Interventions for Promoting Gender Equitable Technology Use in Classrooms

By Melinda J. Bravo, Lucia Albino Gilbert, & Lisa K. Kearney

> "I would go to the computer lab and sort of sit in the corner and try to make things work," Susannah, a middle schooler, said. "None of the boys were very amenable to sitting down with a girl and explaining how things work."
>
> "I never really learned anything," she said. "It was always sort of a negative experience." (Reported by Dean, 2002)

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Computer technology is becoming increasingly important for education at every level. Teachers are expected to incorporate technology into their classroom instruction for all students. Classroom teachers, however, must face a constant challenge that they may not have the tools and strategies to address (Campbell & Sanders, 1997). Increasingly technology is being constructed as a predominately male domain where entering women find they must choose between "the cultural associations of 'femininity' and those of 'computers"'(AAUW, 2000, p. 7). The general acceptance of these views exists even at the middle school level (AAUW 1991, 1998, 2000). In

many classrooms boys dominate (Sadker & Sadker, 1994), typically taking up more of the "air time" than girls and monopolizing laboratory equipment and computers.

Our article describes two kinds of interventions aimed at changing classroom behavior in technology classrooms to create a more welcoming environment for girls. The educational materials we developed and successfully piloted take the form of carefully structured interactive skits and collaborative group exercises involving the use of technology. Both interventions are consistent with the principles of student-centered learning, collaborative group learning, and current thinking about how conventional views of gender can be changed in interpersonal interactions (Deaux & Major, 1987). Utilizing a student-centered "active" learning environment, the activities focus on the role of peer interactions in shaping and perpetuating gendered views of girls' and boys' choices and self-views.

Peer group interactions are particularly influential in perpetuating gender stereotypes, such as the belief that a person who likes computers is male and antisocial. A case study by Schofield (1995) indicated that although enrollment in entry-level computer classes was approximately half girls and boys, boys predominantly took advanced classes. Girls enrolled in advanced computer courses reported feeling isolated and teased about their appearance and their competence by both girls and boys (Schofield, 1995). Being teased and feeling alienated during high school were also common responses among the female college students interviewed in "Unlocking the Clubhouse: Women in Computing" (Margolis & Fisher, 2002). These patterns of behavior do not occur in a vacuum but rather are aided and abetted by societal norms, discourses, and practices that place girls interested in technology in a position of risking peer acceptance and facing isolation if they pursue their interests (Davidson & Schofield, 2002; Koch, 1994; Sanders, 1995). Thus, implementing interventions that counteract these negative experiences is needed to promote the futures of girls in technology.

Design and Description of the Interactive Educational Activities

A true student-centered learning environment requires a blend of techniques in which the learner is central in defining the meaning (Land, 2000). Within this perspective, learning is not seen as a result of development, but rather, learning *is* development. It requires intention and self-direction on the part of the learner. Thus, the learner needs to be active while the leader (or teacher) takes a less active role, allowing students to raise questions, generate hypotheses, and test their own ideas. The interventions we developed present students with several different situations in which girls and boys may differ in their relationship to technology, but are asked to construct their own meaning based on the activity at hand. The interactive activities provide active ways for increasing students' awareness of unquestioned assumptions about girls' and boys' interests, abilities, and roles as well as oppor-

tunities for challenging what they had assumed to be true about the use of technology.

The design of our interventions was guided by recent research and theory in the area of gender and technology (AAUW, 2000; Deaux & Major, 1987; Margolis & Fisher, 2002). Central to our conceptualization of what was needed in a successful intervention were the following requirements: (1) making abstract behaviors and assumptions more concrete, (2) providing opportunities for perspective taking (e.g., boys taking on girls' roles and vice versa), (3) presenting computing and technology as having a purpose by linking computing to other fields and to social concerns, (4) envisioning girls as creators of technology and as leaders in technology areas, (5) envisioning girls as capable of careers in technology, (6) deconstructing views of male students' "natural" attraction to computers, and (7) underscoring the importance of collaboration in advancing technology knowledge and of maximizing every person's abilities and special strengths.

Our goal was to provide teacher educators with strategies and specific interventions for breaking stereotypes surrounding the use of technology and fostering gender-fair collaboration between girls and boys in the classroom. The next section describes the educational interventions we developed and their use in middle school classrooms this past year. We then report on the observations of the teachers who participated in our project and provide comments from students in their classrooms. Finally, we identify several factors teacher educators may wish to consider in applying these kinds of interactive tools.

We constructed two interventions that provide a well-designed package of activities — carefully structured interactive skits and collaborative-learning exercises surrounding the use of technology. These materials are designed to engage students in interactive activities that challenge conventional views about technology. Particularly important in using the materials is allowing girls to experience themselves as creators of technology and leaders in technology areas.

Interactive Skits

Because the cognitive abilities of late adolescents are in transition from concrete to abstract thought, role-playing is highly effective in enabling students to reflect on what they see and helping them connect their new insights to other experiences (e.g., Campbell & Campbell, 1990; Griggs, 2001). Moreover, by assigning roles in skits, girls can take on roles characteristic of boys' gendered behaviors, and boys can take on those characteristic of girls. Thus, students gain opportunities to view and discuss roles depicted in the skits from the perspective of both sexes. While students play adults in some skits, most scenarios place students in everyday school situations where one sex may encounter gender stereotypes (e.g., a girl telling her group of friends that she has decided to attend a summer computer camp). We developed two skits. In the first skit, the lead student plays a girl (or boy) trying to join a group of boys on the computer, and in the second skit

s/he plays a newly hired team leader in a computer game development firm. The scripts for the skits are available from the second author.

On the day of the skit activity, the teacher and a teacher's aide use the classroom to create a theatre-like setting in which some students will take on roles and other students form the audience who observe and comment. Desks or chairs in the classroom are arranged in a semicircle. Four or five chairs/desks are placed in the open area or "stage" at the front of the room. Every skit presents two types of characters: Female or Male Students and their Thought Bubbles. A Thought Bubble is assigned to each Female or Male character to voice her or his thoughts. When prompted by the teacher, Thought Bubbles report what the characters on stage might be thinking and feeling. Because the skits focus on interpersonal action, the Thought Bubbles are a direct, powerful means of exploring the unconscious aspect of gender dynamics. Students not assigned an actual role in the skit form the audience. These students are either asked to serve as reporters who later report on what they observed or asked to complete a handout illustrated with blank Thought Bubbles, which they then use to compose their own thoughts about what the main characters in the skit are thinking and feeling.

Before the action begins, the teacher or teacher's aide takes the lead Female or Male Student and her or his Thought Bubble out of the classroom for instructions while the other person assigns the remaining roles and explains to those actors and the rest of the class how the scene is to be set. In the skit involving a computer game company, for example, students are told that today "they will be fast forwarding to the future." The lead Female Student and her Thought Bubble play a newly hired team leader in a computer game development company that wants to create an innovative game for teenagers. The girl playing the lead Female Student is asked what field she intends to study in college. No matter how the girl responds, the teacher links this field to technology and explains to the class why a person with this particular interest (e.g., music, psychology) would be selected to head up a computer game design project. Three boys are selected for the work team.

Next, the action begins. The teacher allows the student actors to improvise the skit for five to ten minutes. When the action starts to stagnate or when specific gender dynamics become obvious, the teacher calls a "freeze" or a "time out" to the action. The actors stop improvising and the teacher communicates with the Thought Bubbles or initiates audience discussion of the skit. Thought Bubbles, for instance, might be asked to express how their characters felt when a provocative statement is made, such as a statement made by a team member in one skit that, "She was thinking (the lead Female Student), she would rather be at the mall shopping." After all of the Thought Bubbles have an opportunity to speak, the teacher can signal the action to begin again. This process can be repeated from one to three times, depending on the skit's content and the students' responses. Time permitting, the skit is replayed with the roles reversed or changed in ways that best fit pedagogically. We typically followed the initial scenario with one in which a boy played the lead with three boys or three girls

comprising the work group.

In the class discussion following a skit or pair of skit scenarios, the teacher asks for students' reactions and asks them what they thought made the student able to join the group working at the computer or made the team able to work well together, and what may have gotten in the way. If two scenarios of a skit are performed, students are asked to comment on possible similarities and differences. In our experience, students were keen observers and often brought gender stereotypes and dynamics into the discussion.

For example, at the conclusion of one skit in which the girl was having noticeable difficulty joining the computer group, the teacher asked the class, "Why is 'Amy' experiencing difficulty?" The following discussion ensued:

(Girl): Because she is a girl.

(Boy): Maybe it's not because she is a girl; maybe it's just because they are busy.

(Girl): It's not that she's a girl it's just that because she **is** a girl she is talking too sweet so they are ignoring her. Boys are more "macho." You have to talk to them that way.

In a second example, Thought Bubbles in the skit regarding a girl being a leader and designer of technology of an all-male work group commented as follows:

(Boy) "Why'd they hire a girl? Everyone knows guys are so much better."

(Boy) "Yeah. I don't want to have some girl bossing me around."

(Boy) " You're so right. She can't just come in here and take over. I know a lot more than she does about computers and stuff. I am so much better. It should be a guy idea."

Teachers need to be prepared to process this rich material in the discussions of each skit and to use these discussions to help students move beyond their stereotypic thinking. It is also important to reinforce non-stereotypic thinking and behavior. Student observers of one skit commented on how a group that worked well together made decisions based on information they gathered and not on stereotypes about what girls or boys can and cannot do. In another, a student commented that what made the idea the group came up with "so cool" was that boys and girls were working together.

Skits can also be designed as a lead-in for the second type of intervention—the collaborative group projects. In our pilot project we followed the girl's being-a-leader-and-designer skit with a homework assignment designed to segue into the collaborative work-group activity #2 described in the next section. For homework, we asked students to visit popular websites for girls and for boys with an eye toward web design (e.g., www.girltech.com and www.bolt.com). Instructions were to

"Think of yourself as a 'graphic designer.' Look at each of these websites carefully for ideas on how you may want a web page of your own to look. Be prepared to share your ideas about what you found in a small group discussion." Students were provided with a worksheet that contained the web sites and a checklist of items to look for on these sites with regard to design, style, and layout of the home page, and connecting links.

Collaborative Work Groups

Cooperative learning groups (Cohen, 1994) go hand in hand with student-centered learning. Indeed, using collaborative work groups is a preferred way of teaching in many classrooms. They can be used to challenge status categories and stereotypic views students may have unconsciously accepted, introduce students to new ways of learning and interacting, and empower students' competency (Gilbert & Gilbert, 2002). At the same time, gender dynamics can interfere with effective collaborative group work. Boys may take over the leadership roles, monopolize time on the equipment, push to have their ideas followed up, and interact with other males in their work group to exclude or diminish girls in the group (Gilbert & Gilbert, 2002). These kinds of dynamics can dampen girls' interest and participation. For this reason, we designed activities appropriate for this teaching format. The two collaborative group activities we developed have different goals. The true-false activity challenges students to give evidence to stereotypic beliefs regarding girls' and boys' relationship to technology, while the collaborative graphic designer project is constructed to reinforce girls as designers and leaders of technology.

Collaborative group project #1: True-false exercises. This activity challenges students to give evidence to support stereotypical beliefs about girls' and boys' relationship to technology. Teachers ask students who are working in small groups, ideally of three to four students, to think of themselves as scientists who have to come up with "observations" and to decide whether each of four statements is true or false.

Students are provided with a work sheet that provides instructions for the exercise, but does not include the statements. The statements are presented one at a time on an overhead. Students have a few minutes to discuss the statement, decide its truth or falsity by group consensus and agree on the evidence for their decision. One student in each group records the group's response and reasoning. Once the groups have reached a decision, the teacher polls the groups and notes how many reasoned true, false, or neither/not sure. Several work groups are asked to provide their evidence to the class. The teacher then provides the correct answer with data to support the answer (i.e., the rationale presented below). A discussion then follows on that item. This process continues until all four statements have been considered. We developed four statements that we believed would engage students easily and would involve discussions on key aspects of gender stereotyping in technology. Questions can be tailored for any curriculum, however.

(1) *Girls smile more than boys do (True).* We included this item because it is a behavior students' readily observe in a number of settings. Girls on average smile more than boys in accordance with societal expectations that girls and women be friendly and kind and viewed as attractive by others. This finding is well documented in social science research (LaFrence, Heckt, & Paluck, 2003).

(2) *The more math and computer classes you take in high school and college, the more money you will make in your job later on(True).* We included this item to broaden thinking about the kinds of jobs using math and technology and to encourage students to take these classes. This finding is well documented in national salary studies.

(3) *Boys like it when girls don't know as much about computers as they do (Neither true nor false).* We included the item to raise awareness about the pressure on boys and girls to act in stereotypic ways. We saw this behavior played out to some extent in the skits. Often boys assume girls know little about computers and girls sometimes go along with this stereotype. Girls also may be reluctant to let boys know how knowledgeable they are for fear of not being accepted not only by boys but also by other girls. Similarly, boys may assume or say they know more than they really know. These behaviors can be strategies for dealing with societal expectations and stereotypes that boys should be more knowledgeable than girls in certain areas. Acting more knowledgeable than girls can protect boys from negative comments from male and female friends who hold stereotypes about how boys should be and act. The AAUW (2000) report discusses some of these dynamics.

(4) *Girls and boys are equally interested in computers (Neither true nor false).* Here again we included the item to raise awareness and increase discussion in an area in which stereotypes are strongly held. Boys do not have the corner on technology, although what we hear about technology would lead one to think they do. Girls and boys, women and men, use computers to similar degrees and for similar reasons. According to the "iron rule" in social science research (cf. Gilbert & Scher, 1999) there is always greater variability (in this case, of interest in computers) within each sex then between the sexes. That is, there are many girls with more interest in computers than the average interest for boys, and there are many boys with less interest in computers than the average interest for girls.

Collaborative group project #2: Web design. This collaborative web design project places girls in lead roles in a technology assignment. In our pilot project we linked this activity to the second skit. However, if teachers prefer, this activity can also focus on web design projects related to the subject matter of their class.

Following the second skit, students receive specific instructions to visit certain web sites and to pay special attention to the design features of the site. Students who do not have access to a computer at home are given the opportunity to use a classroom computer during free time set by the classroom teacher. Students have one week to complete this assignment in order to be prepared for another "special day."

On the special day, students participate in a collaborative group project of three to four students in which their group now constitute the "technology design team" in the skit that they have participated in or observed earlier. On this class day they are given the assignment to design the layout of the home web page for the new game for teens that emerged from the skit. The small groups are composed of all female/male students or mixed-sex groups of at least half female/half male students, depending on the composition of the classroom. Teachers make the group assignments using cards with students' names on them. The cards also indicate who in that group will be the leader. A female student is assigned, as "lead designer" in all the groups in which there are female students. The teacher remains hands off, encourages students to collaborate as a team, and prompts teams to create links and include some of the interesting graphics from the assigned sites they were to visit for homework. Toward the end of the class period or in the next class period, the teacher asks the "lead designer" to stand up and briefly explain to the class the design of their home page. Students in our project were very engaged in the activity and developed creative web sites. No two were alike.

Teachers' Observations and Students' Responses

These activities are consistent with an active student-centered learning environment and promote dialogue within the community of learners in the here and now. Encouraging students to process the activities in which they are engaged makes central their responsibility for defending, proving, and communicating their ideas to one another (Edwards & Mercer, 1987).

For our project we selected a middle school that draws its students from low-to-middle SES neighborhoods and has a student body that parallels the racial/ethnic composition of the city (approximately 20% Hispanic, 9% African-American, 65% Caucasian, and 5% Asian/other nationalities). Most teachers in the school were Caucasian, although there were also a good number who were Hispanic or African American. One of the school's three seventh-grade teams was selected at random, and the teachers associated with that team invited to participate. The team consisted of four single-subject middle school teachers (history, math, English, and science). All four teachers agreed to participate after learning more about the project. These four teachers and their seventh-grade students participated in our project in spring 2001. The second author met several times with the school's principal and teachers during the fall semester to discuss current thinking about gender dynamics in the classroom and ways they can be challenged. We then partnered with teachers to implement the interventions as part of regularly scheduled classes during the spring semester.

Teachers' Observations

The teachers were interviewed individually at the end of the spring semester. (The math teacher became ill mid-semester and could not participate.) We asked for

their candid thoughts and observations about the various activities and also asked whether and how they planned to integrate the activities into their next year's curriculum.

All the teachers noted a change in the ways girls participated in the classroom, often noting an increase in the collaboration between students within the class itself. Teachers especially noticed that girls became more comfortable expressing themselves in the classroom, choosing to vocalize their opinions in class discussions rather than remaining silent. For example, the history teacher noted that some of her more quiet female students began to speak up more in class and took on more leadership roles, which she attributed to their participation in the skits. Their comments on girls' taking on more active roles were made with regard to Hispanic, Caucasian, and African American students in their classes. Thus these changes appeared to occur across these three ethnic/racial groups.

Teachers also noticed a change in male students' behavior. One teacher noted boys' responses to the girls' increased participation in the classroom. To her surprise, the boys in her classroom began to listen more to what the girls were saying, rather than overpowering them. However, another teacher expressed concern that the boys in her class were threatened about the girls feeling more confident and speaking up in class. Overall, the teachers reported a definite shift in attitude for both the boys and girls in their classroom, which narrowed the gender divide not only in technology, but in other areas as well.

Another theme in the teacher interviews was the breaking of gender stereotypes both within their students and within themselves. One teacher was particularly pleased when she had a discussion on science careers and found a new attitude of "girls can do that, too" in her students, another example of girls finding their voices in the classroom. Girls also began to incorporate female role models into their own learning, with one teacher noticing that some of the girls began to pick women of history as the focus of their reports.

All teachers noted a shift in gender awareness in their own teaching methods. For example, one teacher noticed that all the famous people on her wall were male and sought out posters of notable women in history to add to the collection. This positively influenced the girls in her class and led to their organizing events to celebrate women's history month. In addition, teachers commented on their increased awareness of the disproportionate amount of class time they focused on male students. To counteract this, teachers monitored how much floor time was given to boys and girls and worked to equalize this imbalance. Thus, teachers' increased awareness of gender stereotypes in themselves affected the way these teachers approached teaching in general, not just teaching involving technology.

Finally, teachers emphasized the efficacy of the educational tools for breaking gender stereotypes. All three teachers identified themes and activities that they planned to include as a regular part of their own curriculum. The science teacher was particularly impressed with students' responses to the skits and created ways to

integrate role-playing into her curriculum. She also planned to use collaborative group exercises for issues surrounding healthy choices, where she believed a number of gender stereotypes still exist. The history teacher focused on integrating writing components of the true-false exercises and web site design, which she believed were particularly effective because of their cognitive components. In addition, she placed girls in leadership roles more often. For example, she used thought bubbles in history exercises and asked female and male students to imagine what it would be like for a woman in a particular point of history. The English teacher emphasized the use of skits in helping students understand the gender-role constriction that existed at different time periods for fictional characters they were reading about in class. She designed a curriculum that integrated the use of skits to portray differing gender roles and gender expectations at different points in history and how they may still affect men and women today.

Students' Responses

Students also noticed changes in their own collaborative skills. Several students commented that they learned how to better cooperate with other students, respect others' opinions, and learn the importance of compromise. Other students indicated a change in stereotypic gendered thinking. For example, one boy commented, "I learned that not just boys like computers, but girls also enjoy computers." A female student emphasized the following: "I learned that some people really do think girls are only here to cook and clean. Even though we're in the 21st century, people still have this hang up that guys are so much more superior to women and that they can do everything and women can't. Which is so untrue!" Another girl stated, "I learned about how guys and girls can do the same thing and be equally good."

An increase in understanding gender stereotypes was often combined with positive attitudes towards technology and a desire to be designers, not only users of technology. Both were major goals of our pedagogical tools. One female student responded, "I learned that I probably like computers more than I thought. I also learned anyone can be good with computers!" Boys also responded with more positive computer attitudes. One respondent stated, "I learned that it's fun to design web pages!" Finally, one girl commented, "I learned that I'm not the only one that likes to design a web page. Other people, like girls and boys, can make up their minds and have what they want in their web page."

Girls' increased excitement about using computers and decreased negative attitudes towards computers occurred across ethnicities. One Hispanic female student noted at the end of the program that she learned that girls should not give up on using computers, even if they feel that boys know more. Another Hispanic female student stated, "I learn[ed] how to . . . create websites…I hardly did not know that that was cool." Additionally, a few students in the classrooms were non-English speaking students who had recently arrived from other countries, but had a good

command of the written language. We found that the students in the class were eager for these students to participate and helped them become involved. Using written handouts for the thought bubbles and true-false exercises, described earlier, provided a means for their increased involvement.

Hence, both teachers and students reported positive effects, including collaboration, the breaking of gendered stereoty pes, and for girls, more positive attitudes towards computers and an increased desire to be innovators in technology. That positive effects were observed in students of both sexes speaks well to the effectiveness of these tools.

Factors That May Affect Implementation

A number of contextual factors need to be considered in teaching and using these interventions effectively.

Teacher Perspectives and Classroom Dynamics

We had permission from the teachers in the project to provide them on-going feedback about gender dynamics we observed in their classrooms. Initially, we observed that all four teachers called on boys more than girls, and gave boys more encouragement to engage in active learning, such as more time to figure out a problem and come to their own solution. We also noticed that boys received more attention as a strategy to keep them from disrupting the learning environment. Our providing feedback to the teachers, using concrete examples, was instrumental in their being able to change these behaviors. A poignant example occurred with regard to the group web design intervention. Girls were assigned to head up all the web design teams and then were supposed to report back to the class on the design their team had created. Instead of calling on the girl leaders to report back, one teacher began calling on the male members of the design team. When we quietly called this to her attention, she was amazed. She had no idea that she had been participating in this gendered behavior with her students and realized that she thought the boys knew more.

The interventions are designed to place students in learning environments that counter gendered stereotypes and behaviors about who can be leaders and designers of technology. In planning the use of the collaborative groups exercises we paid close attention to the sex composition of the student work groups. It is well documented that boys dominate group work, especially when they form the majority of the group (Busch, 1996). To minimize this possible effect, we made sure that girls were not in the minority in either of the small group collaborative projects. Moreover, in the skits, girls were asked to join an all male group and then to lead an all male group, experiences designed to provide them with a successful leadership experience in a traditional male domain. Teachers can continue to use these principles throughout the rest of the school year in assisting and empowering their students' learning.

Software biases can also influence the effectiveness of the educational tools. Asking students in the web design collaborative group project to visit web sites that are off-putting to girls or boys could foster a negative attitude in the group work. However, if reframed by the teacher, they could raise students' awareness about the elements of good websites and what draws students to them. We purposely included web sites frequently visited by girls and boys so that both sexes could learn more about these sites and thus draw opinions based on data rather than stereotype. One all-male group designed a website with a repetitive violent theme. After seeing what others in the class designed, they regretted not having taken the time to follow the teacher's instruction to "think outside the box."

The skits and true-false collaborative project were designed to provide a relatively supportive environment in which gender stereotypes about technology could be challenged and changed. Using these occasions to encourage students' ongoing reflection would add to the effectiveness of these activities. For example, in processing the first skit, the teacher asked the class, "What would have to be different for S. (the lead girl) to feel comfortable joining the group?" One boy said, "Maybe if they were friends, if they know each other." In contrast, a girl in the class said, "If it wasn't a girl." The teacher used these genuine responses as an occasion for students to reflect on these comments and the evidence on which students bases certain conclusions and beliefs.

Team Teaching

A team approach may be particularly effective in accomplishing the integration of these tools into the curriculum. A team of teachers working together, as in the pilot project, can provide support and can help ease time constraints. For example, one teacher can work on creating the true/false exercise while another works on creating applicable skits. Another aspect of the teaming suggested by the teachers is the presence of a teacher's aide or a volunteer in the classroom. With another person present, it is easier to engage all students during the skits and to provide feedback.

Selecting software for use in the classroom can be more easily accomplished as a team. Software should focus on design elements that engage the interests of a broad range of learners, girls and boys. AAUW (2000) identified ten design characteristics conducive to engaging boys and girls with computer environments. These included: software that is personalizable and customizable; challenging games that involve strategy and skill; designs that support collaborative or group work and encourage social interaction; games with coherent, nonviolent narratives; and games that are goal-focused rather than open-ended. Teachers could use their work together to develop a "gender aware checklist" to guide the school in selecting software for the classroom.

Students' Prior Experience With Technology

These educational tools can quite easily be modified in response to the classroom context. Teachers whose students have had less prior experiences with technology may wish to add assignments as additional scaffolding before using the second skit and collaborative group exercise. Teachers with students who have the time, desire, and resources to create their own web page may wish to extend the final activity in this way. Such a website could continue throughout the school year, with students also learning how to maintain and update their website.

Some students in our pilot project had never accessed the Internet previously, nor did they know what constituted a web page. Setting aside days that teachers can take their classes to a computer lab to learn how to access the Internet and look at web pages may serve as a leveling effect and encourage students without access to use their neighborhood library or their school library more than they currently do.

Other factors regarding computer familiarity may need to be considered. For example, students with greater extra-curricular computer usage may have the tendency to dominate some activities, such as the web design exercise. By creating groups of similar computer experience in such an exercise, teachers can encourage greater participation by all members. Or students who complete tasks more quickly can aid students just becoming familiar with the computer. Explaining programs and applications to others can enhance students' own technological learning.

Finally teachers need to be careful not to hold the attitude that boys know more than girls about technology and various software. The literature indicates quite clearly that the message from girls is, "We can but I don't want to." (AAUW, 2000, p.7). Boys are more likely than girls to purchase games, but these games do not necessarily provide them with additional technological skills. We found that girls and boys in the project varied a great deal within each sex regarding exposure to and experience with various technologies, but on average they were quite similar. The one variable that did tend to differentiate those students with no computer at home or little to no familiarity with the web was socioeconomic status, which for some students was linked to ethnicity. Students from lower socioeconomic families had less access and less experience.

Subject Matter

These interactive tools were developed and piloted with middle school students in math, science, English, and history classes of 25 to 30 students. Educators can teach these tools to teachers from a variety of fields and empower teachers to use them creatively to fit their own curriculum, and in their own way use the tools to alter conventional gender dynamics and biases in their classrooms.

The teachers with whom we worked taught a variety of subjects and felt the set of educational activities could be adapted and integrated into any technology classroom. For example, a science teacher might create true/false statements about gender stereotypes within the world of science (e.g., "Males make better electrical

engineers than females") and design role plays and collaborative web design projects around topics for the class. A history teacher may create true/false statements about women's roles in a particular historical period and make the goal of the web design exercise to create a web page addressing how women gained the right to vote in the United States. Thus, the tools can be reconfigured to fit a particular subject matter in breaking gender stereotypes and creating a more welcoming environment for girls.

Conclusion

Gender equity in the schools is vital to the development of the full potential of both female and male students. We describe innovative interactive tools for promoting gender equity in classrooms that use technology as part of their curriculum. The interventions are most applicable to altering gender stereotypes and processes in interactive settings such as the classroom; they are not designed to address other forms of inequity in educational contexts. Teachers' and students' responses provide evidence that the interventions were indeed successful in raising awareness as well as effecting change.

While these educational tools were quite effective, no one set of pedagogical tools can overturn all gender inequity and sexism within our schools (Sadker, 1999). They must be followed-up with future opportunities for students to continue the application of the skills they learned. Further, teachers, administrators, and parents must continue their own journeys in promoting gender equity in the schools by altering their own gendered behaviors in interactions with girls and boys and providing other gender equity programs within the school at large.

Acknowledgements

This project was supported by an American Association of University Women Community Action Grant and grants from the Alcoa and RGK Foundations. We gratefully acknowledge and thank the middle school principal and teachers who worked with us.

References

American Association of University Women (AAUW). (1991). *Short- changing girls, short-changing America.* (Available from AAUW, 1111 16th NW, Washington, DC 20036.

American Association of University Women. (1998). *Gender gaps: Where schools still fail our children.* Washington, DC: AAUW Educational Foundation.

American Association of University Women. (2000*). Tech-savvy: Educating girls in the new computer age.* Washington, DC: AAUW Educational Foundation.

Busch, T. (1996). Gender, group composition, cooperation, and self-efficacy in computer studies. *Journal of Educational Computing Research, 15(2),* 125-135.

Campbell, T.A., & Campbell, D.E. (1990). Considering the adolescent's point of view: A marketing model for sex education. *Journal of Sex Education and Therapy, 16,* 185-193.

Campbell, P. B., & Sanders, J. (1997). Uninformed but interested: Findings of a national survey on gender equity in preservice teacher education. *Journal of Teacher Education, 48*(1), 69-75.

Cohen, E. G. (1994). *Designing groupwork: Strategies for the heterogeneous classroom*. New York: Teachers College Press.

Davidson, A. L., & Schofield, J. W. (2002). Female voices in virtual reality: Drawing young girls into an on-line world. In K. A. Renninger & W. Schumar (Eds.), *Learning and change in cyberspace* (pp. 34-59). New York: Cambridge University Press.

Dean, K. (March 23, 2002). Lilith: Geek music to girls' ears. From ASCD SmartBrief listserve. http://www.wired.com/news/women/0,1540,51249,00.html

Deaux, K., & Major, B. (1987). Putting gender into context: An interactive model of gender-related behavior. *Psychological Review, 94,* 369-389.

Edwards, D., & & Mercer, N. (1987). *Common knowledge: The development of understanding in the classroom.* New York: Routledge.

Gilbert, M. C., and Gilbert, L. A. (2002). Challenges in implementing strategies for gender-aware teaching. *Teaching Mathematics, 7 (9),* 522-528.

Gilbert, L.A. , & Scher, M. (1999). *Gender and Sex in Counseling*. Boston: Allyn & Bacon.

Griggs, T. (2001). Teaching as acting. Considering acting as epistemology and its use in teaching and teacher preparation. *Teacher Education Quarterly, 28 (2),* 3-37.

Koch, M. (1994). No girls allowed! *Technos 3* (3), 14-19.

LaFrance, M., Heckt, M.A., & Paluck, E.L. (2003). The contingent smile: A meta-analysis of sex differences in smiling. *Psychological Bulletin*, 129, 305-334.

Land, S.M. (2000). Student-centered learning environments. In D.H. Johanassen & S.M. Land (Eds.), *Theoretical foundations of learning environments* (pp. 1-23). Hillsdale, NJ: Erlbaum.

Margolis, J., & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing*. Cambridge, MA: MIT Press.

Sadker, D. (1999). Gender equity: Still knocking at the classroom door. *Educational Leadership*, 56, 44-47.

Sadker, M., & Sadker, D. (1994). *Failing at fairness: How our schools cheat girls.* New York: Touchstone.

Sanders, J. (1995). Girls and technology: Villain wanted. In S. Rosser (Ed.), *Teaching the majority: Breaking the gender barrier in science, mathematics, and engineering* (pp. 147-159). New York: Teachers College Press.

Schofield, J.W. (1995). *Computers and classroom culture.* Cambridge, UK: Press Syndicate of the University of Cambridge.