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Contents

Introduction

Although they'd like to, most K-12 classroom teachers of mathematics, science, and technology don't know how to recognize gender bias or correct it. As a result, the women of the future will continue to be underrepresented in these fields.

You can teach your pre-service teachers to do better.

"What?" you may be saying "Gender equity again? We did that already in the 80's!" We did, it's true, but there are two reasons to do it again or rather, still.

- Although there has been progress toward gender fairness, there is still a long way to go.

- Pre-service teachers now in school don't benefit from the attention to gender equity common 15 or 20 years ago.

This nationally field-tested book will help you and your colleagues determine the extent to which there is a need at your college or university for attention to gender equity in the education program. The goal is to help you integrate gender equity throughout the process of preparing new teachers — in education courses, content courses, and in their field experiences — and throughout the policies and procedures of your education program. Because this guide was developed from a grant from the National Science Foundation we concentrate on mathematics, science, and technology, but it is adaptable to other content areas as well.

Developed in the Teacher Education Mentor Project (1996-1999), a draft of this book was tested in seven participating universities. Each university created an equity team, consisting of education faculty and others of their choice (Arts and Sciences faculty, partner school teachers, pre-service students, recent graduates, students, deans of education, campus diversity specialists, etc.). Each university received guidance from a mentor who was experienced in implementing gender equity in university education programs. They were:

University	Team Leader	Mentor
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Cherry Brewton, Georgia Southern University, served as a mentor to the seventh university which later withdrew from the project. The book was improved by everyone's suggestions, comments, and contributions. The team leaders and mentors would be happy to give you more information about their experience.

According to the independent evaluator, Dr. Patricia B. Campbell, President of Campbell-Kibler Associates Inc., both individual and institutional gender equity change occurred as a result of the Teacher Education Mentor Project. [1] The foundation of the project was a needs assessment process, based on this book, that was carried out by the equity team of each university. The assessment had multiple values:

- *It pointed out particular problem areas,*
- *It was an instructive experience for the team,*
- *And it built the commitment of team members to remedy the problems they found.*

In response to their needs assessment findings, equity teams integrated gender equity into these institutional and individual areas:

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[1] Campbell, Patricia B.; Hoey, Lesli; and Bachmann, Kathryn Acerbo (1999). The Teacher Education Mentor Project (TEMP) Final Evaluation Report. Groton, MA: Campbell-Kibler Associates, Inc.

Institutional gender equity activities

Evaluations of student teachers
Evaluations of professors
Adding an equity course
Departmental curriculum change, often coordinated
Hiring, promotion, and tenure
New faculty and teaching assistant orientation
New annual Equity Day
Workshops for partner school personnel
Other collaborations with partner schools

Individual gender equity activities

Incorporating teaching activities into classes
Adding projects or action research topics
Inviting specialists to class
Adding to syllabus in the form of readings, tests, grades, projects
Presentations to colleagues within university and/or at professional meetings
Participation in commissions, university to statewide
Publication of articles
Writing dissertations
Winning new grants

Certainly, at the heart of the matter are individual instructors who teach their pre-service students about gender bias and gender equity. But if an individual instructor does so while others don't, or if that instructor should leave the university, the chances are slim that the majority of students will learn about gender equity. For broader impact, gender equity needs to be treated as an essential part of the education curriculum and a part of the department's, school's, or college's culture. Indeed, we have seen this happen with multicultural education (Gollnick, 1995).

Fairness at the Source builds on an earlier project my colleagues and I conducted. It produced a two-volume set of books on gender equity content and teaching activities and materials for education professors and their students (Sanders, Koch & Urso, 1997). Now with this new book, you have all the resources you need to improve the status of gender equity at your institution.

Acknowledgments

Fairness at the Source has greatly benefited from review comments and the suggestions of many people. I am grateful to:

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Chapter 1
Issues in Gender Equity in Education

National figures show that girls and women are still far from equally represented in mathematics, science, and technology (MST) education and occupations. For example:

- In 1998, only 20% of the Advanced Placement test takers in computer science were female. [2]

- Only 18% of bachelor's degrees in engineering were awarded to women in 1996 — and only 12% of the Ph.D.s. [3]

- Women are 46% of the labor force, but only 22 percent of the science and engineering workforce. [4]

When this happens, we as a nation lose access to a significant portion of our talent. In addition, women who are talented in MST lose access to good careers, and female citizens lack the mathematical, scientific, and technological literacy our society requires.

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[2] College Board (1998). Advanced Placement Program Summary Reports.

[3] Chronicle of Higher Education, August 27, 1999.

[4] National Science Foundation (1999). *Women, minorities, and persons with disabilities in science and engineering*. Arlington VA: National Science Foundation (NSF 99-338)

Where do these imbalances come from?

This chapter provides a brief introduction to some of the major gender equity issues in the K-12 classroom, with particular attention to mathematics, science, and technology classrooms. While these issues certainly affect girls, they also affect many boys in K-12 classrooms, particularly the less aggressive or the quieter boys. The material is for those who have little or no background in gender equity — being at least somewhat familiar with the issues is helpful in carrying out the needs assessment process. You may want to consult more extended coverage in sources listed in the bibliography if you'd like more background knowledge.

Embedded Values, Beliefs, and Assumptions about Gender

The terms "gender" and "sex" are strongly related and often overlap in common usage. It is, however, useful to distinguish them. A person's sex refers to the biological aspects of an individual's body relative to reproduction, while gender refers to the social constructions that express for an individual what it means to be masculine or feminine within a given society. In other words, sex is what we're born with, and gender is what we learn.

Why Most Gender Bias is Inadvertent

Many studies have established that, from the moment infants are identified as female or male, the development of a gendered identity begins as they experience familial, societal, and cultural interactions (Golombok & Fivush, 1994; Lindsey, 1997). Starting at birth, girls are rewarded for being polite, behaving well, and looking pretty, while boys are reinforced for their accomplishments, their assertiveness, and winning (Schau & Tittle, 1985; Vogel, Lake, Evans & Karraker, 1991). But are there innate differences?

Available research suggests that in most ways, especially biologically, boys and girls are more similar than different (Campbell & Storo, 1994; Hyde, Fennema, & Lamon, 1990; Hyde, Fennema, Ryan, Frost, & Hopp, 1990). It is society's emphasis on gender difference that creates two separate sets of values, beliefs, and assumptions for girls and for boys that restrict opportunities for each sex.

By referring to gender values, beliefs, and assumptions as "embedded," we recognize that most gender bias, inside or outside the classroom, is inadvertent. Babies learn "maleness" and "femaleness" in the same way they learn about gravity and heat, by frequent personal experience. These lessons become embedded in children's understanding of the nature of reality. As we grow up we carry them with us throughout our lives, often without being conscious of them.

To shed some light on the origin of gender-role attitudes, a number of "Baby X" experiments have been conducted in which adults interact with a baby labeled as male or female and are asked to characterize it. For example, Seavey, Katz & Zalk (1975) told a third of the adults that a baby was male, a third that the baby was female, and a third were given no information about the baby's sex. The same baby was presented to each group. Adults believing they were playing with a girl tended to choose a female toy (a Raggedy Ann doll). Adults believing the baby to be a boy tended to choose either a gender-neutral toy (a plastic ring) or a male toy (a small rubber football). Interestingly, adults who were not told the baby's sex almost uniformly exhibited an immediate need to decide which it was, implying that they had no gender-neutral guide for interaction with a baby. These adults made judgments based on "his" strong grip or lack of hair, or "her" softness or fragility, before choosing a toy for it.

Thinking about this experiment from the baby's point of view for a moment, the implication of this and other Baby X studies is that children — i.e., all of us at one time — experience the world differently according to the adults' identification of them as male or female (Leinbach, Hort & Fagot, 1997). Vetter (1994) cites a study by Patricia Bauer which found that children as young as 24 months know enough about gender to classify themselves as boys or girls. Bauer also found boys will not play games involving changing a teddy bear's diaper, nor will girls play at "building" a garage. We all learn to generalize on the basis of sex, and we learn it pre-verbally perhaps even more powerfully than we learn it consciously. It is no wonder that we in turn treat others differently according to their sex, and behave in ways that are considered "appropriate" for our gender. Interests also become gender-identified: in the United States, it is assumed "natural" for girls to be interested in dance and art and for boys to be interested in mathematics, science, technology, cars, and airplanes. In fact, these interests may have been learned. Because the distinction is embedded in our daily lives, we are only partially aware of our bias. (Valian, 1998)

Gender bias in the classroom, therefore, is ubiquitous, almost always unintentional, and usually unconscious. Accordingly, it is no surprise to learn that women, even some self-identified feminists, exhibit gender bias about as much as men do. Sadker & Sadker wrote, " . . . most studies have found no interaction differences in male- or female- taught classes . . . or that female instructors were more equitable" (1991, p. 297).

Clearly then, there is no place for anger, blame, or other polarizing reactions. To do so simply exacerbates an already polarized situation, making productive solutions more difficult to achieve. Moreover, blame creates resistance to acknowledging and addressing biased behaviors, setting us even further behind.

Mathematics, Science, and Technology as Male Domains

The constructed expectation that mathematics, science, and technology are male domains is reinforced by the obvious predominance of men in these fields, both in number and positions of responsibility. Female students are under-represented at the upper academic levels, and they may be less expected to excel.

Such expectations are often reflected unconsciously by parents, friends, teachers, and the media. Females are educated in a social environment which "knows" that women have a natural aversion to science; that the mastery of science's tools and discourse is difficult for women, and that the potential pool of capable women scientists is small (Brush, 1991; Fox, 1996; Hansen, 1996; Kahle, 1990). These beliefs, while not supported by research, create their own reality for girls and women. Otherwise capable women believe the MST fields are inappropriate for them. These women fail to pursue mathematics, science, and technology courses as far as they could (Madigan, 1997; NCES, 1997; Hill, 1995; Rayman & Brett, 1993) thus shortchanging themselves and society with an ever-increasing need for a work force that has strong technical and scientific foundations.

Causal Attribution

Causal attribution theory has explored how students attribute academic success and failure, as opposed to objective measures of their performance. Following Weiner's 1974 work, attribution theory distinguishes locus of control — internal or external, and the stability or instability of control, as follows:

Causal Attribution Matrix

	LOCUS: EXTERNAL	LOCUS: INTERNAL
STABLE	Task difficulty	Ability
UNSTABLE	Environment	Effort

Examples to explain success

External/stable	The exam was easy. The teacher likes me.
Internal/stable	I am good at this. I have high ability.
External/stable	I was lucky today. I got a lot of help on this exam.
External/unstable	I studied hard for this exam.

Years of research indicate that in the aggregate, when males succeed they tend to attribute their success to ability (stable/ internal). Females attribute their success to effort (unstable/ internal) (Leung, Maehr, Harnisch, 1996; Swim & Sana, 1996; Wolleat, Pedro & Fennema, 1980). Conversely, many males tend to attribute failure to external factors such as an unusually hard exam or a bad day, while many females tend to attribute their failure to internal factors such as a lack of talent. Attribution theory therefore clarifies the disconnect teachers often see between girls' ability and their *assessment* of their ability, particularly common in MST classes. Despite their actual academic performance, girls often underestimate their ability and boys often overestimate theirs. Moreover, there can be the implication that students who try hard, which girls are taught early to do, must be compensating for low ability. The very act of trying hard to succeed can imply to females that they must not be very smart.

A deep discontinuity can exist between stereotypical female behavior expectations and how learning best takes place in mathematics, science and technology, creating what Orenstein (1994) identifies as "a circular relationship among girls' affection for science [and mathematics], their self-esteem, and their career plans." A recent meta-analysis of self-esteem studies found self-esteem higher among males than females (Kling, Hyde, Showers & Buswell, 1999). A girl who participates fully in a challenging MST class can experience conflict with her constructed definition of femininity, something that adolescents find especially difficult. Orenstein (1994) describes the self-limiting ways girls she observed responded to such conflict by exhibiting behaviors that are "a flight toward traditional femininity." As one of them confided, " ...guys like it if you act all helpless and girly, and so you do." This learned helplessness is counterproductive to achievement. While some boys exhibit it, learned helplessness is primarily a female trait (Kloosterman, 1990).

Boys are often taught problem-solving skills such as anticipating obstacles and brainstorming potential solutions. Girls who face the inevitable academic roadblocks often find "help" from peers and teachers who finish tasks for them rather than coaching them to find their own solutions. Knowledge received passively is not easily retained. The "help" girls receive carries a double price. Girls not only learn to doubt their ability to solve problems autonomously, but also find they have difficulty recalling previous learning necessary for new concepts and processes (Fennema & Peterson, 1995). Both aspects erode their confidence and self-esteem. As their confidence falters, competence follows suit, deepening their initial lack of confidence.

Research has repeatedly shown that confidence is strongly correlated with achievement in mathematics, particularly in girls. Yet even when they perform as well as boys, girls' confidence drops significantly during their middle-school years, with girls who view the subject as 'male' showing consistently poorer performance than girls who do not hold that view (AAUW, 1991;

AAUW, 1992; Fennema & Sherman, 1977; Kloosterman, 1977; Meyer & Koehler, 1990). Claude Steele has drawn attention to the vulnerability of older "nontraditional" students (e.g., women in mathematics, African-Americans in academics in general) to what he terms "stereotype threat," and the way in which subtle influences can cause disproportionately severe dropout consequences for them (Steele, 1997). A fascinating validation of Steele's theory is a study of the math performance of Asian-American women which found that their scores went up when their ethnic identity was emphasized, and down when their gender was emphasized (Shih, Pittinsky & Ambady, 1999).

When a girl does succeed in "boy stuff" such as mathematics, science, and technology, constructed gender expectations may prevent the incorporation of these gains into identity. Girls often attribute their intellectual achievement to luck rather than ability, thus preserving their constructed femininity and discounting their ability. (Fennema & Peterson, 1984; Kloosterman, 1990; Fennema, et al., 1990) It is difficult to base career decisions on something as undependable as "luck."

Social Pressures

Research suggests the erosion in girls' self-confidence and self-esteem accelerates in adolescence as social pressures to behave in gender-appropriate ways increase (AAUW, 1991; Harter, 1990; Orenstein, 1994; Piper, 1994; Simmons & Blyth, 1990). During adolescence, peer pressure forces many girls to choose between academic and social success, and they often end up conforming to substantial social pressures to be "feminine" by avoiding public academic out-performance of male peers, especially in the male-identified domains of mathematics, science, and technology. One way of doing this, of course, is by not enrolling in these courses in the first place. (In the "private" realm of grades, girls tend to get higher grades than boys in most MST courses, according to national data.)

Pedagogy and Gender

There are a number of fairly subtle but cumulatively powerful pedagogical issues that play a large role in retention of girls in MST courses. Hard to understand dropout statistics become more comprehensible when these pedagogical issues are clarified.

Biased Teacher/Student Interactions

Gender-biased behaviors are often expressed and reinforced through unconscious behaviors on the part of teachers. Teachers of good intent often unintentionally bias their interactions with students (Sandler, Silverberg & Hall, 1996). Even teachers actively espousing ideals of gender equity often privilege male students over females because of their unconscious patterns of interaction (Sadker & Sadker, 1980, 1994). Small and often subtle behaviors serve to discourage girls and young women from educational excellence, especially within mathematics, science, and technology classrooms. Both male and female teachers have repeatedly been shown to exhibit gender-biased interactions with students (Sadker & Sadker, 1991).

While grossly overt acts of gender bias do sometimes occur, the majority of incidents are subtle. Individual incidents of this sort are trivial, but their accumulated impact emphatically is not. By the 12th grade, girls receive 1800 fewer hours of teachers' instructional interaction time (Kahle, 1994). Research shows that especially in traditionally male subjects such as mathematics, science, and technology, teachers more often call on boys, give boys longer response times, probe boys' responses with higher-level questions, and reward boys' assertive behaviors when they call out while reprimanding girls and reminding them to raise their hands (Grossman & Grossman, 1994; Lockheed & Klein, 1985; Sadker & Sadker, 1994). Research also shows that with training in recognizing and changing these biased behaviors, gender imbalances can be remedied (Kahle & Meece, 1994).

Physical Environment

The physical design and affective climate of the classroom can influence instructional patterns and student activities. (Rosser, 1990; Rosser & Kelly, 1994) Consider these environmental factors in the MST classroom:

Traditional	***Female- (and male-) friendly***
Desks attached to floor	Desks movable for small group work
Desks in rows, which promotes only teacher/student interactions	Desks in clusters, a U-shape, or a circular shape, which promotes student/student interactions also
Equipment hard to access	Equipment easily accessible
Little or no decoration on walls or only abstract or boring materials	Visually interesting and colorful (but age-appropriate) wall decorations
Bulletin board materials that show show only or mostly males in MST	Bulletin board materials that feature women's achievements in MST
Institutional environment:	Welcoming environment:
• *Walls painted an institutional color*	• *Walls painted a warmer, more interesting color*
• *Only fluorescent (cold) lights*	• *Some incandescent (warm) lights*
• *No living things*	• *Plants*
•*Blinds over windows*	•*Curtains over windows*

Collaborative Learning

Many females, as well as a sizable proportion of males, learn best in cooperative, collaborative learning environments which foster positive interdependence among group members (Dillow, Flack & Peterman, 1994; Streitmatter, 1994) — a model not unlike the real-world work environments of mathematicians, scientists, engineers, and technologists, where the work is often in project form and carried out by teams. To the extent that instructional strategies foster isolated, competitive models of learning and interacting, female as well as male students will be unnecessarily disadvantaged and unprepared for the world of work. Teachers who create opportunities for truly cooperative and collaborative learning support the preferred learning strategies of most of their students (Kahle & Meece, 1994).

Collaborative groups may be necessary, but they are not sufficient: it is important to ensure that a few dominant boys are not directing the others, using more than their fair share of the equipment, or acting as the problem-solver while asking a girl to act as note-taker. All of these developments defeat the purpose of collaborative learning groups (Horgan, 1995; Campbell, 1999).

Peer Aggression

Unpleasant behavior in collaborative learning groups leads us to the subject of peer aggression. Research has shown that during periods of classroom instruction, males who exhibit more aggressive behaviors receive more attention and therefore more help than females (Streitmatter, 1994). Aggression is a culturally sanctioned behavior for boys (“boys will be boys”) as is polite passivity for girls (“she’s such a little lady”). Within elementary grades this aggression is often physical, while in secondary settings it is usually verbal. In both settings the object of such aggression is usually girls and less assertive boys (Stein, 1993).

Teachers who fail to intervene and stop boys (and occasionally girls) who engage in aggressive or hostile speech or behavior — which includes teasing and put-downs — toward their quieter classmates inadvertently create a classroom climate where students feel unsafe and thus refrain from expressing their opinions or answering questions for fear of ridicule (Graduate Program in Public Policy and Administration, 1996). This is especially true for girls who may already doubt their abilities in traditionally male domains such as mathematics, science, and technology (Guzzetti & Williams, 1996).

We are talking about scale here. While teasing and put-downs can be considered a normal part of adolescent culture, the point at which the behaviors interfere with other students' self-confidence and learning is the point at which teachers must intervene. When classroom teachers fail to label and address such behavior, a "survival of the fittest" climate prevails in which the voices and talents of less assertive students, including many girls but some boys as well, are silenced.

Social Relevance

A number of researchers have observed that girls find the content of mathematics, science, and technology to be disturbingly distant from real-world concerns (Rosser, 1995; Harding, 1985; Bernstein, 1992). Since girls are often socialized from early childhood to be sensitive to other people's needs and wants, K-12 girls have tended to envision for themselves careers in the helping professions that are traditionally female, such as nursing or teaching. In recent years, girls have expanded their career horizons substantially but still tend to gravitate toward career plans that will permit them to help people and contribute to the solution of the world's problems. For this reason, becoming a doctor is often a popular choice.

In this sense, then, mathematics, science, and technology that are taught abstractly as contextless algorithms can seem pointless to many girls (and boys). Presenting students with an application of an arbitrary precision arithmetic problem in programming sounds very different from presenting them with a population growth /resources problem even though they illustrate the same issue. Teaching MST in terms that have real-world applications can be far more meaningful and attractive to many girls (and boys).

Experience Gap

Secondary and postsecondary MST teachers have often noticed that girls tend to enter their classes less experienced in the subject matter than boys (Seymour & Hewitt, 1997). A national study of science education (National Assessment of Education Progress, 1990) found a clear discrepancy between boys' and girls' hands-on experience of common science equipment, especially in the area of electrical equipment. Fisher, Margolis & Miller (1997) found that women beginning a computer science major had considerably less prior experience with computers than their male counterparts. Sanders (cited in Koch, 1994) points out the frequency with which computers are placed in boys' rooms at home rather than girls'.

The actual experience gap is exacerbated by the culturally sanctioned tendency of boys who have difficulty admitting ignorance. Girls all too often assume boys know more than they do in reality, especially when specialized language is involved, as in the case of computing. One important social function of technical lingo is to demarcate who is knowledgeable — who is in — versus who is not. All this can add up to a considerable level of discomfort on the part of girls who have not had the advantages their male peers have had.

While the experience gap isn't necessarily determinative — Fisher, Margolis & Miller (1997) learned, for example, that while actual performance in a computer science major was not correlated with prior experience, it can cause a number of girls to doubt their ability to continue and result in dropping out.

Gender Bias in Curriculum Materials

Over the years, equity researchers have documented several areas in which gender bias is often found in instructional materials.

- **Linguistic Bias**

Sex-biased materials which use predominantly (or exclusively) masculine terms and pronouns create a linguistic landscape that does not recognize or authorize half its population of readers (Bing & Bergvall, 1996; Richardson, 1987). References to the generic scientist, mathematician, or computer professional as “he” render the contributions and the mere presence of women invisible, as do such masculine occupational titles such as *fireman, businessman,* and *policeman*. The ubiquitous use of the generic pronoun “he” or “man” actually makes maleness the norm: when readers read “he” or “him” they surely do not envision a skirt. (Try: “The scientist in his laboratory.”) This form of sex bias is among the easiest to recognize and eliminate.

More subtle linguistic bias occurs when a woman who is a scientist, for example, is referred to as “a female scientist.” This implies that the real kind, which requires no qualifier, is male. Even citation and bibliographic styles which list initials for the first names of cited sources suggest a male author, since male is in effect the default setting. Obvious and subtle linguistic bias create biased curricular materials. When we accept the language, we accept the embedded ideas as well.

- **Gender Stereotypes**

Gender stereotypes, the assumption that perceived characteristics of men or women as a *group* are always true of *individual* men or women, can appear in curriculum materials. They include stereotypes about physical appearance, attitudes, interests, psychological traits, social relations and occupations. In mathematics, science, and technology texts and supplementary materials, females and males may be stereotypically depicted in traditional roles and demeanors, reinforcing distinct sets of "appropriate" behaviors and cultural expectations for each sex in these fields (Brownell, 1992; Knupfer, 1999). Textbooks have improved considerably in the past fifteen years or so, but males are still more likely to be mentioned, portrayed, and shown in text and problems in mathematics, science, and technology.

- **Invisibility**

Despite significant contributions to all aspects of political, intellectual, social, and creative life, women's accomplishments are often omitted from textbooks used in schools and their experience subsumed under male experience. This form of gender bias creates the erroneous impression that men and their accomplishments are the norm, and outstanding women the exception. When Sadker & Sadker (1994) evaluated the content of newer editions of mathematics, language arts, and history textbooks used in Maryland, Virginia, and the District of Columbia, the under-representation of women was noted in every text they analyzed.

- **Imbalanced Presentation**

Curricular materials can perpetuate gender bias by presenting monolithic interpretations of issues, situations, and events which ignore the role of gender. For example, when textbooks explore the concept of "Man the Hunter" without simultaneously investigating the complementary role of "Woman the Gatherer," or when textbooks routinely devote more text to women's skirt lengths and the fashion of "Gibson Girls" than to women's suffrage, students are given a distorted perspective of the contributions, struggles, and participation of women.

Some critics have maintained that sexism and androcentrism have shaped research in science, and especially biology (Kahle, 1996). A good example is the field of primatology, in which major advances were made because women, new to the field, found topics worthy of study that had been ignored by most male primatologists. Barbara McClintock won her Nobel Prize because she developed a way of working, a way of asking questions and understanding, that differed from traditionally male definitions of scientific objectivity.

The influence of imbalance in curricular material is significant, for “misrepresentations and omissions can negatively affect the self-image, goals, and philosophies of girls” (Sadker, Sadker & Long, 1993, p. 4).

The Impact of Gender Bias

Some people think that doing a needs assessment on gender equity means looking for overt bigotry. Is someone on our faculty telling students that girls can’t do math? Is the registrar refusing to let females take Advanced Physics? Is a cooperating teacher making a student intern ignore girls in class? Is somebody ordering only sexist books? Let’s find them and stop them!

If out-and-out sexist bigots are what you’re looking for, I can almost guarantee you won’t find them. Thank goodness. Really ugly *gender bias by commission* is hard to come by in these relatively enlightened days. But there is a more subtle kind of gender bias by commission, and it’s easy to find if you know what to look for. A teacher tells Katie her paper looks nice and says nothing about its content. A professor calls by name on many more of the male students than the female students. A computer lab assistant spends less time helping the females than the males. An instructor says to a mixed class of students, “Okay, guys, who has the answer?”

Gender bias by omission is also common. A science textbook contains photos of lab work in which mostly boys are shown handling the equipment, and technology materials show mostly men as the technical specialists. A professor mentions the accomplishments of male mathematicians and omits the achievements of their female counterparts. A 7th grade bulletin board displays newspaper articles about the (male) Nobel Prize winners without displaying articles about notable female prize winners.

Another kind of bias by omission is when knowledgeable people in positions of influence fail to challenge gender stereotypes. This behavior in effect conveys tacit approval of stereotypes. If a student says in class, “We have plenty of trucks for the boys to play with, but what about the girls?” and the professor remains silent about the implication, that is gender bias, too.

I would like to stress that none of these incidents is done to deliberately harm female students, and most people who are guilty are unaware of what they are doing. A single instance of gender bias, including the examples I just mentioned, is no big deal. However, when incidents are repeated, especially over years of schooling when materials are frequently biased, when professors and teachers regularly exhibit biased behavior by commission or by omission, the messages accumulate powerfully.

Then you have is a system that strongly discourages many girls and women from achievement in MST and yet is invisible to nearly everyone, including the girls and women themselves. The fact that most gender bias takes place in subtle messages makes it *more* potent, not less. Open bigotry is recognizable and outrageous, so it is easier to resist. The very subtlety of “modern” gender bias means we are not consciously aware of it.

Girls and women internalize gender bias, as do we all, and it looks for all the world like girls and women are simply exercising their free choice to take up literature, art, French, history, and indeed, education. It can even look like girls and women are “naturally” untalented in math or science.

For a choice to be truly free and respond to one’s genuine interests and abilities, it has to be liberated from the distorting influence of gender bias. Teacher educators must teach new classroom teachers how to recognize gender bias and how to counteract it for all our children.

Preparing for the Needs Assessment Process

In the three chapters that follow, you will find many methods for documenting gender equity problem areas in three places: your teacher education program itself; the K-12 partner schools in which your students do their student teaching; and the Arts and Sciences MST courses which your students also take. *Don't do every method!* I have included a variety of methods to choose from according to variations in time, interest, and circumstances.

As you know, however, the more methods you choose, the more reliable your conclusions will be. And the more methods you choose to carry out, the more time will be needed. I strongly suggest approaching your needs assessment as a team activity. Gathering a like-minded group to share the data-collection tasks makes sense in all ways. And because a diverse group has many more options than a narrowly focused one, consider inviting people from the following groups:

- Education MST faculty: the core
- Student teacher supervisors
- Arts and Sciences MST faculty
- Current education students
- Students majoring in MST
- Recent education graduates
- Campus diversity coordinator
- Women's Studies faculty
- Partner school faculty

Who else would be relevant at your institution?

Once you and your team have met to decide which needs assessment techniques to carry out, you may choose to carry out some of the activities in this book or to create others entirely of your own devising. I encourage you to do that: educational institutions are so individual in terms of history, circumstances, resources, and personalities, that creativity is often called for.

Let's turn to how you can learn about the gender equity situation in your college or university. Although my focus is on mathematics, science, and technology for education students, you can easily adapt most of the data collection strategies that follow to gender equity in non-MST areas and for non-education students as well.

Chapter 2
Ways to Assess Gender Equity in Your Teacher Preparation Program

Given the pervasiveness and the seeming "naturalness" of gender bias, it tends to be found in many teacher education classes and programs. I mean this in two senses:

1. *By omission*: instructors often do not teach pre-service students about gender equity problems and gender equity solutions. This is understandable, because we tend to teach as we ourselves were taught, and very few of us learned about gender equity in our own education courses. However, it leaves pre-service students without the ability to encourage *both* sexes to achieve to the top of their ability in mathematics, science, and technology.

2. *By commission*: instructors, like everyone else, learned gender bias as children and can inadvertently reflect it. This is not a good example to set.

Surveys

Surveys are the time-honored method of social science research. You can do them by telephone, mail (U.S., campus, or other), e-mail, and the Web.

This is not the place for a thorough review of survey methodology, so if you do not have the expertise to do this well, ask a colleague. Remember to keep your survey as short as possible (ask yourself: What exactly will I do with the answers to this question?) and to pre-test it with a few colleagues first.

You may find that although I am presenting surveys for faculty and students separately, it's possible to use some questions for both groups.

In all surveys you distribute, be sure to include all demographic items (asking for age, course, sex, whatever) at the ***end*** of the questionnaire. Claude Steele's research (1997) suggests that putting these questions at the beginning may bias respondents' answers.

Surveys of Instructors

Distribute the following survey (as is, or adapted) to instructors of elementary and secondary methods courses (or the equivalent) in mathematics, science, and technology. The questions can be easily adapted to apply to other faculty members.

Faculty Survey #1

To what extent do you address in your methods classes ...

	Extensively				*Not at all*
The under-representation of women in science, mathematics, or technology careers	1	2	3	4	5
The under-representation of girls in advanced courses and extracurricular activities in science, math, or technology	1	2	3	4	5

	Extensively				Not at all
Sex-role stereotypes associated with science, math, or technology	1	2	3	4	5
Teacher-student interaction patterns favoring boys	1	2	3	4	5
Identification of gender bias in the curriculum	1	2	3	4	5
How gender-biased language affects our thinking	1	2	3	4	5
Evaluation of gender bias in textbooks and other educational material	1	2	3	4	5
Title IX and other laws pertaining to gender bias and gender equity	1	2	3	4	5

Who initiates the coverage of gender equity?

__ I do all or nearly all of the time.
__ I usually do.
__ The students and I usually split it 50/50.
__ Usually the students do.
__ The students do all or nearly all of the time.

How many hours or minutes per course, if any, would you estimate that you devote to covering all aspects of gender equity?

__ hours __ minutes

Of this amount, how many hours or minutes would you estimate that you devote to specific "how-to" strategies for increasing girls' participation in science, math, or technology?

__ hours __ minutes

To what extent do you use the following techniques to teach about gender equity?

	Extensively				***Not at all***
Lectures	1	2	3	4	5
Guest lectures	1	2	3	4	5
Student presentations	1	2	3	4	5
Student-initiated class discussions	1	2	3	4	5
Student research projects	1	2	3	4	5
Faculty observation of student teaching	1	2	3	4	5
Student observations of in-service teachers	1	2	3	4	5
Student self-assessment of teaching	1	2	3	4	5
Films or videos	1	2	3	4	5
Case studies	1	2	3	4	5
Games or simulations	1	2	3	4	5
Instructor-initiated class discussion	1	2	3	4	5
Modeling equitable behavior	1	2	3	4	5
Other:	1	2	3	4	5

Is gender equity included in your syllabus?

___ Yes ___ No

Is gender equity a component of students' final grades?

___ Yes ___ No

Faculty Survey #2 [5]

Do you feel the best students in this particular class are male or female?

a. male b. female c. equal

Do males or females ask more questions in this class?

a. male b. female c. equal

In this class, do males or females volunteer more?

a. male b. female c. equal

Do students call out answers in this class?

a. Yes, more males b. Yes, more females
c. Yes, about equally d. No

Do you call on students who have not volunteered?

a. Yes, more males b. Yes, more females
c. Yes, about equally d. No

How closely is the content of this course tied to real-world concerns?

a. Almost always b. Sometimes c. Never

[5] Adapted from a survey developed by the equity team members at Clarion University, Clarion PA.

If you have mixed group work in this class, who takes the lead in decisions and/or equipment?

a. Mostly males b. Mostly females
c. Equally shared d. No group work

Do students ask you questions about course content after class?

a. Yes, more males b. Yes, more females
c. Yes, about equally d. No

Do students ask you career-related questions after class?

a. Yes, more males b. Yes, more females
c. Yes, about equally d. No

Surveys of Students

Distribute the following survey to pre-service education students (as is or adapted).

Student Survey #1

To what extent have you been taught about any of the following in your education courses?

	Extensively				*Not at all*
The under-representation of women in science, mathematics, or technology careers	1	2	3	4	5

Who initiates the coverage of gender equity?

__ Students do all or nearly all of the time.
__ Students usually do.
__ The students and the instructor usually split it 50/50.
__ Usually the instructor does.
__ The instructor does all or nearly all of the time.

How many hours or minutes in an average course, if any, would you estimate that you spend covering all aspects of gender equity?

__ hours __ minutes

Of this amount, how many hours or minutes would you estimate that you devote to specific "how-to" strategies for increasing girls' participation in science, math, or technology?

__ hours __ minutes

To what extent have the following techniques been used in your education courses to teach about gender equity?

	Extensively				***Not at all***
Lectures	1	2	3	4	5
Guest lectures	1	2	3	4	5
Student presentations	1	2	3	4	5
Student-initiated class discussions	1	2	3	4	5
Student research projects	1	2	3	4	5
Faculty observation of student teaching	1	2	3	4	5
Student observations of in-service teachers	1	2	3	4	5
Student self-assessment of teaching	1	2	3	4	5
Films or videos	1	2	3	4	5
Case studies	1	2	3	4	5
Games or simulations	1	2	3	4	5

	Extensively				Not at all
Instructor-initiated class discussion	1	2	3	4	5
Modeling equitable behavior	1	2	3	4	5
Other:	1	2	3	4	5

Focus Groups

Focus groups are data-gathering interviews, not discussions, that last from half an hour to two hours. You'll need a moderator to facilitate and make sure that everyone is heard and another person to be the note-taker. Have a short list of questions you want to address, based on what you specifically want to learn. I wouldn't recommend a group larger than 15. You can videotape the session for a verbatim transcript afterward. Your report should consist of overall themes identified in the session plus illustrative quotations.

Focus Groups of Faculty

Invite a small group of methods instructors or a cross-section of education faculty for a focus group interview. Sample discussion questions for faculty are:

〈 What is your experience of how gender equity issues are handled in this department/school/college of education?

〈 Who tends to bring up gender equity in class: students or instructors?

- If you bring up gender equity in your courses, which courses would that be? What teaching methods do you use?
- How does coverage of gender equity compare with coverage of racial/ethnic issues in this department/school/college?
- How well prepared do you feel to teach gender equity?
- What kinds of assistance in teaching gender equity would you welcome?
- How important do you think it is to teach gender equity?

Focus Groups of Students

Invite selected students or ask for volunteers for a focus group discussion for an hour or more. Sample discussion questions for students are:

- What is your experience of how gender equity issues are handled in this department/school/college of education?
- What courses have you taken in which gender equity has been brought up?
- Who tends to bring up gender equity in class: students or instructors?
- How does coverage of gender equity compare with coverage of racial/ethnic issues in your classes?

〈 How well prepared do you feel to deal with gender bias problems in your classrooms in the future?

〈 How important do you think it is to learn about gender equity?

Classroom Observations

Among the most subtle and unintended forms of gender bias, often consciously imperceptible to both students and instructors without rigorous observation methods, biased classroom interactions can make the ignored sex feel unvalued, unintelligent, and discouraged. A single incident is unimportant, but patterns are powerful. Researchers have found that female students tend to be ignored in mathematics, science, and technology classes, while male students tend to be ignored in history, English, art, and music classes (Lee, 1997).

These patterns can be isolated and quantified. In fact, systematic observation is the *only* way to determine if they are a problem. "Just looking" is almost always inaccurate because of the subtlety of the interactions. Specific incidents of teacher behavior with male and female students need to be tallied (several tallying methods are included in the appendix). Student/teacher and student/student interactions can be observed in person and/or recorded on videotape for subsequent analysis. In fact, they make good teaching tools to help students identify gender bias in a classroom.

Classroom Observations of Faculty

Education instructors also model teaching behavior ("Do as I do, not as I say"), whether consciously or not. What are education students seeing in terms of gender-fair teaching in their courses, particularly mathematics, science, and technology methods courses? How are the instructors treating the students in terms of equity? In most colleges and universities, many elementary math and science methods courses are largely female, so some observation methods that do not require a contrast between male and female students, such as noting whether instructors tend to solve problems for female students rather than letting them solve problems on their own, may be more relevant in those classes.

You can videotape yourself and analyze the tape afterward, or observe a colleague's class. For the latter, either directly or by videotape, you obviously need permission in advance.

Use any of the tallying forms included in the Appendix and observe at any one time any of the following ...

〈 Calling on students, including accepting called-out answers.

〈 How long instructors wait for students' answers.

〈 Instructors' responses to students' answers — simple or complex.

〈 How long instructors allow students to talk before interrupting or stopping them.

〈 Instructors' praise of students for the content of their work or the appearance of their work.

〈 When instructors give students suggestions for solving problems or solve the problems for them.

〈 Where instructors position their bodies in relation to male or female students.

〈 Whether students are allowed to self-segregate by sex in seating patterns.

- In small group work, whether tasks are shared equally or one student dominates the work.

- Whether students' disparaging comments have a gender component.

Classroom Observations of Pre-Service Students

Another form of classroom observation you can carry out is for you to observe your pre-service students' field teaching or practice lessons taught to each other, directly or by videotape, or to have them observe themselves or each other. How they interact with the children in their field teaching is in part a reflection of what they are learning — or not learning — in their education classes. Again, obtain permission in advance. Students' behavior can be observed in terms of ...

- Calling on children, including accepting called-out answers.

- How long they wait for children's answers.

- Their responses to children's answers — simple or complex.

- How long they allow children to talk before interrupting or stopping them.

- Their praise of children for the content of their work or the appearance of their work.

- Their discipline of children.

- When they give children suggestions for solving problems or solve the problems for them.

- Where they position their bodies in relation to boys or girls.
- Whether children are allowed to self-segregate by sex in seating patterns.
- Whether tasks are shared equally or one child dominates the work in small group work.
- Whether children are responsible for classroom maintenance tasks on the basis of gender.
- Whether children's disparaging comments have a gender component.

See also: Gender Exercises on page 51.

Chapter 3
Ways to Assess Gender Equity in K-12 Schools

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Ways to Assess Gender Equioty

In K-12 Schools

Are there gender inequities in your local schools that need attention? Usually, educators who take the trouble to find out are surprised to learn that the answer is yes, particularly in mathematics, science, and technology. Gender bias is usually so commonplace — almost like the air we breathe — and often subtle enough as to be invisible unless one knows what to look for. They are surprised, too, because they had been certain that surely *their* schools were fair. You will want to know what gender messages the cooperating teachers are giving your pre-service students.

The existence of a single minor incident of gender bias, while regrettable, is nothing to get hysterical over. A cumulative pattern, however, is destructive in that it discourages female students from achieving to the level of their full academic and thus occupational potential.

Either you or your students can collect these data, and if the latter, either you or they can report to your colleagues on their findings. If you choose to have your students be the researchers — an approach I recommend for its educational value — be sure their methodology, data collection, and analysis procedures are sound.

Count the Students

The acid test is whether girls are in fact participating in math, science, and technology courses and activities to the same extent as boys. You can obtain male/female counts for:

- High school course enrollments in math, science, or technology, from least (required) to most (elective) advanced.
- Dropout rates in the same courses.
- Advanced Placement tests taken.
- Extracurricular clubs or activities relating to mathematics, science or technology.
- Inter-school contests relating to mathematics, science, or technology (e.g., Intel Science competition, National Junior Academy of Humanities and Science, the Science and Math Olympiads, the American Computer Science League, etc.).

Classroom Observations

Like classroom observations of instructors and pre-service students, you can observe classes of cooperating teachers. Obtain permission first and observe for one at a time of any the following:

1. Calling on students, including accepting called-out answers.
2. How long teachers wait for students' answers.

3. Teachers' responses to students' answers — simple or complex.

4. How long teachers allow students to talk before interrupting or stopping them.

5. Teachers' praise of students for the content of their work or the appearance of their work.

6. Teachers' discipline of students.

7. When teachers give students suggestions for solving problems or solve the problems for them.

8. Where teachers position their bodies in relation to boys or girls.

9. Whether students are allowed to self-segregate by sex in seating patterns.

10. Whether tasks are shared equally or one student dominates the work in small group work.

11. Whether students are responsible for classroom maintenance tasks on the basis of gender.

12. Whether disparaging comments that students make to each other have a gender component.

What's on the Walls?

The physical environment sends subtle but powerful messages about who is valued for what. Here are three places to look.

1. Count the number of pictures of women and men posted on the classroom walls, or in the halls. Are there any

differences in the types of activities they are shown engaging in?

2. Count the number of articles of women and men up on the classroom walls, or in the halls.

3. When student work is displayed on the walls, are there differences in boys' vs. girls' work? (e.g., violence themes vs. delicate flowers)

Textbook Analysis

Just as the physical environment sends messages to girls about what others seem to expect of women, the textbooks they use send these messages with the voice of authority. If girls use textbooks in mathematics, science, and technology where males are the norm, they understand at some level that females are not.

Here are a few ways to determine how textbooks reflect the sexes. First, collect several textbooks in math, science, and technology according to subject or grade level. Try to keep their publication dates fairly close, within five years or so of each other. Then, taking a randomly chosen sequential 50 or 100 pages per book as a sample, use any of the following techniques.

1. Count the number of photos or illustrations of females and males, whether the people are shown in active or passive roles, and/or the ratio of pictures by sex who are identified by name.

2. Count the number of times females and males are mentioned in the text.

3. Count the number of times females and males are used to illustrate word problems, and whether the word problems are sex-role stereotyped (e.g., girls figuring out recipe proportions and boys figuring out rocket

trajectories). Compare these to problems that have only symbols and those that have words but no people.

Gender Exercises

These methods (Mason, Kahle & Gardner, 1991; Baumgartner, 1987) get at gender bias emotionally and directly, and can be done with children, education students, teacher educators, and teachers alike. Ask respondents to do one of the following; have them note their sex and, if children, their age or grade.

1. Draw a picture of a scientist (or a computer specialist, or a mathematician, or an engineer). If you are asking adults to draw a scientist, amend the exercise a little by asking them to draw the picture as they think their students would draw it. Ask them to add a paragraph explaining their drawings.

2. Answer this question in writing: If you were to wake up tomorrow morning a member of the opposite sex, how would your life be different? Be warned: the results of this exercise when done with children can be shocking. Some boys have said that if they were girls they would kill themselves.

Survey Questions for Teachers

Questions could be asked in written form, as presented below, or in oral interviews. Some sample questions are:

> To what extent have you received formal instruction in gender equity problems and solutions, either pre-service or in-service?
>
> a. Five days or more
> b. Two to four days
> c. One day
> d. One to five hours
> e. None

Is gender bias one of the criteria you use for reviewing instructional materials?

a. Yes, it is a major focus.
b. Yes, but it is a minor focus.
c. No, it is not a criterion.

Do you use conscious, deliberate techniques to make sure girls participate in class equally?

a. Yes. It is / they are: ______________
b. I try to pay attention to that but not with deliberate techniques.
c. No, I thought about it but it is not needed.
d. No, I never thought of doing it.

Do you teach students about the achievements of notable women in your subject(s)?

a. Yes, I go out of my way to do so.
b. I do so when I think of it.
c. I don’t focus on that in my teaching.

To what extent do you avoid using generic male language (such as “mankind” for humanity, or referring to an unnamed scientist as “he”)?

a. Yes, I go out of my way to do so.
b. I do so when I think of it.
c. I don’t focus on that in my teaching.

Do you think that gender equity is an important classroom issue? Why or why not?

When you have a student teacher, do you include a focus on gender equity in your interactions with her or him? If so, how?

Have you ever analyzed (or had anyone help you analyze) whether you call on girls and boys equally? If so, how, and what did you learn?

Survey Questions for Children

Adapt this questionnaire specifically for math, science, or technology instead of the general “MST.” Ask them to write their grade and sex at the end.

For Elementary Students [6]

What school subject do you like the most?

What school subject do you like the least?

Do you think your dad is good at MST?
___ Yes
___ No
___ I don’t know

How much does your dad talk about MST at home or at work?
___ A lot
___ A little
___ Never
___ I don’t know

Do you think your mom is good at MST?
___ Yes
___ No
___ I don’t know

How much does your mom talk about MST at home or at work?
___ A lot
___ A little
___ Never
___ I don’t know

[6] Adapted from Cupillari, Antonella, Hostetler, Robert T. and Tauber, Robert T. (1992). Attitudes toward mathematics: male/female differences in three grade levels. *New York State Mathematics Teachers Journal*, 42 (3), pp. 165-172.

Who do you think is better at MST?

___ Girls
___ Boys
___ Both the same

Do you get nervous when you have to take a test?

___ Not at all
___ A little
___ More than a little
___ Very nervous

Do you get nervous when you have to take a MST test?

___ Not at all
___ A little
___ More than a little
___ Very nervous

How good are you at MST?

___ Much better than most other kids
___ About the same as most other kids
___ Not as good as most other kids
___ Not good at all

How much do you think you will use MST when you grow up?

___ Not at all
___ A little
___ A lot

Do you think knowing MST will help you find a job when you grow up?

___ Definitely
___ I think so
___ I don't think so
___ No

Do your friends think you are good at MST?

___ Definitely
___ I think so
___ I don't think so
___ No

Do you think your teacher likes to teach MST?

___ Not at all
___ A little
___ Pretty much
___ Very much

Do you think MST is important?

___ Yes
___ No

For Secondary Students [7]

How important is it to you that you do well in MST?

1 = *very important* 2 = *important*
3 = *a little important* 4 = *not at all important*

Please rank these subjects according to how important it is to you that you do well in each.

(1 = *most important*, 8 = *least important*)

_____ Language Arts
_____ Math
_____ Foreign Language
_____ Science
_____ Physical Education
_____ Social Studies
_____ Computer class
_____ Art class

In comparison with other subjects, how much do you like learning MST? (Circle one.)

1 = *much more* 2 = *about the same* 3 = *much less*

[7] Adapted from Riesz, Elizabeth D. et al. (1994). Gender differences in high school students' attitudes toward science: research and intervention. *Journal of Women and Minorities in Science and Engineering*, 1(4), pp. 273-289.

How much MST do you think most men use in their careers?

1 = *a lot*, 2 = *some*
3 = *very little* 4 = *none*

How much MST do you think most women use in their careers?

1 = *a lot* 2 = *some*
3 = *very little* 4 = *none*

How much effort does your MST class require compared to your other subjects?

1 = *much less hard* 2 = *not as hard*
3 = *about as hard* 4 = *harder*
5 = *much harder*

Compared with your other subjects, how good are you at MST?

1 = *much better* 2 = *better*
3 = *about the same* 4 = *somewhat worse*
5 = *much worse*

In comparison with Language Arts, how good are you at MST?

1 = *much better* 2 = *better*
3 = *about the same* 4 = *somewhat worse*
5 = *much worse*

Below are possible explanations for when you get a good grade in MST. Please rate them according to how much you agree with each one.

1 = *strongly agree* 2 = *somewhat agree*
3 = *somewhat disagree* 4 = *strongly disagree*

___ I am smart in MST.
___ My teacher helped me learn MST.
___ My parents helped me learn MST.
___ I like MST.
___ I worked hard in MST.
___ MST is easy.
___ I used good study skills.

Below are possible explanations for when you get a bad grade in MST. Please rate each one according to how much you agree with each one.

1 = *strongly agree*	2 = *somewhat agree*
3 = *somewhat disagree*	4 = *strongly disagree*

___ I don't like MST.
___ I didn't work hard in MST.
___ I am not smart in MST.
___ My parents did not help me learn MST.
___ I didn't use good study skills.
___ My teacher did not help me learn MST.
___ MST is hard.

I think I could be successful as a [choose one: mathematician, scientist, engineer, computer specialist].

1 = *strongly agree*	2 = *somewhat agree*
3 = *somewhat disagree*	4 = *strongly disagree*

Chapter 4
Ways to Assess Gender Equity in Arts and Sciences Classrooms

Pre-service teachers take Arts and Sciences courses in mathematics, science, and technology while they are in college as well as high school, so the teaching of these subjects is modeled by their professors and teaching assistants. What gender messages do students receive there? Many of the same ways of finding out that were appropriate for K-12 education can be used or adapted for post-secondary education. You will need to obtain instructors' permission to collect any data in their classes: an administrator's support may be especially valuable here.

Count the Students

Get male/female counts for:

1. Majors in math, science, and technology by field and, if you have graduate programs, by degree.

2. Course enrollments in math, science or technology, from least to most advanced.

3. Dropout rates in the same courses.

4. Programs or special events relating to mathematics, science, or technology (e.g., attendance if voluntary at guest speakers' lectures, participation in funded projects, independent research projects).

5. Tutoring for beginning to advanced courses. Look at the sex of tutors as well as tutees.

6. Lab assistant or teaching assistant positions (graduate students).

Classroom Observations

In non-lecture classes, interactions between students and professors or teaching assistants can be observed in person or recorded on videotape and analyzed later. Tally specific incidents of instructor behavior with male and female students (tallying forms are included in the appendix) for any of the following:

1. Calling on students, including accepting called-out answers.

2. How long instructors wait for students' answers.

3. Instructors' responses to students' answers — simple or complex.

4. How long instructors allow students to talk before interrupting or stopping them.

5. Instructors' praise of students for the content of their work or the appearance of their work.

6. When instructors give students suggestions for solving problems or solve the problems for them.

7. Where instructors position their bodies in relation to male or female students.

8. Whether students are allowed to self-segregate by sex in seating patterns.

9. In small group work, whether tasks are shared equally or one student dominates the work.

10. Whether disparaging comments have a gender component.

Surveys

To find out how students feel about the gender dimension of their Arts and Sciences courses in mathematics, science, and technology, you can arrange to distribute a survey to them. Similarly, you can ask instructors of these courses about gender issues, but remember that they are not likely to be aware enough of subtle classroom interaction patterns to be able to tell you about them. Administrative support may help with these surveys.

As mentioned earlier, ask your demographic questions (course, sex, whatever) at the *end* of the questionnaire.

Student Survey #1 [8]

My responses in this questionnaire pertain to my methods course in

A. Secondary mathematics
B. Secondary science
C. Technology
D. Elementary mathematics
E. Elementary science
F. None of the above

This course is

A. Required for my academic major
B. Not in my academic major

My responses in this questionnaire pertain to my content methods instructor who was

A. Female
B. Male

[8] Adapted from a survey developed by the equity team members at Southwestern Oklahoma State University.

Did your instructor know your name?

A. Yes
B. No
C. I’m not sure

How often did students participate in this class by asking questions or making comments?

A. Never
B. Rarely
C. Occasionally
D. Frequently

How often did you voluntarily answer questions or contribute to discussion in this class?

A. Never
B. One to three times during the course
C. An average of once a week
D. One or more times per class

How often did the instructor call on you or ask you to respond to a question or comment?

A. One to three times during the course
B. An average of once a week
C. One or more times per class
D. Instructor did not call on anyone

How did the instructor most frequently call on you?

A. By name
B. By pointing by hand
C. By eye contact / looking directly at me
D. Instructor never called on me

Were there times you raised your hand but did <u>not</u> get called on by the instructor?

A. Once or twice
B. Three or more times
C. Very often
D. I was called on when I raised my hand
E. I never raised my hand

If you wanted to participate in class by asking a question or making a comment but did not do so, what was your usual reason for not doing so?

A. Too many other students wanted to respond
B. Others beat me to it
C. I felt insecure, inadequate, or uncertain
D. This situation never occurred

Which students most frequently participated in class?

A. Those who were most knowledgeable or most interested in the subject
B. Those who were seeking clarification or wanted more information
C. Those who were trying to show off or get attention
D. I did not notice

Which students asked the most questions and made the most comments in class?

A. Male students
B. Female students
C. Male and female students equally
D. I did not notice

How did the instructor react to the questions and comments you made in class?

A. Encouraged me to speak again
B. Discouraged me from speaking again
C. Neither encouraged nor discouraged me
D. I never participated

How did the instructor react to opinions and comments given by other students in the class?

A. Respected their opinions
B. Did not respect their opinions
C. Embarrassed or put down students in this class
D. I did not notice.

Did your instructor make humorous references that you felt were offensive, embarrassing, or belittling to any individuals or groups?

A. Never
B. One time
C. Occasionally
D. Frequently

In your classroom, the seating arrangement ...

A. Followed a seating assignment by the instructor
B. Was not assigned by the instructor

In your classroom ...

A. Females and males sat mostly in single-sex clusters
B. There was no apparent pattern in the seating arrangement
C. I did not notice

How familiar are you with gender fairness issues?

A. Very familiar
B. Somewhat familiar
C. Not familiar

Student Survey #2 [9]

Which most closely describes your career goal?

A. A career in mathematics, sciences, technology, or engineering
B. A career in the arts or humanities
C. I am not sure

[9] Adapted from a survey developed by the equity team members at Clarion University, Clarion PA.

Have you ever been specifically encouraged and/or discouraged in your career goal by a faculty member at this university? (Circle one or two answers.)

A. Encouraged by a female
B. Encouraged by a male
C. Discouraged by a female
D. Discouraged by a male
E. This never happened

Are the best students in this class male or female?

A. Male
B. FemaleC. Equal

Do you feel that you were well prepared academically to take this class?

A. Yes
B. No

How would you rate your ability in this class in comparison with the other students?

A. I am more able
B. I am less able
C. I am about the same

When choosing students to answer questions, whom does your instructor seem to favor?

A. Males
B. Females
C. Neither

Who seems to call out answers more often in this class?

A. Males
B. Females
C. Equally males and females
D. No one calls out answers

When no one volunteers to answer a question, whom does the instructor call on?

A. Mostly males
B. Mostly females
C. Equally males and females

Have you ever heard or seen this instructor treat another student with disrespect?

A. Yes, to a male student
B. Yes, to a female student
C. Yes, to male(s) and female(s)
D. No

Do you feel that the content in this course is closely tied to real-world concerns?

A. Almost always
B. Usually
C. Sometimes
D. Never

Is relating what you learn in this class to real-world applications important to you?

A. Very important
B. Somewhat important
C. Not important

Do students work in groups in this class?

A. Yes, mostly in single-sex groups
B. Yes, mostly in mixed-sex groups
C. No

If you answered B to the previous question, who tends to dominate discussion, equipment, or roles?

A. Usually males
B. Usually females
C. Equally shared

Does your instructor provide written commentary on your written work?

A. No, it is just returned with a grade
B. Yes, more positive comments
C. Yes, more negative comments
D. There is no written work

Survey for Instructors [10]

Are the best students in this class male or female?

A. Male
B. Female
C. Equal

Do more males or females ask questions in this class?

A. More males
B. More females
C. Equal

In this class, who volunteers the most?

A. More males
B. More females
C. Equal

Do male or female students call out more in this class?

A. More males
B. More females
C. Equal

Do you call on students who have not volunteered?

A. More males
B. More females
C. Equal
D. I do not

[10] Adapted from a survey developed by the equity team members at Clarion University, Clarion PA.

Do you treat all students with respect?

A. Always
B. I try, but sometimes sarcasm comes out

Are males or females more likely to stay after class to talk with you?

A. More males
B. More females
C. Equal

Do you feel that the content of this class is closely tied to real-world concerns?

A. Almost always
B. Sometimes
C. Never

How important is relating the content of this class to real-world applications?

A. Very important
B. Somewhat important
C. Not important

Do students work in groups in this class?

A. Yes, mostly in single-sex groups
B. Yes, mostly in mixed-sex groups
C. No

If you answered B to the previous question, who tends to dominate discussion, equipment, or roles?

A. Usually males
B. Usually females
C. Equally shared

Do you provide written commentary on students' written work?

A. No, it is returned just with a grade
B. Yes, with more positive comments
C. Yes, with more negative comments
D. There is no written work in this class

Do students ever come to ask you career-related questions?

A. Yes, mostly males
B. Yes, mostly females
C. Equal
D. No

Interviews of Instructors

Since the number of instructors you may want to collect information from might be manageable, you could interview them. Use some questions drawn from a survey of instructors, augmented by some of the following:

〈 Have you observed any behavior or attitude differences between your male and female students when it comes to their academic work (e.g., grades, neatness, reflectiveness, thoroughness, etc.)? If so, please describe them.

〈 Have you observed any differences between your male and female students in terms of their *confidence* in their academic ability?

〈 Have you observed any behavior or attitude differences between your male and female students in terms of their interactions in class with you or their classmates (e.g., talkativeness, readiness to call out or interrupt, time off task, etc.)? If so, please describe them.

〈 Have you observed any differences between your male and female students in terms of their approach to the content? (e.g., problem-solving strategies, aspects of the content that seem most meaningful to them, etc.)

What's On the Walls?

Count the number of pictures of women and men posted in the halls in areas or buildings devoted to mathematics, science, technology, or engineering, including portraits of previous deans or department chairs.

Textbook Analysis

Collect several textbooks in mathematics, science or technology, keeping publication dates relatively close, within five or so years of each other. Then, taking a random sequential 50 or 100 pages per book as a sample, use one of the following techniques as appropriate.

〈 Count the number of photos or illustrations of females and males, whether the people are shown in active or passive roles, and/or the ratio of pictures by sex who are identified by name.

〈 Count the number of times females and males are mentioned in the text.

Chapter 5
Using What You Learned

Presumably you have learned a lot in your needs assessment. The most common unexpected finding seems to be that education faculty who think they are covering gender equity fairly well discover that according to students, little is getting through. This is the kind of finding that obviously calls for a change.

Spreading the Word

Making others aware of what you have learned about gender equity in your college or university and its partner schools attracts members for your equity team as well as raised consciousness among those not inclined to join the team. (Although they may be drawn to participate, eventually.) Here is a bare-bones outline of a workshop you can deliver to your colleagues or anyone else.

Basic Rules for a Gender Equity Presentation

Because gender equity can be an emotional issue for people, and because some people might have had negative experiences in the past with gender equity workshops, I strongly recommend the following four rules. This is the voice of thirty years of experience speaking to you.

1. **Be factual**. Deliver the workshop calmly, not ideologically or emotionally. Present facts, figures, and findings, not values.

2. **No blame**. Although you are presenting an educational problem that needs to be addressed, there is no question of blame or fault since *all* of us, women as well as men, could not help learning sexist attitudes and behaviors as infants and children. Gender equity is not a women's issue, but a human issue. Which leads me to...

3. **No male-bashing**. I am soundly convinced that women can be sexist and men can be gender-fair. It's extremely unwise to assume otherwise.

4. **Demonstrate support**. Prove that this issue is taken seriously. Have present as many as possible of the dean, department chairs, and senior faculty members.

Outline for a Gender Equity Workshop

Part 1. Awareness

People need to see that gender equity is still a real issue with real consequences in the real world, and that there are, in fact, many areas of life in which we are all artificially limited by our gender. If your group is already well aware of issues of gender bias in schools and the society at large, you can skip Part 1. If not, choose one of the following suggestions:

Personal involvement. [11] This one is the gold standard, and can be done if your group can be counted on to do a little homework in advance. It's best if participants present what they themselves have learned or observed: the cumulative effect of this first-hand testimony is powerful. The workshop activity, of course, consists of participants' reports.

In Your College or University

〈 Interview or survey a representative cross-section of students about their career plans. Note any male/female differences.

〈 Obtain male/female enrollment figures for courses in computers, science, mathematics, and/or engi neering, from the least to the most advanced, for the last few years.

〈 Obtain male/female dropout figures for the same courses in the same years.

〈 Obtain test scores and grades for males and females in these courses.

〈 Survey students about computers in their homes: whether there is one, how long there has been one, which room in the house it is kept, who uses it most.

〈 Obtain male/female figures on majors offered at your school. Compare figures for the physi cal sciences to those for the humanities.

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[11] Adapted from Sanders, Jo; Koch, Janice; and Urso, Josephine (1997). *Gender Equity Right from the Start,* pp. 18-19. Mahwah NJ: Erlbaum Associates.

〈 In an Arts and Sciences mathematics, science, or computer class, count the number of times male vs. female students are either called on or their called-out answers are recognized by the instructor.

〈 Obtain figures from the Academic Computing Lab on male/female usage and if available the amount of time males vs. females spend in the lab, or observe the lab yourself at representative times to collect this data.

In Field Placement Schools

〈 In high schools, obtain male/female enrollment figures for courses in computers, science, and/or mathematics, from the least to the most advanced, for the last three years.

〈 In high schools, obtain male/female dropout figures for the same courses in the same years.

〈 In high schools, obtain test scores and grades for males and females in these courses.

〈 In middle or high schools, obtain male/female figures for extracurricular activities involving math, science, or technology such as clubs, free-access computer labs, etc.

〈 In elementary schools, ask children to draw a scientist. Note the characteristics of the drawings and whether they differ for girls and boys.

〈 At all grade levels, count the number of times girls vs. boys are called on or their called-out answers are recognized by the teacher. Compare these results in math, science, and/or computer class vs. classes such as Language Arts and Social Studies.

〈 At all grade levels, count the number of males vs. females pictured on classroom and/or hallway bulletin boards or showcases.

In the Community

〈 Analyze the gender messages in greeting cards for birth and birthdays up to age six.

〈 Analyze the gender messages in a toy store, with special attention to toys related to math, science or technology.

〈 Analyze the gender messages in children's television programs, particularly those dealing with math, science or technology. (Watch an hour of Saturday morning TV.)

〈 Keep track of all the newspaper articles you see in a given period of time concerning mathematics, science and/or technology. How many men vs. women are mentioned?

〈 Obtain several issues of popular magazines con cerned with computers or science. Count the number of times men vs. women are pictured, are the focus of articles, and/or are the authors of articles.

〈 Go to a video arcade and count the number of males and females there. What are the females doing? The males?

〈 Go to a computer store and count the number of employees and customers who are male vs. female.

Easel Worlds. Tape four easel pages, widely spaced, to the wall, or use a large chalkboard. Write a heading on each: *Home, School, Community, Media*. Divide participants into four smaller groups, one group per easel page. Ask them to write the influences and messages in each arena that affect girls' and boys' notions of mathematics, science, and technology, or their general notions of what it means to be male and female in each of these areas in our society. After a few minutes ask each group to move on to the next easel page, and continue until everyone has had an opportunity to contribute to each page and to see what others have written.

Draw a scientist / mathematician / computer professional. Ask participants to draw this picture as they think the typical elementary or secondary student would draw it. Use paper and tape drawings to the wall, or have people draw directly on the chalkboard. Afterward, discuss the characteristics shown in the drawings (e.g., crazy hair, pocket protectors, glasses, isolated activities, etc.), and what the drawings suggest about the people in these professions. How attractive are they? How realistic are they? What impressions do girls and boys have of such people?

If I had been born a member of the opposite sex. Ask people to spend a few minutes thinking about and writing some notes on how their lives would have been different if they had been born a member of the opposite sex. Discuss it. Why do these differences, these divisions into male and female worlds, exist? Are they unnecessarily limiting to children's futures?

Imagine. Divide faculty into small groups, half of which are to invent a life story for a newborn baby, Jane, and the other half of which invent a life story for another newborn baby, John. After discussing the following in small groups, pull them back together for a discussion of any differences between Jane's life and John's.

Infancy:	clothes, room, most influential people
Nursery school:	playmates, toys, clothes, most influential people
Elementary school:	interests, play, learning, most influential people
Middle school:	interests, play, learning, most influential people
High school:	interests, favorite subjects, social activities, learning, most influential people
College:	avocational interests, vocational interests, social activities, learning, most influential people

Part 2. Education and Labor Market Statistics

Let state or national statistics on post-secondary education, occupations, and salaries make a dispassionate, factual, non-ideological case for you that males and females are far from equal and that it matters in terms of their own futures as well as the well-being of our country.

You will find current education statistics from the *Digest of Education Statistics* at: http://nces.ed.gov/pubs99/digest98. This publication is issued annually, so in later years it should work to update the year numbers in the URL.

You will find labor market statistics on detailed occupational participation and earnings by sex at: http://stats.bls.gov/cpsaatab.htm#empstat. Choose Table 39, Weekly Earnings Data. They are available in March or April for the preceding year.

Part 3. Local Findings About Gender Equity

Against the background of the statistics, present first what you learned about gender equity in your local K-12 schools and in Arts and Sciences. Be sure you have enough data not to focus on only a few events, which can be challenged as unrepresentative. If in your data collection you observed teachers or professors engaging in or permitting gender bias, do not identify them by name. Be factual and calm, not political or ideological. Emphasize that gender bias is usually inadvertent and unintended, and that it is a human issue rather than a women's issue.

Part 4. Attention to Gender Bias in Your Education Program

Last, present what you have learned about the extent to which gender equity is or is not addressed in your teacher preparation program. If you surveyed faculty members or students or observed them in class, do not attach names to your findings. Make the point that without addressing gender equity in their teacher preparation years, your education students in their own careers will in all likelihood perpetuate the gender-biased patterns that you found in your local K-12 schools and in Arts and Sciences courses (Part 3), which when aggregated lead to the unbalanced occupation and salary figures you started with (Part 2).

Know ahead of time what you would like participants to do with the information you have given them, and sign them up to do it.

The Acceptance Continuum

As you put together a team or group of people to work on gender equity issues in your teacher education program, you should assume a continuum of acceptance on the part of your colleagues. I find it is helpful to think of people affected by change in five groups.

1. **Leaders**, who are committed to change and will work hard for it.
2. **Supporters**, who will help but not lead.
3. **Fence-sitters**, who won't do anything to help or to hinder.
4. **Skeptics**, who may passively resist the change.
5. **Resisters**, who will actively work against the change.

Your goal is to move everyone one step up the ladder.

Because some people will never move for reasons of their own histories and personalities, it is not realistic to try to move everyone to Level 1, and if you have this goal in mind you will surely become demoralized. On the other hand, over time it might be possible to move some people up still another level.

It is important not to demonize people who do not share your own commitment to gender equity change. They usually have understandable reasons for their opposition to gender equity change. Some education faculty hear it as implied criticism of their teaching and thus their professional identity and self-worth, which they naturally resent. Some people may feel unjustly accused, since they are *absolutely positive* they do not discriminate against their female students. Faculty may assume a gender equity discussion is merely another instance of academic political correctness, posturing without importance or substance, or perhaps yet another here-today-and-gone-tomorrow educational fad, and thus dismissible. While men tend to assume they will be blamed as the culprits, gender equity can make women feel threatened, too. Certainly people who were raised within a traditional sex-role context may feel that gender equity is genuinely harmful for girls.

It is not necessary for everyone to agree to make substantial gender equity progress.

What Gender Equity Looks Like in Practice

From 1997 through 1999, we worked closely with the universities that participated in the Teacher Education Mentor Project (they are listed in the Introduction). We helped and watched as they formed equity teams, carried out the needs assessment process, decided what to do about their findings, and then implemented and evaluated a number of activities.

Because your own trajectory might be somewhat similar, you will probably be interested in what they accomplished.

Needs Assessment Findings

The universities each carried out a needs assessment process, using methods presented in Chapters 2, 3, and 4. These are their collected findings. Yours may well be different: you cannot know without collecting your own data.

Teacher education programs

- The program addressed other equity issues well but not gender.
- Students did not recall any or much exposure to gender equity issues.
- Students do not recognize equity education as a part of the teacher education program.
- Students believe gender equity is important.
- Gender equity was not a part of most syllabi or of nearly all grades; when included, it was left to the discretion of the professor.
- Faculty did not have knowledge about equity issues or instructional strategies.

K-12 schools

- Teachers were unaware of gender equity issues.
- Teachers believe gender equity is a "no-problem" problem.

Arts & Sciences courses

- Female students were likelier to be encouraged by female than male professors.
- Female students said their written work came back usually with either a grade or negative comments; male students reported they usually received positive comments.
- Female students were discouraged from doing math.

How Equity Teams Addressed Their Findings

In the remaining year and a half, equity teams at the universities carried out the following activities to address the problems they had discovered:

Activities with students

- Held a program-wide conference on gender equity for all education students.
- Held a series of focus group meetings for students.
- Worked with pre-service teachers to devise research projects on gender equity.
- Added items related to equitable practice to intern teaching form.
- Held a workshop for students, who presented the workshop the next year to new students.

Activities with faculty

- Held professional development sessions, workshops, and retreats for faculty.
- Invited a gender equity specialist to speak to a university-wide audience.
- This gender equity specialist also did a workshop for in-service teachers, pre-service teachers, and university faculty.
- Taught activities from *Gender Equity Right from the Start* (Sanders, et.al., 1997).
- Added gender equity to individual methods course syllabi.
- Integrated gender equity into the conceptual framework of the teacher education program.
- Held a workshop for science faculty.

Activities with cooperating teachers	〈 Held a workshop for cooperating teachers. 〈 All cooperating teachers used classroom observation tool to record biased interactions. All elementary math pre-service teachers used the same instrument.
Other activities	〈 Added consideration of gender in hiring, promotion, and tenure decisions. 〈 Established a gender equity resource center, including videos. 〈 Held a workshop for graduate teaching assistants. 〈 Established a gender equity web site. 〈 Prepared a booklet on gender equity for faculty, with research done by students. 〈 Set up an internal listserv for members of the equity team. 〈 Made presentations at local, state, regional, and national professional meetings. 〈 Wrote articles for university, local, and professional publications.

The Change Progression

Every change can be carried out on a continuum from superficial and fleeting to systemic, profound, and permanent. Surely in your experience of schools and universities, you have seen the entire range. In terms of gender equity in mathematics, science, and technology education, we can envision change occurring from the most superficial to the most systemic in this baker's dozen of levels.

1. There is little or no attention to gender equity in any education courses for pre-service students.

2. There is no attention to gender equity in any mathematics, science, or technology methods courses.

3. Gender equity is brought up in these methods class reactively, if students happen to mention it. Discussion, such as it is, focuses on problems rather than solutions.

4. An instructor devotes part or all of a methods class to gender equity, perhaps by bringing in an outside guest speaker. That takes care of that.

5. An instructor devotes more time and effort to gender equity, possibly by assigned readings, projects, and/or out-of-class activities. Gender equity is on the exam.

6. In this instructor's MST methods classes, gender equity becomes a continuing theme, integrated throughout. It is reflected in the teaching and learning process and the syllabus, and represents part of the final grade.

7. All mathematics, science, and technology methods instructors integrate gender equity into their courses.

8. All education faculty in other, non-MST areas integrate gender equity into their courses.

9. Partner schools and supervising teachers are included in the gender equity effort, so that students do not receive one gender message in their education classes and another in field experience.

10. The education department incorporates gender as an element of its policies, procedures, and culture: hiring and tenure decisions, promotions, committee responsibilities, teaching/research responsibilities, task force topics, invited speakers, reward structure.

11. The college of education incorporates gender as an element of its policies, procedures, and culture: hiring and tenure decisions, promotions, committee responsibilities, teaching/research responsibilities, task force topics, invited speakers, reward structure.

12. Arts and Sciences faculty in mathematics, science, and technology are included in the gender equity effort, so that students do not receive one gender message in their education classes and another in their Arts and Sciences classes.

13. The entire university incorporates gender as an element of its policies, procedures, and culture: hiring and tenure decisions, promotions, committee responsibilities, teach ing/research responsibilities, task force topics, invited speakers, reward structure.

As you can see, institutionalizing gender equity involves much more than teaching a lesson on it every now and then. What I suggested about the Acceptance Continuum holds even more strongly for the Change Progression. Change is possible, change is necessary, but miracles and revolutions don’t occur very often and certainly not overnight. Keep your eye on the next level up, keep trying to move up, but appreciate and celebrate each and every bit of progress.

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Appendix

Included here are four coding forms to enable you to tally gender bias in teacher/student interactions. Use the one you are most comfortable with, and code only one behavior at a time. If several people will be coding interactions in multiple classes and combining results, be sure to use the same form.

Teacher/Student Interaction Coding Form 1

Behavior observed ____________________________

Date ____________________________

Teacher ____________________________

Observer ____________________________

Instruction: Make a cross-hatch mark each for each codable incident.

GIRLS **BOYS**

Jo Sanders, 1996

Teacher/Student Interaction Coding Form 2

Date ____________________

Teacher ____________________

Time observation started ____________________

Time observation ended ____________________

Description of lesson and instructional strategies:

Student Name	Gender	Race	Called On	Called Out

Patricia B. Campbell, 1996

Teacher/Student Interaction Coding Form 3

Date __________________

Teacher __________________

Time observation started __________________

Time observation ended __________________

Description of lesson and instructional strategies:

Student Name	Gender	Race	Called On	Called Out	Disciplined	Praised for answer	Praised for Other Things

Patricia B. Campbell, 1996

TEACHER/STUDENT INTERACTION CODING FORM 4

VERBAL INTERACTION CATEGORIES

Instruction: Fill out the form on the next page according to these verbal interaction categories.

PRAISE ACADEMIC Teacher rewards and reinforcement given directly for the intellectual quality of academic work. For example: "Good answer," or "You've written a very interesting report."

NON-ACADEMIC Teacher rewards and reinforcement that are not directed to the intellectual quality of the work, such as "You're being nice and quiet today."

ACADEMIC CRITICISM INTELLECTUAL QUALITY Critical remarks directed at the lack of intellectual quality of work, such as "Perhaps mathematics isn't a good field for you."

EFFORT Teacher comments attributing academic failure to lack of effort, such as "You're not trying hard enough."

NON-ACADEMIC CRITICISM MILD Negative teacher comments that reprimand violations of conduct, rules, forms, behaviors, and other nonacademic areas, such as "Tom, stay in line."

HARSH Negative comments that attract attention because they are louder, longer, and/or stronger than mild criticism, such as "Tom, get back in line. I have had more than enough from you today. Stay in line or suffer the consequences. MOVE."

QUESTIONS LOW-LEVEL Teacher questions that require memory on the part of the student, such as "Who was the fifth president of the United States?"

HIGH-LEVEL Teacher questions that require intellectual processes and ask the student to use the information, not just memorize it, such as "What would you include in your personal statement on animal rights?"

ACADEMIC INTERVEN-TION FACILITATE Teacher behaviors that facilitate learning by providing students with suggestions, hints, and cues to encourage and enable them to complete the assignment themselves, such as "Think of yesterday's problem and try that one again."

SHORT-CIRCUIT Comments that prevent or short-circuit student success by taking over the learning process, such as "That's wrong. The answer is 14."

Daniel P. Shepardson and Edward L. Pizzini, Science and Children, Nov./Dec. 1991

Page 2

TEACHER/STUDENT INTERACTION CODING FORM 4

Verbal Interaction Categories

VERBAL INTERACTIONS FORM

VERBAL BEHAVIOR	BOYS	DIRECTED AT GIRLS	
PRAISE			ACADEMIC
NON-ACADEMIC			
ACADEMIC CRITICISM			INTELLECTUAL
EFFORT			
NON-ACADEMIC CRITICISM			MILD
HARSH			
QUESTIONS			LOW-LEVEL
HIGH-LEVEL			
ACADEMIC INTERVEN-TION			FACILITATE
SHORT-CIRCUIT			

Daniel P. Shepardson and Edward L. Pizzini, 1991

NOTES