each observation, I typed my research notes and saved them in a word processor. While examining the printouts, I made handwritten notes, which suggested certain categories of repeated observations. As Merriam (1998) explained, when short descriptors are assigned to these data, these descriptors are codes. The aforementioned categories were assigned codes, some of which remained stable from the pilot study done in early 1999. Finally I used Ethnograph 5.0 to code the data categories and to easily locate supporting passages for each code. Appendix C contains both code definitions for my observations and one coded observation.

After each interview, I paid undergraduates to transcribe the interview tapes. I then listened to the tapes myself, to ensure accuracy, and made changes when necessary. During my pilot study in the fall of 1999, all coding was done inductively. In the present

study, the second level codes (Miles & Huberman, 1994) were retained, and data relating to these themes were coded based on the interview data themselves. Appendix D contains interview codes and one coded interview. One fellow doctoral student coded a single interview data file, and an undergraduate student coded two interview data files, to measure inter-rater reliability. As a training procedure, the undergraduate student and I practiced coding and discussed differences. The undergraduate student and I had 87% and 89% agreement on our coding of respective data files. The fellow doctoral student and I had 80% agreement on our coding despite not coding a practice interview together or training her for any substantial length of time.

Reliability and Validity

Because it is impossible to exactly duplicate a qualitative study, reliability and validity are particularly critical issues in this study (McCracken, 1988). Therefore the following attempts were made to ensure that my results are both reliable and valid. I attempted to triangulate the findings from my observations and interviews, cross-checking them to ensure that the results were reasonable from both sources of evidence (Merriam, 1998). Including more than one case also contributed to the external validity of this study. As mentioned above, my codes produced high inter-coder reliability. I also included member checks, asking both teachers and one student from each school to confirm the accuracy of my observations and the reasonableness of my interpretations (Yin, 1993). My biases and assumptions will be made clear in the following subsection. Finally, during my study I kept a detailed research log of how data were collected, how codes emerged, and how decisions were made in order to maintain the chain of evidence (Yin, 1993).

Researcher Perspective and Bias

As a former computer science teacher of nine years, I entered this study with certain biases and a definite perspective. I felt confident, for example, that students were capable of helping each other. I also believed that in a computer science class setting, peer help would often be required, as the teacher cannot possibly help all students simultaneously. However, I also held a firm belief that there was a distinction between aiding fellow students and doing the work for a peer. Thus I was inclined to listen carefully to student conversations to ascertain which of these situations was occurring when students were discussing a project.

I also believed that females were at least as capable as males in the area of computer science. Having taught exceptionally talented females and having worked with outstanding female programmers left me dismayed at the proportional underenrollment of females in computer science. One of the motivating factors behind this study was the perplexing consistency with which the computer science classes I taught had been overwhelmingly male-dominated.

Researcher bias was also evident in the fact that I knew several of the students involved in the study at School A, and was therefore familiar with their strengths and weaknesses. I was also familiar with the structure of the computer science courses at School A, as the current computer science teacher adopted much of my syllabus. In order to account for my relative closeness to School A, I visited School B in the Spring of 1999 in order to gain some familiarity with the school and the students and also to let the students become familiar with me. During this visit I also helped some of the students

with their computer science work. In fact two of the girls in the study remembered my visit from the previous school year.

Limitations and Assumptions

Because this was a qualitative study, the results cannot be generalized to the population. However, instead of hypothesis testing, hypotheses may be generated (Merriam, 1998). Furthermore, by supplying rich, thick description, this study allows for reader or user generalizability, which Merriam described as allowing others to decide how well this study applies to their particular scenario. My study assumes that the classes I visited were typical classes that were not particularly influenced by my visits. I also must assume for this study that the participants gave me authentic data during interviews. The interviews were certainly influenced by the fact that I am male and the students interviewed were all female.

Results

A pilot study was conducted at School A during the winter and spring of 1999. Eight girls participated in this study. Results of this pilot study suggested that students generally chose peer helpers based on proximity, knowledge, and friendship. Furthermore in this study girls claimed to prefer the teacher's instrumental help-giving rather than their peers' executive help-giving. Some of the girls in this study preferred to work in groups, while others preferred to work alone.

Context

At School A, all students were required to take a keyboarding class and a computer applications class; any computer science classes students took after these two courses were optional. At School B students were required to take a single computer

class, either keyboarding or beginning programming; any further computer science courses were optional. This distinction in requirements may have affected the results, because the students at School A had more experience with computers in the classroom upon entering the introductory computer science course.

A typical class period at School A began with a lecture by the teacher, followed by a period of student programming. The lecture portion of the class spanned anywhere from 5 minutes up to 50 minutes of the 55 minute class. Typically the lecture portion was under 20 minutes. Towards the end of the trimester, the students programmed for the entire class period with no lecture from the teacher. Students were allowed to choose their own seats daily.

A typical class period at School B began with the teacher addressing the students in the classroom across the hall from the computer lab. The teacher generally took roll or gave a brief lecture before escorting the students across the hall to the computer lab, where they would program for the remainder of the class period. On one occasion (during a time when I was at the school for an interview) I observed that the teacher lectured in the classroom for the entire period. There were instances when another class of students shared the computer lab with the computer science class. In those instances two or more computer science students sometimes shared a single computer. This was rare though, based on comments by the teacher and the students. The students were allowed to choose their own seats at the beginning of the class, but were then encouraged to stay in that seat because their programs were saved on that particular computer's hard drive.

At both schools, the period of student programming following the teacher's lecture was characterized by two defining features. The first feature was that the teacher

at each school moved among the students, offering help to students whose hands were raised or who asked for help as the teacher walked by. Typically the teacher at School B spent longer with each student, sometimes even sitting down in their seats. He was also more preoccupied with solving any hardware problems, sometimes spending as long as 16 minutes fixing a single computer hardware problem. The second defining feature in both schools was that students generally talked quietly among themselves, asking each other questions about their computer projects and sometimes just socializing. Because they realized that they could not spend time helping every student to the extent that each student desired, both teachers encouraged students to help each other. School B tended to have a noisier computer lab than School A did, partly due to the relaxed style of the teacher and partly due to the sheer number of students.

It should be noted that the culture of the classroom at both schools allowed for students to get out of their seats to seek help from classmates or just to socialize as long as the conversation did not get too loud. There were instances in each of the seven classes in which students walked across the room to get assistance from another student, to pick up a printout, or just to talk to a friend. At no time during my 28 hours of observations did I hear a teacher reprimand a student for standing up or getting out of her seat.

The classes at School A tended to move at a faster pace than the classes at School B. This was partially attributable to the fact that classes at School A were smaller and the teacher was able to spend more time clarifying issues individually with each student. Another reason for the difference in speed of coverage was that the teacher at School A merely collected the homework and graded it outside of class, while the teacher at School B went to every student's computer during class time to grade each student's program.

This entailed the teacher running the student's program, filling in a sheet of seven yes/no questions, and then assigning the student a grade. Because this was so time-consuming with so many students, there were entire days at School B during which nothing new was taught. On October 6, 1999, for example, the teacher told the introductory class to "find something to amuse yourself" while he graded student programs throughout the entire class period.

The tests given at each school also seemed to reflect different goals for the class. At School A, the tests primarily required students to write programs. At School B, the tests were primarily fill-in-the-blank and matching questions designed to explore computer knowledge in general, and then students were asked to write a single computer program. This may have been related to the school requirements for computer classes. The teacher at School B may have been attempting to give his pupils more of an overview of computers rather than merely teach them how to program, whereas this was not a need at School A.

At School A, the teacher used the whiteboard to lecture at the beginning of class and depended heavily on student participation, sometimes getting frustrated if he did not receive it. The discussions generally revolved around what the students were trying to do by writing a particular program, and only occasionally revolved around a new command. The teacher at School B had students copy notes word for word which he projected from an overhead transparency. These notes were almost exclusively devoted to syntax, and there was no discussion of the notes. Instead the teacher read the notes aloud to the students to be sure that the written words were clear.

Finally, another difference in the teaching between School A and School B was that the teacher at School A would sometimes stop the entire class during programming time if the same question was being asked of him repeatedly. He would then discuss the problem, using the whiteboard, with the entire class. After about a month of school, the teacher at School A started to insist that the students flowchart their programs before writing them, and would sometimes check to see if they had done so before answering their questions. At School B the teacher would not stop class if he was asked the same question repeatedly; instead he would patiently continue to help each person individually.

Certain trends emerged from the observations and interviews conducted over the two month period of the present study, as codes were repeatedly used. The six overall themes were (a) reaction to being in the gender minority (b) resolving conflicting solution approaches, (c) determinants of peer interaction, (d) factors detracting from willingness to help peers, (e) teacher versus peer assistance, and (f) preference for group interaction.

How do these girls respond to being in the gender minority in the classroom?

The girls in this study were generally aware of their status as a gender minority in the classroom. About half of the participants said they wished there were more girls in their classes, but the other half claimed to be comfortable with the gender mix. More girls made negative statements about their gender's involvement in computer science than made positive statements. Nevertheless, almost all of the girls in this study were accepted socially in the classroom, and many had partners with whom they worked regularly on programming assignments.

In a classroom observation on September 7, Kally (the only girl in her Advanced Placement computer science class) walked into the introductory class at School A that

had only one enrolled girl. Kally asked Bobbie somewhat sarcastically, "don't you like being the only girl?" Bobbie responded, "The first day when I walked in I kept looking around. I couldn't believe I was the only one." Kally countered, "I'm the only one in AP but I expected that. Only dorks take AP" (sarcastically, for the benefit of the teacher standing nearby). Most of the girls were aware of their status as a gender minority in the classroom and could fairly accurately state the number of girls in the class. The only exception was the introductory class at School B with almost half female enrollment.

In observations at School B there were instances of two girls regularly working together (Sandy and Noreen), three girls regularly working together (Mary, Selena, and Nancy), one girl regularly working with two boys (Erin), and one girl regularly working with one boy (Rashaun, Stephanie). The only girl who seemed somewhat isolated socially was Martina, and this appeared to be due more to her language skills and her late arrival into the school and the class than to her gender. At School A the two girls in the only class with more than one girl did not work together as regular partners. However, none of the five girls at School A was socially isolated, and all had peers available whom they asked for assistance. Sabrina and Vanessa both had regular partners with whom they worked on their projects.

The class with the largest female representation was the introductory class at School B, with 11 girls out of 25. This class was also described by the teacher as the weakest of his classes. On September 13 he remarked to me "This is going to be interesting. This many people, this clueless." This class was also the loudest of all of the classes, although this was probably partially attributable to its size and the disciplinary

style of the teacher, because the other class that was frequently loud was the other large introductory class at School B.

Eleven of the girls in this study said that they wished there were more girls in their classes. Jocelyn was one of two girls to cite an instance of a boy specifically picking on a girl. She explained, "if you have fewer girls they can make fun of the girls and stuff like Brian makes fun of someone I don't know her name...." She speculated that it might not specifically be harassment based on gender though, saying that "they probably have some classes with her and they just say funny things about her." Vanessa admitted that "the guys sometimes tease me ...[because] I'm the only person who reads the book in that class and so they tease me, just kind of boy-girl teasing. Nothing major, just, I don't know." Lilly mentioned that when she first started taking computer science, "I used to be kind of like, you know, like 'There's all guys, what am I going to do?'" She said that "I was kind of scared being one of a few women in that field, but now you just go with it." Stephanie concurred and gave a very similar story of adapting over time.

> You feel kinda alone in there...I commented to [the teacher] at the beginning of the year..."dang, only two girls in the class and both of us are Oriental females."...and so we feel kinda out of place, and [the teacher] talked to us, he told us, "get used to it. This is what the real world situation is like."...[Now] I've been used to it.

It seems possible that some of these girls may have just gotten "used to it" and therefore might not even pay much attention to boy-girl teasing in computer science classes.

Most of the girls who wanted an increased female presence claimed to want an even gender balance. Darné said that with an even gender balance "you wouldn't feel so out of place.... [It's an] awkward situation because all the guys talk about all their video games and stuff and I'm just like 'I really don't care.'" Sabrina explained that "guys are

more likely to yell out, and try to top each other for answers and stuff, and they might—and sometimes a lot of times they'll just pretend like they know what's going on, even if they don't. And so I think we need more girls in the class, to even out the ideas." Sabrina went on to explain the issue in terms of fairness, stating that "I just think it should be normal to have half girls and half guys in all the classes. It should be, like, even in the school. They try to take half the population of the school girls and half guys, so I think it should be the same for the classes."

Only two of the girls in the class with 11 girls enrolled wished they had more female students in their class (20% of those interviewed). On the other hand, 9 of the remaining 13 girls interviewed (69%) wished they had more girls in their classes. This is not particularly surprising given the fact that the girls' status as a gender minority was much clearer in classes with very few girls enrolled. All five of the girls in the non-introductory classes wished for an increased female presence, which is again not surprising because these classes had among the fewest girls enrolled. For the same reason, four out of five girls enrolled at School A expressed a desire for more girls in their class. Interestingly, only 1 out of 7 African American girls expressed a desire for more girls in the classroom, whereas 10 out of the other 16 girls wished they had more female students in the classroom.

Both sophomores in this study wished for more girls in their class; part of the reason for this may have been that these two girls were also among the youngest in the class and may have been seeking increased comfort level in any way possible. Finally, all three Vietnamese girls in this study wished for more girls in their classes. Included in this group of three was one of the girls in the class with the largest representation of girls.

They may have also been looking for an increased comfort level in the computer science class. As noted in Stephanie's comment above about "Oriental females," these students seemed very aware of their status as double minorities.

Twelve of the girls in this study, including all three girls who were the only female representatives in the class, claimed that they were okay with the number of girls in the class. Vanessa claimed, "It's kind of fun being the only girl. I don't feel intimidated at all. Maybe two other girls would be nice, but I really have no problem with it." She went so far as to say, "they don't see me as a girl." Kally denied being harassed based on her gender, and claimed, "they don't give me any crud about it, and you know, nothing like that...." She went on to suggest in fact that "one reason why I do like having all guys in the class [is] just because guys don't judge you if you say—if you do something different. You know, you can be totally yourself.... They don't care. They don't notice anything that you do anyway. So if you say something stupid they'll laugh and they'll be like 'so where are you going tonight?'.... A girl would be like 'oh my G-d, oh my G-d, I can't believe you did that!"

Sandy and Robin were the only two girls to suggest the possibility of having more girls than boys in the class. Sandy claimed that in a class of 25 she would want "most of them" to be girls, but could not explain why. She did say that "more girls in the class is more comfortable...and I don't like, you know, boys. And sometimes you just walk...in, and they're just looking around and you don't feel good about it." Sandy also claimed that hers was a general preference for fewer boys in every class. Robin said that as far as she was concerned "the whole class could be girls." She later clarified that she was also interested in having more friends specifically in the class, and most of her friends

happened to be girls, so that was what she had envisioned. Stephanie clarified this succinctly: "I really interact the same with both [boys and girls] because they're just sort of distant friends and not among my really close knit friends." Bobbie agreed, saying, "I think it's funner having a friend or two no matter if they're a girl or a boy in the class."

Six girls in this study made comments about girls that were not particularly positive. Erin for example stated that she would prefer fewer girls in the class because "they don't seem to really know what's going on.... They're always asking Gene [for help] too." Nancy also claimed that "I have found that most of the girls really don't really know how to do this stuff.... I am one of the few ones that can actually pretty much do this on my own to an extent, and I have to help with all the other girls." She also pointed out that "everybody I said that I go to for help, all of those are guys." Sabrina believed that "maybe it's more of a boy's class or something, and [girls would] rather go take aerobics...more girls should take the class." The other three girls believed that girls were more likely to chat during class time, generally on topics other than the class itself. For example, Jocelyn insisted that "if you have too many girls, then there would be a lot of talking about fashion and other things, and you don't get anything done." She characterized the primary difference in a class with more girls as "more talking and more grooming themselves." Vanessa disputed this characterization, claiming that with more girls in the class "the class would probably be a lot quieter just because, I feel comfortable raising my hand but other girls might not.... So you might get the little shyness thing goin' on there."

On the other hand, three girls made statements regarding the fact that girls were just as capable or more capable than boys. Jocelyn said that she believed that "girls are

smarter so if you have like a lot of girls in the class then competition will be really high, but with guys, you kind of just do anything and you get an A, so it's not much competition." Robin seemed to concur, explaining that with more girls "I believe there would be a lot of competition in the class...and I believe I would learn more if there were more girls in my class." Melony claimed that some of the best programmers in the class were girls, and maintained that "[the girls] know what we're doing, so far. And, you know. I would get done before someone else would—a boy. So...I think the girls are turning out to be better than some of the boys."

It was clear in observations that many of the classes had either one individual or a group of students who were considered to be the class experts. Sometimes other students would ask the expert student to come help them, even waiting their turn for this expert advice. Only Rashaun referred to this group of expert students explicitly, calling them "brainiacs." She stated, however, that "I kinda feel like 'oh no I can't ask them [questions].'...I kind of feel like they're on a whole 'nuther level." Rashaun proceeded to say that "I made the mistake, well not the mistake, but I asked the question and he went on and on and on and I was just like 'Mark, never mind, I don't understand anything you're saying.'" She clearly was intimidated to ask these "brainiacs" for help although they were an acknowledged source of expert student advice. When asked if there were any female "brainiacs," though, Rashaun replied, "No. Well Stephanie is, Stephanie is, yeah." She later clarified that friends were not included in this "brainiac" category, and she and Stephanie were friends. Therefore Rashaun really was referring to non-friend experts when she characterized "brainiacs."

Two girls made interview statements that made it appear that they believed they were representing all girls. Kally explained that "...if I'm behind the entire class I feel really inferior because I'm the only girl! And I'm the slowest girl, or whatever. It would be different if there were other girls with me...." Melony explained the stereotypical beliefs about gender and computer science, then explained her case for an increased female presence in the classroom.

> For some reason I have this idea that more boys are used to computers. That they use computers more than girls, and...I haven't had that image of girls being in computer science or anything. But I [would] like 11 or 12 [girls in the class] because they're good numbers.... It's about half. And that keeps an even shot for the people who think that girls can't do it.

In addition, in a classroom observation on September 17, Vanessa asked her male partner, "why am I like the dumbest person in the class?" These statements seem to imply that gender stereotypes were well-known to these two girls.

Although the girls in these two schools were generally aware of their status as a gender minority in the class, most of them were nevertheless able to successfully integrate themselves into the working environment of the classroom. Some of the girls believed that friendship was actually a more important relationship for them than gender in the computer science classroom. Many of the girls in this study seemed aware of the stereotyping involving female students in the computer science environment.

How do girls in selected high school computer science classrooms resolve conflicting solution approaches?

Observations and interviews suggested that when students disagreed with peer help, the most likely response was to ask another peer or the teacher to help resolve the disagreement. In interviews a few of the girls claimed that they might not be

knowledgeable enough about the substance of the solution to disagree with any help they were offered. For example Nancy claimed that "I wouldn't not agree with [another student's] answer because I don't know what I'm doing. I'm not going to tell them they're wrong." Other girls insisted that they would try the proposed solution or engage in a discussion with the student helper, either in place of or in addition to asking another person for help. Observations at both schools confirmed that each of these approaches was being employed.

Twenty of the girls in this study claimed that part of their strategy for resolving conflicting solution approaches involved asking either another student or the teacher for help. For some of these girls their entire strategy to resolve the disagreement revolved around asking for another opinion. For other girls, asking for a second opinion was merely a part of their strategy, and then it was usually not the first alternative. Nine girls stated that they would specifically involve the teacher, five girls implied that they would specifically involve another student, and six girls claimed that they would get another opinion from either the teacher or their classmates.

Selena's response to a potential disagreement with a student helper was cut and dried: "Go to the teacher." She later elaborated to say that "Even if I—if I don't agree or if I have doubts, first thing I would do is go to the teacher." Sandy stated that "I usually ask the teacher to make sure that I understand it...." Nancy claimed that "sometimes...we just argue with each other 'til we're just completely lost and I just ask [the teacher] for help."

When these girls did not specifically refer to asking the teacher to resolve their dispute, they were referring to their classmates. For example, when Noreen claimed that

she would "wait and like, ask somebody else," she was implying that she would ask a classmate to help settle the disagreement. Robin agreed that she would "go to someone else." Sabrina said she would "ask somebody else...and if you don't agree with them, just ask someone else and see if they agree with you. If not, take the advice that most people give."

Among the six girls who did specify to whom they would turn for a second opinion, Vanessa's response to disagreeing with a student helper was that "I would generally go to ask my teacher.... Or maybe ask another person to join the conversation with you." Bobbie stated that she would ask "'Are you sure you do it that way' and then if they're like 'I think so' then either ask somebody else or ask the teacher." Allison concurred that "I guess I would ask [the teacher] or someone else that could put it in simpler terms so I could understand."

Four girls stated that they would first try the proposed solution. Most of these girls implied that if the solution did not work, they would then involve another student or the teacher. Erin simply said, "I guess try [the proposed solution]. Doesn't hurt. And then I'd ask [the teacher]." Janene explained, "If it's wrong it just won't work at all on the computer and there's no debate about it." Paula maintained that "I pretty much go by their opinion, because if they know better than I do, most likely... chances are their answer is going to be more accurate than mine." Kally also claimed that she would try the solution, but only after a debate with her classmate.

Eleven of the girls stated that they had engaged in discussions with their classmates when they disagreed with the help they received. Ten of them claimed that they learned something from the conversation. Mary, who debated such items as "single

quotes and quotes, where they go" denied learning anything from the conversation, but all of the others believed that they had learned. Bobbie described a conversation in which "you go back and forth until you...either convince the other person or the other person convinces you and if you can't reach—hit a stalemate, then you ask the teacher I guess." Kally also described this scenario but added the possibility of trying the solution before asking the teacher. Darné believed that in her debates "they can make a point and then you'll realize, oh, that's probably a much better reason...." Sabrina stated that "you can actually save time and code and make it clearer if you have discussions."

Included in those who believed they had learned from discussions were three out of the four AP students in this study, and four out of the five students who were not in an introductory class. This is in sharp contrast to the 6 out of 18 students in the introductory class who engaged in such discussions. Perhaps these girls learned over time that this was a successful method of learning, or possibly the girls who learned that lesson were likely to persevere in computer science. In addition, four out of the five girls at School A claimed to have learned from discussions with peers, suggesting that the teacher may have encouraged this method in some way.

In summary, when these girls disagreed with peer help they responded in a number of ways. Most commonly, they asked someone else for help, at least as part of the solution. Other responses included trying the suggested solution and engaging in a discussion with the peer helper. Almost every girl who had engaged in a discussion with her peer helper believed that she had learned something from the discussion.

Which peers do girls in selected high school computer science classrooms ask for help, and why?

Observations and interviews suggested that there were a number of factors that determined from which classmate a student requested help. These factors included friendship status, knowledge of computer science, gender, willingness to help, proximity in the classroom, similar working paces, similarity of projects, and common spoken language. Table 3 indicates whether each girl in this study cited a given determinant of peer interaction as being important in her interview.

As can be seen in Table 3, every girl in both schools who asked for peer help cited proximity as important in determining from which peer she would seek help. Every girl except Amanda also cited knowledge as being important, and Amanda stated during her interview "of course everybody is smart" and doubted that she would be asked for help by classmates because "I don't know much about this class." Hence, Amanda thought that anyone she asked for help would be more knowledgeable than she was. Lilly, described by her teacher at School B as "very bright" and "in the gifted program," was the only girl who claimed to have never asked a peer for assistance. This was confirmed by class observations, during which time I witnessed Lilly being asked many questions by her classmates, but never asking her peers for assistance in return.

Erin claimed that her first reaction upon encountering difficulty was "I just ask the person beside me." Sandy explained, "I mean, usually I look around and I see the people behind me or around me, and if they know how to do it, I just go ahead and ask for it...." When asked how she selected which peers to ask for help, Jocelyn replied, "Because she sits next to me and she's close and so I don't have to yell and walk all the

way to go to Jim and ask him." Kally definitively explained her views on whom to ask for help.

> Interviewer: Which student do you ask second for help?
>
> Kally: The person on the other side [of me] (laughing). If there's only one—like if I'm sitting on the edge when there's only one person there, I'll ask that person, and then if they don't know, then I'll turn my chair around and ask the person behind me. Something like that. You know. It's no big thing, but normally I ask anyone close to me.

Most of the girls in this study were not as able to clearly articulate their help-seeking strategies. Rashaun was similarly explicit in her explanation.

> I usually ask Ben. I usually ask Ben because Ben's the closest one to me. If Ben doesn't understand then, you know, I just go to the next closest person, which is Al on the other end. If Al doesn't understand, I have to get up and go across the room and say, "Hey, Jay or Mike" or one of them.

I observed numerous instances during classroom observations of students turning to their neighbors for help; it was much more rare to see students walking across the classroom for help, although it did occur in each of the seven classes I observed. The level of the class did not seem to influence the girls' decision whether or not to walk across the classroom for help.

Knowledge was also an important factor for these girls in deciding whom to ask for help. Vanessa claimed that the primary quality she was seeking in a peer helper was "if they know what they're doing. We have a couple people who don't know what they're doing, so it's generally not very helpful to ask them." Selena explained her choice of one student helper over another by explaining "she's more familiar with it and she knows what she's doing." Melony described her first choice in peer helper as "one of those people who went out and bought computer programming books and actually does this at

home for fun." Again, classroom observations confirmed that in many of these classrooms there were acknowledged experts to whom many questions were directed.

Because the pilot study made it clear that both knowledge and proximity were important, I designed interview questions to determine their importance relative to each other. The first question designed to aid in this clarification was: "How did you choose where to sit?" Possibly these girls could have chosen to sit by classmates they knew in advance to be good with computers, in which case proximity would naturally be the result, but knowledge would have been the primary instigation in their choice of peer helpers. For example Erin claimed, "I definitely wanted to sit by him more because he knew more about computers than anything else." Rashaun explained that she chose her seat because "we're all sitting together because we were the ones who took the class last year...[we're] all working together like 'okay, we can help each other.'" Melony stated that she sat at a computer "so I had two people right next to me that could help.... I sat by my friends, and they sit by people who know what they're doing." Only four girls said that they explicitly chose to sit near someone they knew was good at computer science.

The second question designed to clarify the relative importance of proximity and knowledge was: "If the [person mentioned as the first person to ask for help] were sitting across the classroom, would you still ask that person for help?" Approximately half of the students said that they would not make that effort. Bobbie, one of the girls who said she would walk across the classroom to ask a knowledgeable helper, still maintained that she would only ask him after first asking her neighbors. Erin said that she would walk across the room, but mainly because her tutor was a friend of hers. A much more typical reaction was that of Jill, who said she would not walk across the classroom "because it

wouldn't be convenient." Rashaun's answer was a reluctant compromise between asking a neighbor and walking across the classroom for help:

> If I really really had a problem and I understood nothing of what Ben and Al were saying. For the most part, I think everybody understands things to a certain degree. Some people are better with certain things. I know that Jay is one of the better ones dealing with functions and I know that when we deal with functions Jay's always the first one I ask versus Ben or Al who are close to me.

The most explicit rationale for not walking across the room to get help came from Kally.

> Interviewer: Is [proximity] the only qualification you look for, as far as a student to ask for help?
>
> Kally: Normally (laughing). I mean there are lots of students in the class that are, you know, more advanced than the person sitting next to me, but it's just easier to be like "Hey what did you get?" instead of, you know, going across the room and be like, "So, across the room over there! Help me! Come to my computer and help me!

Because only four girls explicitly chose where to sit based on sitting near a knowledgeable person, and approximately half of the girls said that they would not walk across the room to ask someone knowledgeable, the data support proximity as being more important than knowledge, although both are valued.

Aside from proximity and knowledge, the next most cited factor in determining a likely peer helper was friendship status. All but four of the girls mentioned a friendly relationship with their peer helpers as being important. In naming her first source of peer help, Noreen cited "my friend who sits next to me—the Vietnamese girl." In giving advice on how to get help, Rashaun explained, "I guess you want to go to one of those people who you're friends with, somebody you're comfortable with asking." Martina recommended that "you go to friends and you say 'can you help me? I need this and this,' and I think if it's a good friend or if he has time or knows it, they help.'"

There was a great deal of crossover in many of the factors cited as reasons for choosing a peer helper, particularly among the primary three reasons listed above. For example, Vanessa mentioned all three when she stated that she chose a peer helper "because he's *right next to me* and *I know him* and *he generally knows what he's doing*." (italics mine) This was not at all uncommon. Most of the girls included at least three reasons, and Sabrina included six different factors—including four alone in the following exchange.

> Interviewer: How do you choose to ask that one person? *Because he's working on the same thing*?
>
> Sabrina: *Yeah*, and *he sits next to me* and it's just easiest. And this one guy behind me, *he usually knows what he's doing*, but he's usually *too busy with his own project* so he won't help me. (emphasis mine)

The other reasons for choosing a peer helper were cited considerably less often. Four students believed that a willingness to help was important enough to specify. All four of these girls were high school juniors. Rashaun suggested, "If you see someone that you know frequently helps other people, you ask that person." Willingness to help was also specified as being particularly important in a group setting. Allison explained that the main quality she sought in members of her group was simply "just as long as they're willing to help." In one case, confirmed by observations, unwillingness to help was cited as a negative trait. Sabrina described the boy behind her as "usually too busy with his own project so he won't help me. So I yell at him a lot." During one observation Sabrina asked Jill if this boy was helping her; when Jill denied receiving help, Sabrina turned towards the boy's back and asked "isn't he selfish?"

Four girls also cited students learning at a similar pace or having a similar level of knowledge as being important factors in determining from whom they sought help.

Melony explained that in reaction to her neighbor suggesting one solution method, instead "I asked someone else who was also just beginning." This was also cited as being an important factor in a group, as Bobbie explained, "If it's like three or two people of the same learning ability, it's like you learn together and you're on the same wavelength." In my field notes from October 4, 1999 I recorded an instance of collaboration among students moving at the same speed in the introductory class at School A.

> Sabrina continues a running dialogue with the boy behind her. She says "let's do the next thing." They appear to be collaborating step by step on this project. They continue to talk, look at each other's screens, and discuss alternatives.

Five girls also believed that gender was important in their selection of peer helpers, and four specifically believed that the helper should be female. Sandy explained that "when you do something you just go ahead and do it, or ask to [*sic*] your friend because she's a girl, you know it's easy, you talk with...." Amanda stated that "usually I ask a girl first and then a guy" and confirmed that if her neighbors were of different genders, she would ask the girl first. Although she was the only girl in her class, Kally described in detail why she might ask a girl a question instead of a boy.

> It's the same reason why you tell a girl your problems instead of a guy.... Girls seem to understand and sympathize more and explain it in a better way. Guys are kind of just like "Well, what I did was this. Here, let me just print you out my code and you can leave me alone so I can finish programming." (laughing) I mean some guys are real compassionate though...but you know other guys are just kind of like "I don't know. Go back to your computer."

These girls were explicitly aware of asking females for help, and had reasons why they might do so. Interestingly, of the three Vietnamese girls who participated in this study,

two of them cited gender (female) as an important determinant in whom they asked for help.

I examined the data closely to determine whether there might be an interplay between the gender determinant and the friend determinant because it seemed likely that many of these girls' friendships might be with other girls, but this did not seem to be an important combination. At least as many mentions were made of friendly relationships with males as were made of friendly relationships with females. In addition, Nancy—who specifically mentioned five female friends—did not explicitly set out to seek help from males, but did notice that "everybody I said that I go to for help, all of those are guys." So although the possibility exists that there may have been a slight undercounting of those who believed that gender was an important determinant, the data do not suggest that a significant number of girls were necessarily referring to other girls when they discussed the importance of asking a friend for help.

An interplay that may need to be explored further is that between friendship and proximity. Because the teachers in this study did not assign seats, 11 of the girls in this study claimed that they chose to sit near a person with whom they were friendly on the first day of class. This would certainly account for an interplay between these two factors. Some of the girls denied sitting near a friend, and some girls claimed that they really were not friendly with anyone in the class outside of the classroom, but unassigned seating makes it difficult to cleanly separate proximity from friendship. Of course girls in each class could also become friendly with neighboring students as the term progressed.

Interestingly, of those girls in the introductory course, only 1 girl out of 18 believed that it was important to ask another girl. On the other hand, of those students in

more advanced courses, three girls out of five mentioned the importance of getting help from another girl. When looking merely at those enrolled in the Advanced Placement courses (all of whom had taken at least two-thirds of a year of computer science), three girls out of four stressed the importance of seeking help from other girls. Perhaps the help-seeking preferences of these more advanced programming students evolved over time, whereas the more novice programming students had not yet fully developed their ideas of help-seeking in the particular context of a computer science class.

The only other factor to be mentioned in this study was working on a similar project. Sabrina explained that "I usually ask the person next to me, because he's doing the same thing as me usually. And then, if he doesn't know—he's usually actually stuck on the same thing I am, so we ask [the teacher] together." From my pilot study, I observed that this factor of working on a similar project became important at School A during the final project, when students were allowed to choose their own game to create. At this point students were often working on different concepts and therefore sought out peers working on the same game.

Martina, an exchange student from the Czech Republic, was the only student to cite a common spoken language as a factor. "He's from Ukraine [*sic*] and I speak with him in Russian," she noted. This was the only instance in which nationality or race was explicitly stated to play a part. However, in observations at School B, Erin (who was White) sat next to two White boys who were her primary sources for help. Furthermore, Mary, Selena, and Nancy, all Black students, worked together on a daily basis. It seems likely that race was an unspoken factor influencing at least some of these girls' decisions

as to whom to ask for help. In addition, race could have also influenced friendship decisions, indirectly influencing help-seeking behaviors in this fashion.

In summary, the primary factors that determined from which classmate a girl requested help included proximity, knowledge, and friendship, in that order. Other factors included gender, willingness to help, similar working paces, similarity of projects, and common spoken language. Race may have been an unspoken factor involved in the decision-making process.

What reasons (if any) do these girls provide for not giving help to classmates seeking their assistance?

There were six major reasons cited by these high school girls for not giving help to classmates who requested it. The most cited reasons were the need for time to do one's own work and lack of necessary knowledge. Fifteen girls said that they would gladly help if they actually knew how to help on that particular problem. A typical response to the query of if there was any reason they would not help a classmate was that of Janene, who said, "if I didn't know how to help them. There's no other reason I wouldn't." Vanessa was the only one who said she might also use this as an excuse. She claimed that if she was busy she might "lie and be like 'No, I don't know the answer!' (laughing) So they'd have to go to [the teacher]." All of the students at School A mentioned this reason to not help peers, which might reflect the uncertainty they felt in a challenging academic course.

Fourteen girls believed that if students were busy with their own work or needed time to complete their own projects that they might be less likely to give help. Again, this group of girls included every student at School A, suggesting that they may have been more pressed for time due to the faster pace of the class. Bobbie suggested that she might

defer giving help in that situation, explaining, "sometimes if you're on a roll and you know exactly what you are doing...it's kind of like you don't want to be interrupted and have somebody be like, 'wait can you help me with this?' And you're like, 'hold on, hold on, let me just finish this real quick.'" Students at School B seemed less worried about this aspect because, as Erin explained, "so far we haven't [had a lot of work]." This comment was indicative of the unchallenging nature of the class and helped explain why students were not as worried about not being able to finish a project on time. Jill noted that sometimes questions from classmates would cause her to "lose my train of thought." Stephanie explained this idea most directly: "The first priority really would be yourself, so you try to get yourself done before you even help someone else, and I mean you can help someone else while you're working on yours, but just try to get yours done."

All seven White students in this study cited both of the above reasons for not helping peers. This may be mostly attributable to the fact that five of the students attended School A rather than to any racial difference. Nevertheless, it stands out in stark contrast to the 2 (out of 16) students of other races or nationalities who did not cite both of these reasons for not helping a peer.

A closely related reason for not helping a classmate was if the question asked was extremely lengthy. Nine girls believed that a long question would be less likely to get answered, including again all five students from School A. Six girls believed that it would depend on the nature of the individual whose help was sought or on the progress that the helping student had made with her project. Stephanie believed that a long question might be answered depending on "if they've finished their project or not." Selena believed that "it depends who it is." Sabrina simply believed that a long question

was less likely to get answered "because we actually don't have that much time in class." Kally admitted that if she were asked a question she knew required a lengthy discussion she would be more likely to suggest, "'Why don't you talk to [the teacher]?' Just because I would probably need the class time to work, because I don't have a lot of time after school to come in."

Three students stated that a legitimate reason not to help a classmate would be if they believed that the person asking for help could get a more satisfactory answer from another classmate or the teacher. The primary rationale these students cited rested on lack of knowledge as a foundation. For example, Rashaun explained that if she could not answer her peer's question she would say, "Hey, I don't know, let me get so-and-so." The other two girls believed that the more likely response was to tell the person seeking help to ask someone else, rather than continued help-seeking being the role of the helper. Additionally, Stephanie suggested that having to complete one's own work would also constitute a legitimate reason for a referral. She stated, "If I am rushed for a deadline, I might glance at their program and see what's going on with it, and if it takes me more than ten minutes, I might ask them that they may wanna ask [the teacher] or someone else."

Jocelyn was the only girl who said that the only reason she might not help a classmate was "if they act in class like you know everything and you're all bossy." She stated that she would still help that person, but "I'd just be like, 'well you do it this way and that way'—just put it there for them, not really explain it to them." She explained this as a response because "the way they act shows me that they know everything but asking is like, well, playing a joke I guess."

Sabrina from School A was the only student who insisted that she would not always help a classmate who merely wanted to know the answer.

> The other day I worked for like 45 minutes to try and figure out this, this, prime project that we're doing. And it took me so long to figure out how to make the prime factors show up, and this one kid is like, "Tell me how you did that." I don't want to tell him. It just took me so long to do it. I just want to be like (sarcastically), "Oh yeah, just type this in. Go ahead."

She explained that she handled this situation by telling the student to "go make pseudocode for it, and think about how he wanted to put it, and then he could ask me to kind of show him how to do it, but I wouldn't just give him my code or anything." On the other hand, Mary from School B claimed that "if they need to get a piece of paper and come write it down, you know, I'll be more than happy. They can look on my screen anytime."

As mentioned above, field observations on September 7 confirmed that there were indeed times that students at School A did not help classmates when they were asked for help. In observations the primary reason for denying help seemed to be a desire to work on one's own program. As noted above, one girl was denied help from a boy for this reason, and one girl denied help to a boy for the same reason. There were instances of momentarily delayed peer help at School B, but no observed instances of help to peers denied.

The primary reasons the girls in this study supplied for not giving help to classmates who requested it were the need for time to do one's own work and lack of necessary knowledge. Other reasons cited included a question that was particularly lengthy, the belief that others could better help the classmate, a bossy classmate asking the question, or a student asking for help who merely wanted the answer. Most of the

girls in this study claimed that they would help their classmates in most situations if they had the knowledge to help and were not in the middle of an important project of their own.

Do these girls see a distinction between peer help and teacher help, and if so which do they prefer?

Because of the perceived unavailability of the teacher as he moved across the classroom helping students, a majority of the girls in this study first asked their peers for help instead of the teacher. However, more of the girls in this study stated a preference for the teacher's help than stated a preference for student help. Because the teachers at these two schools gave help to students in different ways, girls at the two schools tended to give different reasons for their preference in helpers.

Sixteen of the girls, cutting across both schools, mentioned that the teacher was frequently busy helping other students. Mary commented of the teacher: "He's always busy helping someone." Stephanie agreed, explaining that "it's hard to get his attention a lotta times." Selena noted that "usually he's on the other side [of the computer lab], or he's working with someone." Observations at both schools confirmed that the teachers tended to move around the room helping different students for periods of time. Sometimes this led to frustration. In observations on October 6, Noreen turned to Sandy and said, "[the teacher] never looks at me" after the teacher had told the students to raise their hands if they were ready to be graded and then walked away from her. The teacher at School B tended to actually sit down and spend a longer amount of time with each student he helped, and more actively encouraged students to help each other than the teacher at School A did, reasoning that he could not help everyone at the same time.

Surprisingly, the comment that the teacher was always busy did not seem related to teacher, to class size, or to school. The students in the two smallest classes (enrollments of 9 and 11, both at School A) commented on how busy the teacher was, while four of the girls in the two largest classes (enrollments of 26) did not attest to this fact. In fact four out of five students at School A explained that the teacher was frequently unavailable, even though he moved around the computer lab relatively quickly and was generally dealing with smaller classes. Surprisingly only 3 out of 7 African American girls (43%) mentioned that the teacher was frequently too busy to help, whereas 13 of the other 16 girls (81%) made this claim.

Largely in reaction to the perceived unavailability of the teacher, 13 girls claimed to first ask other students for help, as opposed to first asking the teacher. All of these girls were from School B, and this group included every member of the AP class at School B. One of the girls, Melony, had never asked the teacher a question and therefore naturally first asked her peers. Selena's explanation of why she first asked her classmates was typical: "I'll go to my neighbor first, and if she doesn't know, then I'll go to the teacher, because I'm sure he's going and helping someone else so I'm not gonna sit there and wait for him." Jocelyn asked her classmates first, then she asked the teacher if her classmates were not able to help her: "First of all I can ask my friends first and if they don't have an explanation that I understand then I ask the teacher for my explanation."

Five girls said they first asked the teacher for help, as opposed to their classmates. One of these girls, Lilly, had never asked her classmates any questions. Bobbie claimed, "a lot of the times [the teacher] answers it the quickest and he knows what he's doing a lot better than the students." Noreen made a distinction as to the role of the teacher in

order to justify asking the teacher first. She insisted, "First I yell at [the teacher]...because he's the teacher, and—I don't know. I just feel more comfortable. It's not only about computers, it's just my—and that's how I am. I always ask the teacher to help. All my classes, I always ask the teacher and then, if they can't tell me, then I ask other people around me."

Five girls said that they sometimes first asked the teacher and sometimes first asked other students. Four of these were at School A, where students made a distinction between the way that the teacher and the students helped them. Jill claimed that "if it's just a little thing I can ask a kid next to me, or if it's something not working at all I can ask [the teacher]." Sabrina claimed that "if it was something I didn't hear, I'd ask the person next to me. But if it was something I didn't understand, I'll ask him." Kally distinguished between minor and major questions.

> Normally, I look around, and if the teacher's busy, I'll ask the person next to me. Or sometimes if it's a really simple question, like, if it's like, "How do you declare AP string," or something like that, I'll always just ask a student. But if it's a major question, that I don't think someone will be able to help me with, I'll ask the teacher.

This distinction that the girls made between when to ask the teacher and when to ask peers seemed generally well thought-out.

Three girls, all from School B, two Vietnamese and one Greek, claimed to be somewhat intimidated by the teacher. Melony, a student of whom the teacher spoke highly, claimed, "I'm scared he might yell at me or something for not listening." Although she said this while laughing, she had not asked the teacher a question yet that semester. The other two girls seemed to put the role of a teacher in general on a higher level than the other students in the class did. Sandy explained that "when you talk to

students, it's kind of really easy and you feel kind of—you don't feel like, he's your teacher or she's your teacher so you have to talk a different way or something like that." In fact Sandy even got flustered discussing the matter. Amanda said, "I'm scared to [ask the teacher a question] because he's my teacher and you know, so I mean I would rather go ask a friend than a teacher." Certainly culture probably played a role in forming these three girls' relationships with the teacher.

Nine girls expressed a preference for the teacher's help rather than their peers' help. In addition, one girl, Lilly from School B, had never asked a student for help so could not make a judgment. There were some common reasons that these girls preferred the teacher's assistance, but there were also some differences in the way that the teacher at each school helped the students. This accounted for some variation in student reasoning.

At School A for example, Bobbie claimed to prefer the teacher's help because "he helps me understand it." Vanessa stressed that "[the teacher] would ask me questions and then we would kind of build on it, like he would ask me what would happen if we type that in or something like that and then I would answer and we would build on that." Sabrina preferred the teacher because "he knows all the answers." She stressed both the time that the teacher spent with students and the teacher's method of supplying hints rather than merely stating the answer.

> Sometimes your classmates will just be so busy with like, doing their own thing. Like even me myself, you just kind of tell them, "Okay, okay, this is the answer," or print out the code and say, "You're supposed to do this." [The teacher] will probably give you hints, like, "How would you think you'd say it?" and make you write pseudocode and it takes a lot longer, but I guess you end up understanding it better.

Kally explained that the instant gratification supplied by student help was not always the best solution for her.

> Well, personally I prefer—you know, the student says, "Hey, I did this," just because I don't have to think. But in the long run, it's better—[the teacher's] way is much better, just because I know that I'll be able to do it again in the future because I'll think about, "Oh, I did this before."

The teacher was also observed to be helping in this fashion. In field notes on October 4, I noted, "[the teacher] asks [Bobbie] leading questions about how she would teach a young girl how to check to see if a number is prime, which she answers." Later in the same class period the teacher "suggests the next step, and then turns things around and asks [Bobbie] questions about what to do next."

At school B, Darné explained her preference for the teacher's help by expressing a negative view of some of her classmates: "Some of [my classmates] I don't think know that much what they're doing." Darné also explained that the teacher had "been doing this for awhile and he's more knowledgeable of the different areas and can explain to me how to do it instead of just clicking it, and fixing it, and then I wouldn't understand." Erin claimed to prefer the teacher's method because "he makes me get up...and sits down in the chair and does it himself...it's the easy way out...[but] I'm not really big on computer science, so yeah [I prefer the teacher's help]." Noreen claimed that sometimes the teacher "will come over and do it for me.... [He] is just showing me how to do it. But that's how I learn. So, I—I just watch what [he's] doing and that's how I get the idea." Mary added that "things we haven't learned that need to be in there, he'll come by and put 'em in." The teacher at School B was observed to sit at the students' computers and type on a number of occasions. In field notes on September 13 I recorded, "The teacher is helping Mary—he sits and types while she stands and watches."

Only five girls explicitly preferred student help over teacher help, but two girls claimed no preference, and six girls said that their preference was situational. Of the five who preferred student help, one girl, Melony, had never asked the teacher for help and so may not been able to make a good comparison. None of the students at School A expressed an outright preference for student help; instead they either preferred the teacher's help or believed that their preference was situational. The other two White students in this study also fit into this same category of preferences. The student method of helping was essentially the same at both schools. The one primary difference between schools was that only students at School B complained about the teacher speaking above their level of understanding.

Erin sometimes preferred the help of her classmates because "it's easier to get a hold of them." Furthermore, sometimes the teacher "gives too much information for me. He'll go into detail about something and use words that I've never heard of whereas Gene would just be like 'put this, type in your semicolon and you're fine.'" Jocelyn was one of a few girls who simply believed that "I feel [more] comfortable around my friends than I do with the teacher." She was not positive whether she preferred the help of her classmates or the teacher.

> The teacher just—does give you a correct and accurate explanation, but your friends know you can talk about it in any way and they don't give you—explain it in higher level words I guess, because a teacher you know expects you to know some words that you don't understand like some computer words like, I don't know—like if I didn't know the meaning of literal value and I ask my friend she can tell me, "well it is like the real value of the constant declaration," but my teacher would be like, "oh it's the blah blah blah," and I would be lost and stuff, but the teacher does give great explanations in his own words.

Rashaun concurred, explaining that "I feel that [students] understand it on my level. They can explain it to me and I won't be totally confused versus if [the teacher] says something I'm like, 'What is that? What did you say?'" Sabrina observed that "[the teacher] has to go from person to person with different parts, and usually the classmates—most of them are on the same track as I am, so they know what I'm—what I'm doing at the same time." Finally, some students at School A sometimes preferred a quick answer. In classroom observations on September 17, Jill remarked to a boy helping her, "Don't ask me these questions. Just tell me how to do it."

Although most girls in this study claimed to ask their peers for help before they asked the teacher for help, more girls actually preferred the teacher's help than preferred their peers' help. This apparent contradiction was explained by the teacher's perceived unavailability at both schools. Although the teachers at these two schools helped students in different manners, one commonly perceived benefit of asking the teacher was that he was the expert in the subject area being studied.

Would these girls prefer to work alone or in traditional groups?

When given the option of the status quo in the classroom—each girl working on a computer—or working in a group on a single computer, more girls stated a preference for working alone. Of the 23 girls interviewed, 7 stated a preference for working in a group, 13 stated a preference for working alone, and 3 expressed some desire to work alone at times and to work in a group at other times.

Among those who said they preferred to work in groups, there were a number of rationales cited. Jocelyn was one of three students who believed that more ideas would lead to a stronger program: "They [members of a group] have more ideas and they can all

put their ideas together and you can get a better program and more complicated a thing." Paula took a very similar stance, but focused more on competing ideas rather than cooperating ideas: "You'd have a lot more ideas coming in at once, and you can compromise rather than you doing something by yourself. It's just nice to have a lot more different ideas, because you might find that you like their ideas better." Allison believed that more eyes would make checking the work more efficient: "It's easier to get—well like, for the proof reading and stuff like that, it would be easier to do stuff like that." Rashaun apparently misunderstood the question, because she appeared to describe a time-saving model in which students worked on their own individual computers: "Most of the time when we're doing our programs there's a lot of collaborating going on so I guess it would make it easier for everybody if you have a group and everybody has a set task of what they need to do. And, a lot more could get done in a quicker amount of time." Sandy was one of two girls who argued that a built-in group of helpers would be helpful: "They can help you when you don't understand, or...or they can give you the opinion about what to do and stuff."

Describing the downside of working alone, Jocelyn explained that "[With] one person just—you either know it or not.... You can't share ideas and you either know how to do the program or you cannot learn more things from...someone else, because it's just you and the computer...but if you're working with someone else the person can say, 'well put it this way, and you'll come out better then.'" She later admitted, however, that she did sometimes get this exact type of help from students in the current lab situation.

Among those who said they preferred to work alone, there were a number of rationales cited. Nancy preferred to work alone due to personal accountability,

explaining, "I don't have to rely on anybody else. It's on my own. If I fail it's my fault, and if I pass then I did it." Lilly simply stated that it was a personal preference, indicating, "I'm just one I like to figure it out myself." Jill focused on ease of completing the assignment, saying, "I like to work independently regardless of the class, and it's easier for me to get things done by myself." Vanessa focused more on understanding. She claimed, "I work better ...doing stuff myself because then it's my way and I understand it better."

Those who preferred to work alone pointed out what they considered the downside to working in a group. Melony was one of two students who focused on keyboard time:

> You don't have an actual chance to get to actually touch the keyboard, and actually to type it in yourself. Someone else would do it. So probably someone else would take over, and you wouldn't get a chance to actually work it out yourself.

Noreen was one of four students who believed she would not learn because either she would allow others to do the group's work, or others would simply take control because they were the most capable:

> Sometimes I depend on people when I'm stuck. And if we have a group—like if we have to do something—and there's always somebody in the group who's better than—like, gets to be like, the leader—and he or she will do all the work, and we just don't do anything. I won't get to learn anything.

Mary took this idea to the logical conclusion, worrying about her performance on tests if she learned nothing from group work: "Maybe I'll ... depend on the smarter person in the group to do all the work and I wouldn't be learning anything when it came test time." Nancy took the opposite tack, that of knowledgeable group leader frustrated with the rest

of her group: "I [would] have to wait on [other people] and be like, 'Well you were supposed to do this' and they don't do their part."

A few students had conflicting opinions on the matter, and they also held some original opinions about the pros and cons. Kally believed that as far as class projects, "You have so many conflicting ideas, and you'd be like, 'Well, I think we should solve it this way.' 'Well, I think we should solve it this way.' And both ways might be perfectly fine, both ways might be the answer, and then you've got a couple more people saying, 'Well, I think it should be solved this way.'" On the other hand Kally had a positive experience taking a group test and commented that tests were "so much better when you work with other people, just because—it's not only easier, but it's better to be able to discuss it.... It's just easier to debate and you can talk about it and stuff." Martina, the exchange student from the Czech Republic, claimed that in her own country she preferred to work alone but that in the United States she preferred to work with a group who could help her. She commented, "I can [work by myself on one computer] in Czech because I understand everything, but here I prefer a group." Although Sabrina finally decided that she preferred to work alone because "I can decide how I want it to be and work at my own pace," she believed that the partner project she had worked on had been a positive experience. She described this experience as such: "If I didn't know one thing, then my partner would, and we kind of could put our minds together and figure out what it was supposed to be."

Selena was the student who had the most unique perspective. She claimed to be a "group person" in all of her classes, except those classes that worked with computers. "I really do like group projects and everything, but when it comes to computers, I just like it

to be just me and the computer and that's it for some reason. I don't know why." She explained that "at home on my computer, I like it to be quiet and everything, but when I'm at school the only reason why I do prefer us being in the open with everyone is because if I do need help, I need the teacher there."

Five other students also claimed that they would prefer working in total isolation rather than in a group setting. Jill was one of two students who claimed that she would like to be in isolation on occasion, although at other times she might require some guidance. On the other hand, Robin believed that she would always prefer isolation. She stated, "I believe I would react to [isolation] good because I like to work by myself and I believe I, not learn more, but I believe comprehend it more if I do it by myself."

The only classes in which I observed any kind of formal group work were at School A. I observed two classes, both the introductory computer science courses, in which students were placed into pairs with the person in the next aisle to work on a project. In this project however, students remained at their own computers and completed their projects individually. However, the teacher repeatedly reminded them, "remember you are not alone—you have a partner" and encouraged them to ask their partners questions before consulting him. Additionally, Kally and Vanessa both mentioned in their interviews that in their classes at School A students had been paired together for a test. Interestingly, all of the girls at School A concluded that they preferred to work on projects alone, although Kally expressed a preference for working together on tests and Sabrina mentioned that there were many aspects she liked about the partner project I observed.

Both sophomores in this study, Vanessa and Darné, expressed a preference for working alone. In addition, each White student in this study expressed a preference for working on projects alone. In contrast, four of the seven African American girls (57%) in this study exclusively preferred working in groups. Only 3 of the remaining 16 girls (19%) in the study exclusively preferred group work.

During observations of the partner project on September 7, 1999, I observed some successes of this method and some failures. Bobbie helped her partner by "show[ing] him how she did something" (field notes 9/7/99). Jill helped her partner on two occasions, and Sabrina asked her partner numerous questions. However, Sabrina also became very frustrated with her partner's focus on his own work, at one point saying, "you are just thinking 'go away so I can do my program!'" She then implored, "Dan, help me...I know you have to work but you are supposed to help me—I'm your partner..." She finally concluded in sarcastic frustration, "You're a great partner. I never want to work with you again (laughing)." Sabrina also got the teacher involved by saying to the teacher, "I think [Dan] should get points taken off because he doesn't want to help me." The teacher got further involved in this class because Jill was focusing on her own work and ignoring her partner. The teacher chided Jill by saying to her partner sarcastically, "just tap her on the shoulder. She'd be *happy* to help." Jill proceeded to wait to be tapped, then agreed to help, and the teacher offered his thanks.

Most girls sought partners who would not waste time in a group, were smart, worked well in a group, were fun and friendly, and were willing to help. Bobbie also claimed that she sought partners working at the same pace at which she worked. Two girls claimed to be seeking "fun" partners. Thirteen girls sought partners who "wouldn't

waste time" during group work, and nine were looking for partners who worked well in a group. Twelve girls wanted groupmates who knew the subject well, although two girls specifically stated that this was not important to them. Two girls said they certainly preferred to have friends in the group, two stated that it would be nice but didn't really matter, and three girls denied the importance of having friends in their group. Four specifically sought groupmates who were willing to help.

In summary, more girls in this study stated a preference for working alone rather than in a group on a single computer. This majority included those girls at School A who had had experience with group work in the computer lab. The majority of girls in this study preferred working alone for a number of reasons, including personal accountability, personal preference, increased understanding, and increased keyboard access. It is possible that some girls also found the setup posed in the question distasteful, in that they might have reacted negatively to having a number of students crowded around a single computer.

Discussion

Theorists who suggest that qualitative inquiry is required to reveal the intricacies of students' motivation are correct that these intricacies more readily surface when students' actions are observed and when their voices are heard than when surveys are the sole means of gathering data. Self-report instruments, in addition to their well-known limitations, bound student responses to the issues tapped by the items that comprise them. The girls in this study provided insights beyond those currently available. However, it should be noted that these results may be unique to the girls in the computer science classes at these two schools with these two teachers. Furthermore, many of the findings in

this study may not be gender specific. Because boys were not included as participants, it would be speculative to suggest that these findings are or are not specific to girls only.

For girls in computer science classes in two schools, physical proximity was an important determinant of help-seeking behaviors. Another finding was that girls in this study often asked their peers for help even if they preferred the teacher's help and believed that the teacher was more knowledgeable. One particularly counter-intuitive finding was that most girls in this study preferred to work individually in a setting in which there was substantial peer interaction. In general, girls in this study were aware of their help-seeking strategies and of how important a role help-seeking played in their classroom life.

Perceptions of status as a gender minority

Schofield's (1995) investigation of the experience of four girls in computer science classes revealed that the girls had negative experiences, as they were unable or unwilling to acquire help from their male classmates, establish ongoing working relationships with classmates, or even work together with their female classmates. In contrast, the girls in the present study were almost always easily able to gain the assistance of their peers, including their male classmates. A number of girls entered into ongoing working relationships with classmates, and this was true across schools. There were also regular instances at School B in which girls worked together. Due to the modest sample sizes in each study and the number of moderating variables, such as teacher attitude, influencing the results, this inconsistency in findings merits further research in more varied settings with greater sample sizes.

Resolving conflicting solution approaches

If disagreement with peers in and of itself is a source of cognitive conflict (Nelson & Aboud, 1985) then most of the girls in this study had the opportunity to generate cognitive conflict. If providing verbal explanations is one primary way of resolving cognitive conflict (Jackson, 1994; Kumpulainen, 1996), then many of these girls missed opportunities when they quickly turned to other helpers at the first sign of a disagreement. Although some of the girls stated that they had engaged in discussions with their classmates, the majority had not. If resolving cognitive conflict is important, teachers would do well to encourage students to experiment on the computer with the programming code suggested by peers. Only four girls in this study claimed to try the code on the computer. Especially because the teacher is not readily available, this is often the only method available to these girls to test the solution. Findings from the present study are consistent with Damon's (1984) recommendation that teachers encourage students to supply verbal explanations when disagreement is expressed by peers.

Determinants of peer help-seeking

As noted above, there were three primary characteristics that determined which students were most likely to be selected as helpers by the girls in this study: proximity, knowledge of computer science, and friendship status. Because for this sample physical proximity was a critical factor in girls' seeking help, attention to seating patterns in a computer lab might merit closer scrutiny. If future researchers obtain similar findings with other samples, then several strategies might warrant trials. One possible seating arrangement that might maximize help-seeking would be to evenly distribute talented programming students throughout the classroom. This would allow students to use

capable peers as a resource when the teacher is busy assisting others, allowing them the opportunity to more easily cross their zone of proximal development (Vygotsky, 1978). It may also be advantageous for teachers of high school computer science to encourage friendships among their students. The policy of the teachers in this study to not assign seats seems to allow students to sit near their friends, which might in turn increase peer interaction and academic help-seeking. This could be beneficial, assuming that peer interaction is a positive attribute of a classroom and not a distraction. In observations at these two schools this seemed to be the case, and this was also supported in interviews by Bobbie who claimed "in my computer class it's more like we don't really talk about any other stuff except, 'how do you do this?'" This idea is further supported by research done by Lee (1993) in which 80% of peer interaction within four-person groups was task-related.

The suggestion in this study that proximity might be an important factor in help-seeking behaviors has not received attention in either the help-seeking literature or the literature on the computer science lab environment. This might be a fruitful area for further study. Although it seems intuitively obvious, further study is necessary to confirm this hypothesis. Certainly the possibility that proximity is more important than knowledge would bring into question some of the help-seeking strategies of these girls. Of course there are other possible explanations, ranging from the speed at which the various courses covered new topics to the amount that the teachers encouraged peer help to how comfortable these particular girls were standing up in any classroom setting.

Reasons for not helping classmates

The primary reasons that the girls in this study cited as reasons not to help their peers were lack of knowledge and the need to do one's own work. This avenue of exploring help-giving rather than help-seeking introduces some new research possibilities. Most of the current literature focuses on the students seeking help rather than those supplying it. It would be perhaps equally instructive to study the motivations supplied by help-givers, so that the other side of the help-giving equation was more fully understood.

The distinction between peer help and teacher help

Although more girls in this study preferred the teachers' help than preferred their peers' help, and almost every girl agreed that the teacher was a source of greater knowledge on the subject than their peers, more girls actually asked their peers for help before they asked the teacher for help. This was largely due to the perception that the teacher was not always available to assist them. Many of the girls said that their choice of peer help or teacher help depended on the situation. In some cases girls at both schools seemed to prefer executive help (for example, Jill said, "Just tell me how to do it"). At School A though, most of the girls believed that the teacher's method of "hints" (instrumental help) helped them "understand it better" so that they would "be able to do it again in the future." This suggests that this teacher's method of "hints" (instrumental help) could be taught to students so that they might use it in their help-giving. However, having students use the teacher's method of help-giving might destroy the very aspects of peer help that lend to it the strength attributed in the literature, most notably the

directness of the approach (Webb & Lewis, 1988). As students at School B indicated, their peers often "understand it on my level" and are "on the same track as I am."

Because the teachers at these two schools provided help in such different ways, it is difficult to make a distinction in these girls' preferences for teacher help or peer help. Some of these girls were interested in learning computer science, and some were not. Some believed that they learned better when the teacher guided them to solutions through hints, and some believed that they learned well when the teacher did their work for them. Also, some of these girls may have been socialized in ways that influenced their behaviors with the teacher. As Noreen explained "...that's how I am. I always ask the teacher to help." On the other hand, Melony claimed "I'm scared he might yell at me or something for not listening." Finally, one of these girls found the course so easy that she did not ever need to ask for teacher help. Because of the complexity and variety of these factors, it would be nearly impossible to make a blanket statement about whom female students prefer to ask for help—even in computer science classes in just two schools.

Working alone versus working in groups

Some girls in this study preferred to work individually in a setting in which there was already substantial peer interaction. This preference might occur in other classes as well. Well-intentioned teachers may react to the generally reported finding that girls prefer to work in groups (Barbieri & Light, 1992) by insisting that most projects be the product of group work. Results of the present study sound a note of caution. Some girls may prefer the personal ownership involved in working individually and may feel that they learn more when working alone. Teachers should be wary of applying the general

finding that girls prefer group work to every girl in a class and should instead respect the preference of the individual.

Many of the girls in this study were hesitant to work with others. This supports Sheingold's assertion that students do not want to work with others who may dominate the work (as cited in Chandler, 1984) and could explain the tension in the groups observed by Jackson (1994) when more experienced computer users monopolized the keyboard. Regardless of Light and Blaye's (1990) assertion that students do not learn less because of reduced keyboard access, the affective aspects of learning would appear to be affected if the negative expectations of these girls regarding group work were to come to fruition. Therefore, if group projects are undertaken, the teacher should pay particular attention to alternating student roles within the group and encouraging mutually supportive group members, as suggested by Jackson (1994).

Areas for Future Research

In this study the interaction among students freed the teacher of constant, simultaneous demands on his time, as researchers have suggested (Damon, 1984; Diem, 1986). Many of the students stated that one of the motivations for asking peers to assist them was the fact that the teacher was quite busy. Although the girls in this study did point to some of the advantages of interacting with peers, such as the use of a common language, in general they did not think that they learned more from their peers than from the teacher. This belief is supported by the work of Ellis and Rogoff (1982), who found that their learners tested better when taught by adults.

Further support for Ellis and Rogoff (1982) was evident in the mode of helping by students. The students at both schools tended to demonstrate their own programs

frequently. The students' method of helping seemed to allow for little student participation because they were often merely telling their peers the answer. Finally the students appeared to focus primarily on task completion, rather than teaching their peers general rules for future use. Damon (1984) would probably categorize most of the student help as peer tutoring rather than peer collaboration, because the focus seemed to be on transmitting information rather than mutual intellectual discovery.

This study also supports much of the literature. In these particular computer courses, enrollment was indeed primarily male, as suggested by Hoyles (1988). Many of the students commented on the tension cited by Jackson (1994) between doing their own work (for a high grade) and helping classmates. None of the females in this study commented on being frustrated with helping those with less expertise, as Webb (1984) feared, but Sabrina's frustration with a student interested only in completing the task rather than learning is in line with Webb's intimations.

Further study is called for in a number of areas as well. There is very little qualitative research available that investigates a naturalistic computer science classroom. With the increasing availability of computers across the nation, the model of one person per computer may become the dominant classroom model in computer science classrooms in particular. As of 1984, teachers assigned groups to computers less than half of the time (Webb & Lewis, 1988), and it would seem likely that increased availability of computers would see this number continue to drop. Although Colbourn and Light (1987) admitted that children working by themselves on the computer "engaged in very nearly as much task-related talk as children working in foursomes," there is a need for more systematic research of this naturalistic classroom setting.

Further study is also called for to investigate the stated preference of many of these females to work alone on their programs rather than in groups. It is possible that because they are satisfied with the amount of interaction already taking place in the classroom, that the perceived benefits of group work are relatively few. The stated preference for individual work found in this study neither supports nor rejects the theory of the social construction of knowledge (King, 1989); there was still a great deal of interaction in the computer labs in this study regardless of whether students were working together in a formal group. Nevertheless it appears that interviewing girls regarding their preference for collaborative work in computer science would strengthen the quantitative findings in this subject area. It is possible that other students such as Rashaun may also have a different understanding of the term "group project" than researchers might expect. More research would need to be done to make any definitive statements on this topic.

In summary, if similar findings occur with other samples, results from such investigations could hold possible implications both for educational researchers and for teachers of computer science. As regards research, additional investigations with larger samples would add critical information to our understanding of the importance of physical proximity in determining interactions in the computer lab. Appropriate analysis would determine the importance of preexisting peer interaction in the classroom as a factor affecting the preference of girls for group work. Also, investigation into the role of help-givers would round out the research on help-seeking. For their part, teachers of computer science might be encouraged to evenly distribute capable students throughout the classroom. Teachers might also be encouraged to think long and hard before relying

exclusively on group work in the belief that it will be most effective for every girl in the classroom. Students might be encouraged to verbalize reasons for their help giving.

Because most interactions in the computer lab take place between students (Schofield, 1995), peer interaction is a natural focus for an investigation into the female experience in computer science classes. Additional insights into this experience can be developed by analyzing help-seeking behaviors in terms of the six classroom interaction patterns identified in this study. As these interactions are improved, girls may become more enthusiastic about their computer science experience. The logical aim of investigating these educational practices is of course to increase the number of girls and women in computer science classes and computer science careers.

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Appendix A

Interview Guide

Preference for interaction

- Some people would say that they would rather be given the assignment, a general introduction by the teacher, and then just be left alone to work. How would you respond to them?
  - Would that be a mode you would prefer?

- How do you prefer to resolve questions you have during class?
  - peers, teacher, on your own, use the book, look at someone's program

- Would you prefer more interaction during class, less, or about the same?

- How would you compare the amount of student interaction in this class with other classes you are taking?

With whom do you interact?

- Who do you usually ask first for help?
  - Why?/How do you choose which classmate to ask when you have a question? (friends, grades in course, age, understanding, seating proximity)
  - Who do you usually ask second, and why?

- How did you originally choose which seat to sit in during class?
  - (anything to do with sitting near a friend? A female?)
  - Do you ever change?
  - Why or why not?

- How many girls are in the class?
  - If you were to designate a gender mix, how many girls would be in the class? Why?
  - Does the number of girls in the class affect the way you behave in any way?
  - Does the number of girls in the class affect the way you work?
  - Are you happy with the number of girls in the class?

- Would you prefer group projects or working on your own?
  - What kind of partners would you select?
  - How many partners would you want?

How to get help

- Suppose I had a question about my program. How would I go about getting help from a classmate?
  - What if it's a question that will require someone to spend time looking at my program?
  - What if I don't agree with the answer?
  - Is that what you do?
  - Some students have told me that they like to debate with their classmates so they hear an explanation of the other person's side. Have you ever had a conversation with a classmate like that? If so, did you feel like you learned anything from the conversation?

How to give help

- If someone asks you for help, is there any reason you might not help?

Student/Teacher

- Does your teacher help you in the same way that your classmates do? Explain.
  - Which do you prefer?

Appendix B

INFORMED CONSENT FORM
for PARTICIPANTS and their PARENTS or LEGAL GUARDIANS

I am a doctoral student at Emory University and I am conducting research on student interactions in a computer science classroom. I have received permission from your school and your computer science teacher to invite you to participate in this research study. The following information is provided in order to help you make an informed decision whether or not to participate. If you have any questions about any aspect of this study, or the information on this form, please do not hesitate to ask. You are eligible to participate because you are a student in a programming class at your school.

Participation in this study will require one interview of approximately 30 minutes and is not considered part of the course. This interview will take place in a public location on campus during free time you may have during the school day. Throughout the interview, the researcher will be asking you questions concerning your interactions with other students during computer science class. The researcher will also be observing a number of classes. Participation or non-participation will not affect the evaluation of your performance in this class. There are no known risks or discomforts associated with this study.

You may find the experience enjoyable, and the information may be helpful to you in better understanding your interactions with fellow students. The information gained from this study may also help me better understand the factors that influence student interaction in the computer science classroom.

Your participation is *voluntary*. You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the researcher or with your school. Your decision will not result in any loss of benefits to which you are otherwise entitled. If you choose to participate, you may withdraw at any time and for any reason. If you have any questions about the manner in which the research is being conducted, you should contact Dr. Robert Jensen, Chair of the Arts and Sciences committee of Emory University that oversees the rights of human subjects, at the number listed below. Upon your decision to withdraw, all information pertaining to you will be destroyed. If you choose to participate, all information will be held in strict confidence and will have no bearing on your academic standing or services you receive from your school. The information obtained in this study may be published in scientific journals or presented at scientific meetings, but your identity will be kept strictly confidential.

If you are willing to participate in this study, please sign the statement below, have a parent or guardian sign the statement, and return it to Mr. Paul Oberman. Keep the extra unsigned copy. If you choose not to participate, you may retain both copies of the agreement. Thank you for considering participating in this study.

Project Director: Paul Oberman, Ph.D. student at Emory University
Atlanta, GA, Telephone (404) 251-1331
Chair of Emory University's Human Subjects Committee:
Dr. Robert Jensen, (404) 727-0606

I have read and understand the information on the form and I consent to volunteer to be a participant in this study. I understand that I have the right to withdraw at any time. I have received an unsigned copy of this Informed Consent Form to keep in my possession.

Name (PLEASE PRINT) _____
Student's Signature _____
Signature of Parent or Legal Guardian _____

Appendix C

Coding

INT:Code Book–Summary **12/12/99 2:03:28 PM**

Code Word	Parent	Text	Definition	Modified	Added
FRI	CHO	YES	Chosen based on being a friend	09/29/99	11/03/99
GEN	CHO	YES	chosen based on gender, esp. being a	09/29/99	11/03/99
LAN	CHO	YES	Chosen because they speak the same	10/29/99	11/03/99
PAC	CHO	YES	Chosen because working at same pace	10/09/99	11/03/99
PRO	CHO	YES	Chosen based on proximity	09/29/99	11/03/99
SAM	CHO	YES	working on same project	09/30/99	11/03/99
SMA	CHO	YES	Chosen based on being smart in CSci	09/29/99	11/03/99
WIL	CHO	YES	Chosen based on willingness to help	10/09/99	11/03/99
ASS	CON	YES	Asked a different student for help	09/29/99	11/03/99
AST	CON	YES	asked teacher for help in response	09/29/99	11/03/99
TAL	CON	YES	had a discussion in reaction to	10/09/99	11/03/99
TRI	CON	YES	tried the suggestion in response to	09/29/99	11/03/99
EQU	DIF	YES	no preference for teacher or student	09/30/99	11/03/99
INT	DIF	YES	intimidated by teacher	10/09/99	11/03/99
NAT	DIF	YES	never asked the teacher a question	10/09/99	11/03/99
PRS	DIF	YES	prefer student help	09/29/99	11/03/99
PRT	DIF	YES	prefer teacher help	09/29/99	11/03/99
SFI	DIF	YES	Ask students first when have	10/09/99	11/03/99
STM	DIF	YES	student method of helping	09/29/99	11/03/99
TAB	DIF	YES	Teacher is always busy	10/09/99	11/03/99
TEM	DIF	YES	teacher method of helping	09/29/99	11/03/99
TFI	DIF	YES	Ask the teacher first when have	10/09/99	11/03/99
BOY	GIR	YES	reference to boys or girls as a	09/29/99	11/03/99
DER	GIR	YES	derogatory reference to girls	10/14/99	11/03/99
FIN	GIR	YES	happy with the number of girls--it's	10/09/99	11/03/99
GGG	GIR	YES	Girls just as good or better than	10/09/99	11/03/99
LIK	GIR	YES	liked being one of the girls in the	09/29/99	11/03/99
MOR	GIR	YES	Would prefer more girls in the class	10/09/99	11/03/99
NLI	GIR	YES	did not like being one of the girls	09/29/99	11/03/99
NOM	GIR	YES	gender doesn't matter at all	09/30/99	11/03/99
RAN	GIR	YES	reference to rank in class	09/29/99	11/03/99
REP	GIR	YES	feel as if representing all girls	09/29/99	11/03/99
WHI	GIR	YES	reference to "whiz kids"	09/29/99	11/03/99
CHO	None		How to choose someone to ask for	03/19/99	00/00/00
CON	None		conflict resolution	03/19/99	00/00/00
DIF	None		difference between peer and teacher	03/19/99	00/00/00
GIR	None		reaction to being a girl in the	03/19/99	09/29/99
NOT	None		Reason for not helping	03/19/99	09/29/99
PRE	None		preference for working alone, in	03/19/99	09/29/99
BET	NOT	YES	teacher or another peer would give a	09/29/99	11/03/99
DIS	NOT	YES	dislike the peer asking the question	09/29/99	11/03/99
DKN	NOT	YES	don't know the answer	09/29/99	11/03/99
LEN	NOT	YES	question is too lengthy	09/29/99	11/03/99
OWN	NOT	YES	Need to do own work, busy, no time	09/29/99	11/03/99
REC	NOT	YES	feel being taken advantage of/ no	09/29/99	11/03/99
ALO	PRE	YES	prefer working alone	09/29/99	11/03/99
FUN	PRE	YES	someone who is fun in the group	10/09/99	11/03/99
GRO	PRE	YES	Prefer working in a group	09/29/99	11/03/99
HAP	PRE	YES	happy with the amount of interaction	09/29/99	11/03/99
ISO	PRE	YES	prefer working in complete isolation	09/29/99	11/03/99
NIS	PRE	YES	do not prefer total isolation	09/29/99	11/03/99
NWT	PRE	YES	doesn't waste time in group	10/09/99	11/03/99
UNH	PRE	YES	unhappy with the amount of	09/29/99	11/03/99
WNG	PRE	YES	want in my group because work well	10/09/99	11/03/99

INT:Code Book--All Code Words 12/12/99 2:03:11 PM

Code Word	Parent	Text	Level	Added	Modified
FRI	CHO	YES	2	09/29/99	11/03/99
	Chosen based on being a friend Ex. "I chose him because I like him as a friend"				
GEN	CHO	YES	2	09/29/99	11/03/99
	chosen based on gender, esp. being a girl "I chose her because she's a girl"				
LAN	CHO	YES	2	10/29/99	11/03/99
	Chosen because they speak the same language Ex. "I ask him for help because he speaks Russian"				
PAC	CHO	YES	2	10/09/99	11/03/99
	Chosen because working at same pace on the project Ex. "Well he is stuck on the same problems I am and other people are way ahead" or "He works at the same speed I do"				
PRO	CHO	YES	2	09/29/99	11/03/99
	Chosen based on proximity ex. "I chose him because he was right next to me."				
SAM	CHO	YES	2	09/30/99	11/03/99
	working on same project ex. "I asked him for help because we were working on the same project"				
SMA	CHO	YES	2	09/29/99	11/03/99
	Chosen based on being smart in CSci Ex. "I chose her because she seems to know what she is doing"				
WIL	CHO	YES	2	10/09/99	11/03/99
	Chosen based on willingness to help Ex. "well she's really nice and will help me" or "he was done with his program"				

INT:Code Book–All Code Words 12/12/99 2:03:11 PM

Code Word	Parent	Text	Level	Added	Modified
ASS	CON	YES	2	09/29/99	11/03/99

Asked a different student for help in response to cognitive conflict
Ex. "I would just ask another student in the class if I didn't agree with the advice someone gave me"

Code Word	Parent	Text	Level	Added	Modified
AST	CON	YES	2	09/29/99	11/03/99

asked teacher for help in response to cognitive conflict
Ex. "I would just ask the teacher if I didn't agree with the advice someone gave me"

Code Word	Parent	Text	Level	Added	Modified
TAL	CON	YES	2	10/09/99	11/03/99

had a discussion in reaction to conflict
ex. "we talked about our disagreement"

Code Word	Parent	Text	Level	Added	Modified
TRI	CON	YES	2	09/29/99	11/03/99

tried the suggestion in response to cognitive conflict
Ex. "I tried it to see if it would work, even though I didn't think it would."

Code Word	Parent	Text	Level	Added	Modified
EQU	DIF	YES	2	09/30/99	11/03/99

no preference for teacher or student help
Ex. "I liked getting help from them both." "They helped me in basically the same way"

Code Word	Parent	Text	Level	Added	Modified
INT	DIF	YES	2	10/09/99	11/03/99

intimidated by teacher
ex. "I'm afraid he might yell at me"

Code Word	Parent	Text	Level	Added	Modified
NAT	DIF	YES	2	10/09/99	11/03/99

never asked the teacher a question
Ex. "I've never asked the teacher for help"

Code Word	Parent	Text	Level	Added	Modified
PRS	DIF	YES	2	09/29/99	11/03/99

prefer student help
Ex. "I prefer the help of my classmates"

INT:Code Book--All Code Words 12/12/99 2:03:11 PM

Code Word	Parent	Text	Level	Added	Modified
PRT	DIF	YES	2	09/29/99	11/03/99

prefer teacher help
ex."I prefer the help of the teacher."

Code Word	Parent	Text	Level	Added	Modified
SFI	DIF	YES	2	10/09/99	11/03/99

Ask students first when have questions
ex. "When I have a problem the first thing I do is askmy friend Jimmy"

Code Word	Parent	Text	Level	Added	Modified
STM	DIF	YES	2	09/29/99	11/03/99

student method of helping
Ex. "The way a peer would help me is to tell me the answer."

Code Word	Parent	Text	Level	Added	Modified
TAB	DIF	YES	2	10/09/99	11/03/99

Teacher is always busy
Ex. "The teacher is always helping someone else, so I asked my friend"

Code Word	Parent	Text	Level	Added	Modified
TEM	DIF	YES	2	09/29/99	11/03/99

teacher method of helping
Ex. "The teacher would basically turn the question around."

Code Word	Parent	Text	Level	Added	Modified
TFI	DIF	YES	2	10/09/99	11/03/99

Ask the teacher first when have questions
ex. "When I have a problem the first thing I do is ask the teacher"

Code Word	Parent	Text	Level	Added	Modified
BOY	GIR	YES	2	09/29/99	11/03/99

reference to boys or girls as a group
Ex. "The boys just seem to have more computer experience at home" or "The girls are doing well."

Code Word	Parent	Text	Level	Added	Modified
DER	GIR	YES	2	10/14/99	11/03/99

derogatory reference to girls
Ex. "I wish there were fewer girls in the class"

Code Word	Parent	Text	Level	Added	Modified
FIN	GIR	YES	2	10/09/99	11/03/99

happy with the number of girls--it's fine
Ex. "It doesn't matter how many girls there are in the class"

INT:Code Book--All Code Words 12/12/99 2:03:11 PM

Code Word	Parent	Text	Level	Added	Modified
GGG	GIR	YES	2	10/09/99	11/03/99

Girls just as good or better than boys
Ex. "so I think the girls are good programmers, sometimes better than the boys"

Code Word	Parent	Text	Level	Added	Modified
LIK	GIR	YES	2	09/29/99	11/03/99

liked being one of the girls in the class
Ex. "I liked being the only girl in the class." or "I liked having so many girls in the class."

Code Word	Parent	Text	Level	Added	Modified
MOR	GIR	YES	2	10/09/99	11/03/99

Would prefer more girls in the class
Ex. "I wish about half the class were girls"

Code Word	Parent	Text	Level	Added	Modified
NLI	GIR	YES	2	09/29/99	11/03/99

did not like being one of the girls in the class
Ex. "I wish there had been more girls in the class."

Code Word	Parent	Text	Level	Added	Modified
NOM	GIR	YES	2	09/30/99	11/03/99

gender doesn't matter at all
ex. "It doesn't matter to me how many girls are in the class"

Code Word	Parent	Text	Level	Added	Modified
RAN	GIR	YES	2	09/29/99	11/03/99

reference to rank in class
ex. "I am the smartest in the class"

Code Word	Parent	Text	Level	Added	Modified
REP	GIR	YES	2	09/29/99	11/03/99

feel as if representing all girls
Ex. "When I do well it makes girls look smart."

Code Word	Parent	Text	Level	Added	Modified
WHI	GIR	YES	2	09/29/99	11/03/99

reference to "whiz kids"
ex. "Well, with the expert kids, they always know that they are doing"

Code Word	Parent	Text	Level	Added	Modified
CHO	None		1	03/19/99	00/00/00

How to choose someone to ask for help

INT:Code Book--All Code Words 12/12/99 2:03:11 PM

Code Word	Parent	Text	Level	Added	Modified
CON	None		1	03/19/99	00/00/00
	conflict resolution				
DIF	None		1	03/19/99	00/00/00
	difference between peer and teacher help				
GIR	None		1	03/19/99	09/29/99
	reaction to being a girl in the class				
NOT	None		1	03/19/99	09/29/99
	Reason for not helping				
PRE	None		1	03/19/99	09/29/99
	preference for working alone, in partners, with people, etc.				
BET	NOT	YES	2	09/29/99	11/03/99
	teacher or another peer would give a better answer Ex. "I thought someone else could answer the question better"				
DIS	NOT	YES	2	09/29/99	11/03/99
	dislike the peer asking the question Ex. "I didn't help him because I don't really like him"				
DKN	NOT	YES	2	09/29/99	11/03/99
	don't know the answer ex. "I wouldn't help if I didn't know how to."				
LEN	NOT	YES	2	09/29/99	11/03/99
	question is too lengthy ex. "I wouldn't help if it would take too long or was too complicated"				
OWN	NOT	YES	2	09/29/99	11/03/99
	Need to do own work, busy, no time ex. "I need to get my own work done." "I was on a roll."				

INT:Code Book--All Code Words 12/12/99 2:03:11 PM

Code Word	Parent	Text	Level	Added	Modified
REC	NOT	YES	2	09/29/99	11/03/99

feel being taken advantage of/ no reciprocity
ex. "Well, if he could never help me out, why would I help him?"

ALO	PRE	YES	2	09/29/99	11/03/99

prefer working alone
Ex. "I would rather work by myself than with a group"

FUN	PRE	YES	2	10/09/99	11/03/99

someone who is fun in the group
Ex. "I would want to have fun in my group"

GRO	PRE	YES	2	09/29/99	11/03/99

Prefer working in a group
ex. "I would prefer to work with partners"

HAP	PRE	YES	2	09/29/99	11/03/99

happy with the amount of interaction in the classroom
ex. "I like the amount of interaction in the class"

ISO	PRE	YES	2	09/29/99	11/03/99

prefer working in complete isolation
ex. "I'd prefer to work in a room alone."

NIS	PRE	YES	2	09/29/99	11/03/99

do not prefer total isolation
ex. "I would rather be in the classroom with other people than in a room alone."

NWT	PRE	YES	2	10/09/99	11/03/99

doesn't waste time in group
Ex. "I would want someone in my group who doesn't watse time"

UNH	PRE	YES	2	09/29/99	11/03/99

unhappy with the amount of interaction in the classroom
ex. "I wish there was more (less) talking in the class."

INT:Code Book--All Code Words **12/12/99 2:03:11 PM**

Code Word	Parent	Text	Level	Added	Modified
WWG	PRE	YES	2	10/09/99	11/03/99

want in my group because work well with a group
Ex. "I would want someone in my group who works well with the group"

Coded Version of AB10-18M 12/12/99 1:05:43 PM

Interview with Anne Bobel, Monday
10/18/99, outside steps at Marist,
2:00-2:14 pm, people keep walking by

Tape 5A

#-NIS
I: Some people have told me that wish in their computer science classes they could just get the assignment from the teacher and then go into a separate room with a locked door and just work on their assignment totally alone. How would you react to that?

AB: That might be better but a lot of times I find that I need more attention from the teacher and a lot of times I don't know how to figure out how to do something on my own, so I do like being in a classroom situation with a teacher and other kids that can help me figure it out.

#-TFI
I: When you have a question on your program what's your first instinct to get it resolved, what do you usually do?

AB: Well, I usually go and I look and I see if I can figure it out and then if I have no clue, I'll probably, I just raise my hand and ask the teacher.

#-HAP #-PRO
I: O.K. As far as the amount of interaction between students in the class, is it a good amount? Would you like more or less?

AB: There's actually, there's a good amount. Like the kids who sit around me we always ask each other questions and stuff. So, I mean, it's a good amount I guess.

#-HAP
I: How does it compare with the amount of interaction among students in your other classes.

AB: Well, in my other classes it's like we're not-I interact with kids, but not about the stuff that we're learning, more about the weekend and stuff like that. And then in my computer class it's more like we don't really talk about any other stuff except, "how do you do this?"

#-PRO #-SOC #-PAC

Coded Version of AB10-18M 12/12/99 1:05:44 PM

I: O.K. When you do have a question and you are gonna ask one of your classmates for help, which is the first classmate you usually ask for help?

AB: Devon Misel, 'cause he sits right next to me. And then if he can't help me the kid who sits behind me, Chris I don't know his last name.

I: O.K. Are they both pretty good with computers?

AB: Chris is I know, but Devon sometimes figures things out right before I do, so he helps me out, but, I mean, he's probably about like me maybe a little better.

#-PRO

I: So how did you pick those two to ask questions?

AB: Because they're right near me.

I: O.K. So if they were across the room…

AB: Then I wouldn't ask them, I'd ask whoever sat next to me.

#-SMA

I: O.K. How about if even the person who was awesome who was the best with computers sat across the room, would you go over there?

AB: Well, yeah, this kid Evan, he's really good at it, and so sometimes he usually finishes his project a few days before me, so I go and ask him.

I: O.K. But you don't ask him first or second…you ask him…When would you ask him?

AB: If the other people can't answer my question.

I: O.K.

AB: Or if they're busy or something.

#-TFI #-TEM

I: Gotcha. And also you listed the teacher asking-you ask him first? Before any of the students?

AB: Un hm. [yes] Right.

I: Why's that?

AB: Well, a lot of the times he answers it the quickest and he knows what he's

Coded Version of AB10-18M 12/12/99 1:05:44 PM

doing a lot better than the students, I mean he'll just look at my code and say, "well, you have a problem right there," and then I can fix it. But a lot of times I guess students don't know what to look for when they have code that's messed up, so…that's it. #

#-TEM #-STM
I: Do they…I wasn't sure if you were going on (laughing)-do they help you in the same way? Like when the teacher helps you, does he help you the same way the students help you? #

AB: Well Mr. Yoder actually makes me look at it and he's like, "O.K. Well now look at this. Does this look right? You have the property, but, here," or whatever and so actually makes me think about it. I'm like, "Oh yeah, I could change that," and he's like, "is that the best way to go about doing that?" and I'm like, "Maybe." He's like, "Or could you do something else?" And he kinda makes me think about it but with like, I guess the students. I'm like, "how do you do this?" and they tell me the code. And then I put it in. #

#-PRT #-TAB
I: Which one do you prefer? #

AB: Mr. Yoder's way, just because then he helps me understand it, but a lot of times he's helping other kids in the class so if I need a quick answer and I'm just fed up with trying to understand it I'll just be like, "how do you do this?" #

#-FRI
I: O.K. Do you remember how you originally chose where to sit in that class? #

AB: I think it was because I was the last student in the classroom, and I'm the only girl so it was kinda like I didn't want to go… I don't know-there was just a seat kinda like up in the front like next to Devon, and I know Devon, so I sat next to him. #

#-FIN
I: How does your being the only girl figure into that statement? #

AB: I mean it's fine, because I'm older

Coded Version of AB10-18M 12/12/99 1:05:45 PM

than most of them. I'm the only senior in the class, so I mean it's not bad. I'm not intimidated or anything.

I: O.K. How-I mean… I was unclear how you brought it up like where you chose to sit. I'm not sure how did that figure in? I mean if you were one of fifteen girls would you have sat in the same spot?

#-FRI
AB: Oh. Well I just sat next to somebody that I knew.
#-FRI

I: O.K.

AB: I mean I-Devon was actually one of the only ones I knew in the class.

I: O.K. Do you ever change seats?

AB: Sometimes if my computer's not working.

I: Oh.

AB: But usually we all just sit in the same seats.

#-NOM #-FRI
I: O.K. If you had a choice-alright let's say that class has fifteen people in it, how many would you want to be girls?

AB: It doesn't really matter, I don't think. I mean I just, I think it's funner having a friend or two no matter if they're a boy or a girl in the class. I mean it doesn't really matter I guess to me.

I: O.K. So one is fine…

AB: yeah

I: seven would be fine…

AB: Yeah. That's fine.

I: … Funner is a word as far as you know.

AB: Funner yeah. (laugh)

#-FRI
I: So how many friends do you have in that class that you feel like you're pretty close with?

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```
AB: Maybe two.                                  257   |
                                                      |
I: O.K.  and Devon…                             259   |
                                                      |
AB: Devon and that Evan kid who's there.        261   |
                                                     -#
#-NOM
I: O.K.  Do you think the fact that             263  -#
  you're the only girl does that affect         264   |
  the way you work or behave in any way?        265   |
                                                      |
AB: …No.  I don't think so.                     267  -#

I: O.K.  I was just thinking that               269
  sometimes if you are the only one you         270
  might think-you know things you do            271
  might                                         272
  become magnified.  Like you might             273
  think…                                        274

#-NOM
AB: Yeah.  No I seem to be the one that         276  -#
  asks a lot of questions, but I mean I         277   |
  don't think they look at me any               278   |
  different. I hope…(laughs)                    279  -#

I: O.K.  I was just curious.  Like the          281
  story I always compare this to is,            282
  when                                          283
  I was growing up, the rabbi's children        284
  in my town would say they didn't even         285
  feel like they could go into a                286
  restaurant to get something like a            287
  Coca-Cola that would be kosher,               288
  because                                       289
  people would say, "Oh my gosh, those          290
  are                                           291
  the rabbi's kids.  They're going into         292
  that non-kosher restaurant."  So I            293
  didn't know if that tied in with your         294
  experience and computer science class         295
  in                                            296
  any way.                                      297

#-NOM
AB: …I don't know.  I mean I don't think        299  -#
  it's a big deal.                              300  -#

#-FIN
I: O.K.  So you're happy.  You're fine          302  -#
  with being the only one?                      303   |
                                                      |
AB: Yeah, I thought it was funny when I         305   |
  walked in.  And I was just like,              306   |
  "Right." (sarcasm)                            307  -#

#-ALO
I: (laugh) As far as working on your            309  -#
  projects, if you had your choice,             310   |
  would                                         311   |
  you prefer the way you do it now, or          312   |
  would you prefer to work on a single          313   |
  computer in a group?                          314   |
                                                      |
AB: Hm…I think the way we do it now,            316   |
  because that way you can get your own         317   |
  answers and put it into your own              318   |
  computer instead of having to work all        319   |
```

Coded Version of AB10-18M 12/12/99 1:05:45 PM

```
  together on one computer.                320   |
                                                 |
I: What would be the downside of that?     322   |
                                                 |
AB: I think a lot less individual          324   |
  learning, because you can't actually     325   |
  yourself just go in there and type in    326   |
  the code and then get your own result.   327   |
  Instead you have to-and you don't        328   |
  figure                                   329   |
  it out yourself.  It's like everybody    330   |
  trying to do it together.  And then      331   |
  when                                     332   |
  you do have to go do it yourself it's    333   |
  like you can't.                          334  -#

I: O.K.  If you did have to have a         336
  group, what size group would you want?   337

AB: Probably a small group like two or     339
  three people at the most.                340

#-PAC
I: O.K.  And what would you be looking     342  -#
  for in your partner or partners?         343   |
                                                 |
AB: Probably people with the same          345   |
  learning ability as me.  Just because    346   |
  if                                       347   |
  I had two really smart people in my      348   |
  group and I was not as skilled on the    349   |
  computer, or whatever, then I would      350   |
  feel                                     351   |
  like they would do it all themselves,    352   |
  y'know.  And then I would just try to    353   |
  pick up things as they went.  But if     354   |
  it's like three or two people of the     355   |
  same learning ability, it's like… you    356   |
  learn together and you're on the same    357   |
  wavelength.                              358   |
                                                 |
I: Gotcha.  Would it matter to you if      360   |
  they were friends?                       361   |
                                                 |
AB: No. (casually)                         363  -#

#-PRO        $-OWN
I: Let's say I were in that class, and I   365  -#-$
  had a question about my program.  Just   366   | |
  take me through step by step, how        367   | |
  would                                    368   | |
  I go about getting help from a           369   | |
  classmate?                               370   | |
                                                 | |
AB: Usually you just find somebody who's   372   | |
  not really working or you look at the    373   | |
  person next to you and you're like,      374   | |
  "could you help me on something?" and    375   | |
  they're like, "O.K."  Or if they're      376   | |
  like, "hold on let me do this," and      377   | |
  then                                     378   | |
  you're like, "well that's O.K., I'll     379   | |
  just ask somebody else."  And that's     380   | |
  about it.                                381  -# |
                                                   |
I: So, they might not help you if          383     |
  they're working on something else?       384     |
                                                   |
```

Coded Version of AB10-18M 12/12/99 1:05:45 PM

```
AB: Well, right.  I mean, yeah I guess      386      |
  not.                                      387      |
                                                     |
I: Why's that?                              389      |
                                                     |
AB: Well sometimes if you're on a roll      391      |
  and you know exactly what you are         392      |
  doing,                                    393      |
  and you just have seventy thoughts        394      |
  running through your head, it's kind      395      |
  of                                        396      |
  like you don't want to be interrupted     397      |
  and have somebody be like, "wait can      398      |
  you                                       399      |
  help me with this?"  And you're like,     400      |
  "hold on, hold on, let me just finish     401      |
  this real quick."                         402    -$

#-LEN
I: How about if I asked a question that     404  -#
  was gonna be really lengthy, do you       405   |
  think I am as likely to get an answer     406   |
  from a classmate?                         407   |
                                                  |
AB: Probably not.  A lot of people are      409   |
  like, "Uh, you better ask Mr. Yoder       410   |
  about that one."  You know. But…          411  -#

#-ASS        #-AST
I: How about if I ask a question… (tape     413  -#
  cuts off)… We're back. Suppose I          414   |
  had--a                                    415   |
  student just walk by-I know I am going    416   |
  to forget that later,                     417   |
  otherwise-suppose                         418   |
  somebody tells me an answer and I         419   |
  don't                                     420   |
  agree with the answer.  What would I      421   |
  do?                                       422   |
                                                  |
AB: Well just be like, "Are you sure you    424   |
  do it that way?" and then if they're      425   |
  like, "I think so," then either ask       426   |
  somebody else or ask the teacher.         427   |
  Just                                      428   |
  be like, "well…" I think the teachers     429   |
  like it better when you have an idea      430   |
  about what you are doing instead of       431   |
  just                                      432   |
  being like, "tell me how to do this."     433   |
  If you are like, "well should I do it     434   |
  this way, or do you think this way        435   |
  would                                     436   |
  be better?"                               437  -#

I: Is that what you do if you…?             439

AB: Yeah.                                   441

#-TAL
I: O.K.  Some people have told me that      443  -#
  they have-they like to hear what the      444   |
  other person's thinking and then they     445   |
  say what they're thinking and then        446   |
  they                                      447   |
  sorta go back and forth in a mini         448   |
  debate                                    449   |
  or something.  Have you ever done         450   |
```

Coded Version of AB10-18M 12/12/99 1:05:46 PM

```
  that?                                          451   |
                                                       |
AB: Yeah, I'm like, "Well that wouldn't          453   |
  really work, because you have to watch         454   |
  out for this part," or it's just kinda         455   |
  like you go back and forth until you           456   |
  are                                            457   |
  like, you either convince the other            458   |
  person or the other person convinces           459   |
  you                                            460   |
  and if you can't reach…hit a stalemate         461   |
  then you ask the teacher I guess.              462   |
                                                       |
I: O.K.                                          464   |
                                                       |
AB: Or someone else.                             466   |
                                                       |
I: Do you feel like you learn from that          468   |
  conversation?                                  469   |
                                                       |
AB: Yeah.  Yeah I think you do.                  471   -#

#-DKN
I: If somebody asked you for help, is            473   -#
  there any reason that you might not            474   |
  help                                           475   |
  them?                                          476   |
                                                       |
AB: No, I mean if I didn't know the              478   |
  answer, of course.  But I think that's         479   |
  about it.                                      480   -#

I: O.K.  Do you think in that class that         482
  you ask more questions of your                 483
  classmates or they ask more questions          484
  of                                             485
  you?                                           486

AB: I ask more questions… of my                  488
  classmates.                                    489

I: O.K.  Do some people ask you for              491
  help?                                          492

AB: Sometimes, on occasion…but not               494
  really.                                        495

#-RAN
I: Are you doing pretty well in that             497   -#
  class?                                         498   |
                                                       |
AB: Yeah, not bad.  B I think or B+.             500   -#

I: Is it interesting? Do you like it?            502

AB: Yeah, I do like it a lot.                    504

I: I'm glad you took it then. (laugh)            506

AB: Yeah. (laugh)                                508

I: As far as the questions I am asking           510
  about interaction with other students,         511
  is there any question I didn't ask you         512
  that you think I should have asked             513
  you?                                           514

AB: …I don't think so.                           516
```

Coded Version of AB10-18M 12/12/99 1:05:46 PM

I: OK. Well thank you very much for your time. 518 519

AB: You're welcome. 521

OBS:Code Book--Summary 12/12/99 1:56:28 PM

Code Word	Parent	Text	Definition	Modified	Added
AVO	None	YES	avoiding giving help, or putting off	02/19/99	11/14/99
BOY	None	YES	general comment about girls/boys	11/14/99	11/14/99
CON	None	YES	conflict over proposed solution	02/18/99	11/14/99
DOI	None	YES	doing the work for the peer; any	11/14/99	11/14/99
FAR	None	YES	someone far away helping	11/14/99	11/14/99
FEM	None	YES	female peer help	11/14/99	11/14/99
GIV	None	YES	giving help	02/18/99	02/19/99
GRO	None	YES	(teacher-assigned) group or partner	11/14/99	11/14/99
LOK	None	YES	Looking at someone's program	02/18/99	11/14/99
MAL	None	YES	male peer help	11/14/99	11/14/99
MUT	None	YES	muttering to oneself	02/18/99	11/14/99
NEI	None	YES	nearby peer helping	11/14/99	11/14/99
PAC	None	YES	peer help at same pace/place	11/14/99	11/14/99
RAN	None	YES	reference to rank in class	11/14/99	11/14/99
SHS	None	YES	sharing success or surprise with	02/18/99	02/18/99
SOC	None	YES	Social interactions	02/18/99	02/21/99
ST-GET	None	YES	acquiring help from peers	02/19/99	11/14/99
SUG	None	YES	suggesting a solution, either in	02/18/99	11/14/99
TE-GET	None	YES	getting help from the teacher	11/14/99	11/14/99
TE-WAIT	None	YES	waiting for the teacher to come help	11/14/99	11/14/99
TEL	None	YES	telling the peer directly how to do	11/14/99	11/14/99

OBS:Code Book--All Code Words 12/12/99 1:56:37 PM

Code Word	Parent	Text	Level	Added	Modified
AVO	None	YES	1	02/19/99	11/14/99
	avoiding giving help, or putting off giving help				
BOY	None	YES	1	11/14/99	11/14/99
	general comment about girls/boys				
CON	None	YES	1	02/18/99	11/14/99
	conflict over proposed solution				
DOI	None	YES	1	11/14/99	11/14/99
	doing the work for the peer; any time the keyboard is touched by a different person				
FAR	None	YES	1	11/14/99	11/14/99
	someone far away helping				
FEM	None	YES	1	11/14/99	11/14/99
	female peer help				
GIV	None	YES	1	02/18/99	02/19/99
	giving help				
GRO	None	YES	1	11/14/99	11/14/99
	(teacher-assigned) group or partner work				
LOK	None	YES	1	02/18/99	11/14/99
	Looking at someone's program				
MAL	None	YES	1	11/14/99	11/14/99
	male peer help				
MUT	None	YES	1	02/18/99	11/14/99
	muttering to oneself				

OBS:Code Book--All Code Words 12/12/99 1:56:37 PM

Code Word	Parent	Text	Level	Added	Modified
NEI	None	YES	1	11/14/99	11/14/99
	nearby peer helping				
PAC	None	YES	1	11/14/99	11/14/99
	peer help at same pace/place				
RAN	None	YES	1	11/14/99	11/14/99
	reference to rank in class				
SHS	None	YES	1	02/18/99	02/18/99
	sharing success or surprise with others				
SOC	None	YES	1	02/18/99	02/21/99
	Social interactions				
ST-GET	None	YES	1	02/19/99	11/14/99
	acquiring help from peers				
SUG	None	YES	1	02/18/99	11/14/99
	suggesting a solution, either in general terms or by asking questions				
TE-GET	None	YES	1	11/14/99	11/14/99
	getting help from the teacher				
TE-WAIT	None	YES	1	11/14/99	11/14/99
	waiting for the teacher to come help				
TEL	None	YES	1	11/14/99	11/14/99
	telling the peer directly how to do something, showing them how you did it, speaking in computer code				

Coded Version of MVB110-4 12/12/99 1:02:22 PM

```
Monday 10/4/99, Marist Visual BASIC 1st      1
  period, 8:15-9:10, 1G/15 today             2

8:15 AB enters, after bell, sits behind      4
  me on separate row as B already in her     5
  seat.                                      6

me  B B B B                                  8
AB  B B B                                    9
    B B B B                                 10
    B B B                                   11

8:19-8:23 After prayer ends, T going         13
  over assignment. Written on board "1       14
  full day of coding PRIME. Read handout     15
  6-12 to 6-19-for next loops,               16
  factorial, string comparison and           17
  construction." T asks if anything else     18
  upcoming, AB says "test." Then 30          19
  seconds later AB mentions no school on     20
  Monday, which was planned test day.        21

8:25 people working quietly on their own     23
  programs.                                  24

#-TE-GET
8:28 AB asks T question as he walks by.      26  -#
  Turns into a series of questions, much     27   |
  of which revolved around the crux of       28   |
  the                                        29   |
  prime program. He asks her leading         30   |
  questions about how she would teach a      31   |
  young girl how to check to see if a        32   |
  number is prime, which she answers.        33   |
  8:32                                       34   |
  T leaves after recommending pseudocode     35   |
  first-then call him back over.             36  -#

#-TE-GET     $-TE-WAIT
8:35 AB raises her hand for T, who goes      38  -#-$
  to help a B first. She puts her hand       39   | |
  down. 8:38 re-raises hand and T comes      40   | |
  over. AB asks him to go over her code.     41   |-$
  He looks at her code and suggests the      42   |
  next step, and then turns things           43   |
  around                                     44   |
  and asks her questions about what to       45   |
  do                                         46   |
  next. As she suggests what needs to be     47   |
  done, he helps her translate it into       48   |
  code. 8:42 T leaves to help B with         49   |
  hand                                       50   |
  up.                                        51  -#

#-TE-GET     $-TE-WAIT
8:43 AB hand back up, but T still            53  -#-$
  helping B…so hand back down. 8:45 T        54   | |
  (just finished helping B) over to help     55   | |
  in response to her raised hand. She        56   |-$
  asks                                       57   |
  about an undeclared variable. She          58   |
  decides (after prompting) that it is a     59   |
  local variable. 8:46 T moves on.           60  -#

#-ST-GET     #-MAL        #-NEI
8:53 asks Devon if he knows what he is       62  -#
  doing, and Devon says no. B in her         63   |
  seat                                       64   |
```

Coded Version of MVB110-4 12/12/99 1:02:23 PM

```
  comes over to help instead, and pulls    65   |
  up                                       66   |
$-DOI
  the chair behind to help her out. He     67   |-$
  uses the arrow keys on the keyboard to   68   | |
  try to locate her problem.               69  -#-$

8:54 before B is able to help AB, T        71
  announces to class that pseudocode       72
  helps                                    73
  a lot and then goes to board and says    74
  he                                       75
  will be the scribe for class             76
  suggestions. At 9:00 T says if you       77
  call                                     78
  me over I expect to see                  79
  pseudocode-"I'm                          80
  not going to ask you 20 questions to     81
  come up with this stuff."                82

#-ST-GET     #-NEI        #-MAL
9:01 B has been at AB's seat all the way   84  -#
  through T talk and now begins to help    85   |
$-TEL
  her. He tells her what she can do, by    86   |-$
  pointing at screen and describing in     87   | |
  detail. T announces he is going over     88   |-$
  pseudocode with 1 B at 9:03, but AB      89   |
$-DOI        $-TEL
  stays with B. He types something on      90   |-$
  her                                      91   | |
  screen, then continues to advise her     92   | |
  (dim blah blah as a string). 9:08        93   |. |
  announcements come on and B returns to   94   |-$
  seat to log out. AB cleans up too.       95   |
  Then                                     96   |
  B returns to help 30 seconds later.      97   |
  Devon comes over and looks over          98   |
  shoulder                                 99   |
$-SUG
  for 10 seconds until bell rings. B      100   |-$
  still                                   101   | |
  advising her after bell has run "if     102   | |
  there are 2 factors have to show it's   103   | |
  prime; if not more than 2 show it's     104   | |
  not                                     105   | |
  prime." AB asks if he can help again    106   | |
  tomorrow, and he says yes.              107   |-$
                                                -#
At 9:11 she leaves after saying to me     109
  "This is not fun."                      110
```

Table 1. Classes

School	Language	Level	Course Length	Number of Girls	Grade Range
A	Visual BASIC	Introductory	Trimester	1 of 15 students	8–12
A	Visual BASIC	Introductory	Trimester	2 of 16 students	8–12
A	C++	Intermediate	Trimester	1 of 11 students	9–11
A	C++	AP	Year	1 of 9 students	9–12
B	Pascal	Introductory	Year	11 of 26 students	10–12
B	Pascal	Introductory	Year	6 of 26 students	10–12
B	C++	AP	Year	3 of 14 students	11–12

Table 2. Participants (Pseudonyms)

Name	Grade	Course	School	Female Enrollment	Ethnicity
Erin	12	Introductory1	B	11 of 26	White
Robin	11	Introductory1	B	11 of 26	African American
Janice *	11	Introductory1	B	11 of 26	African American
Martina	11	Introductory1	B	11 of 26	Czech
Sandy	12	Introductory1	B	11 of 26	Vietnamese
Allison	11	Introductory1	B	11 of 26	African American
Nancy	11	Introductory1	B	11 of 26	African American
Noreen	12	Introductory1	B	11 of 26	Indian/British
Paula	11	Introductory1	B	11 of 26	African American
Mary	11	Introductory1	B	11 of 26	African American
Selena	11	Introductory1	B	11 of 26	West African
Amanda	12	AP	B	3 of 14	Vietnamese
Stephanie	12	AP	B	3 of 14	Burmese
Rashaun	12	AP	B	3 of 14	African American
Jocelyn	11	Introductory2	B	6 of 26	Nigerian
Janene	11	Introductory2	B	6 of 26	White
Tandy *	12	Introductory2	B	6 of 26	African American
Darné	10	Introductory2	B	6 of 26	Polish
Melony	11	Introductory2	B	6 of 26	Greek
Lilly	12	Introductory2	B	6 of 26	African American
Bobbie	12	Introductory1	A	1 of 15	White
Kally	12	AP	A	1 of 9	White
Sabrina	11	Introductory2	A	2 of 16	White
Jill	12	Introductory2	A	2 of 16	White
Vanessa	10	Intermediate	A	1 of 11	White

* parents would not consent to grant interview permission

Table 3. Determinants of Peer Help-Seeking

Name	proximity	knowledge	friendship	Gender	Willing to help	Similar pace or level	Similar project	Spoken language
Erin	x	x	x					
Robin	x	x	x					
Martina	x	x	x					x
Sandy	x	x		x-female				
Allison	x	x			x			
Nancy	x	x		x-male				
Noreen	x	x	x					
Paula	x	x						
Mary	x	x	x					
Selena	x	x	x		x			
Amanda	x			x-female				
Stephanie	x	x	x					
Rashaun	x	x	x	x-female		x		
Jocelyn	x	x						
Janene	x	x	x					
Darne	x	x	x					
Melony	x	x	x		x	x		
Lilly			(x)		(x)			
Bobbie	x	x	x			x		
Kally	x	x	x	x-female				
Sabrina	x	x	x		x	x	x	
Jill	x	x	x					
Vanessa	x	x	x					

(x) = has not asked classmates for help, but imagines that these are factors