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# Theme Section

# Gender, Educational Technologies, and the School Library

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The focus of the theme section in this issue of *School Libraries Worldwide* is gender and educational technologies (ET). Educational technologies, as a subset of information and communication technology (ICT), are an ever-increasing presence in schools and school libraries. Neuman's (2003) review of the school library media research suggested that "the question of how students learn with electronic information sources is one of the field's key research questions for the coming decade" (p. 510). An important subdivision of this area is the consideration of how gender affects students' use of educational technologies. Although large bodies of gender and ET research exist in the fields of education and gender studies, there has been relatively little related research in library and information science and even less in school library settings. In this introduction to the theme section, I review some of the major literature in the area and explain why this issue is relevant to school library media service.

## Gender and Educational Technologies in Education Research

Volman and van Eck (2001) reviewed 10 years of recent education research relating to gender and ICT, dividing it into three major categories: "access to computers, processes of computer-related learning, and outcomes" (p. 613). Concerning access, the authors concluded that throughout the 1990s, girls in most countries continued to have reduced access to computers at home and at school, although girls were beginning to catch up to boys.

As for processes of computer-related learning, most of the studies Volman and van Eck (2001) reviewed found no differences in male and female teachers' attitudes toward technology. Many of the studies did indicate, however, that girls continue to use computer games less frequently than boys, resulting in reduced computing interest and skills.

In the area of outcomes, Volman and van Eck (2001) reviewed many studies indicating that girls have significantly lower self-confidence in computer use than boys, which leads to reduced learning outcomes for girls, even after computer experience is taken into account. They concluded, "Students who often work with computers perform better than students with less

experience, and boys generally have more experience than girls" (p. 626). Looking toward the future, the authors suggest

> linking two sorts of research that are often carried out separately at the moment: (a) research on achievements in ICT tasks, which shows that girls score less well, and (b) research on the methods of working and the types of software that girls find attractive. (p. 629)

It remains to be seen whether education research will head in this direction.

## Gender and ET in Library and Information Science Research

Burdick (1996) asserted nearly 10 years ago that "there is a lack of research in library and information science literature on the impact of gender on the experience of information seeking" (p. 19). This statement remains true today. The limited library and information science research regarding gender and ET that does exist complements the larger body of education research reviewed by Volman and van Eck (2001). It offers specific perspectives on the roles of libraries and librarians in working to improve gender equity with ET in four major thematic categories: computer use gender gap, computer attitude gender gap, gender and computer information behavior, and gender and computer resource design.

### *Computer Use Gender Gap*

Earlier in the evolution of gender and ET research, the education literature indicated that boys tended to use computers more than girls both at school and at home (Durndell, Glissov, & Siann, 1995; Giaquinta, Bauer, & Levin, 1993; Inkpen et al., 1994). As discussed above, Volman and van Eck (2001) showed that this gap appears to be diminishing. In the field of library and information science, Beeson and Williams (1985) studied preschool children's decisions to use computers in a preschool program and found inconclusive, mixed results that neither affirmed nor negated the computer gender rift for preschoolers.

Other library and information science research has operated on the assumption that the gap exists, rather than trying to measure the extent of the gap. For example, Clark et al. (1989) suggested strategies for minimizing the computer use gap in libraries. Suggestions included:

> Targeting females as a group needing specialized or different instruction ... Eliminating sexist computer practices ... Making computer use as social as possible ... Stressing the importance of using the computer to access information during the course of instruction ... Examin[ing] the hardware and software they are providing patrons for any inherent male or female bias ... [And] provid[ing] opportunities to develop computer equity for library staff. (p. 117)

In a similar vein, Jacobson (1994) sought ways to reduce high school girls' computer anxiety and increase their computer use in school. Based on dis-

cussions with members of Women, Information, Technology, and Scholarship (WITS), a group of women who work with technology, Jacobson offered a number of recommendations for encouraging girls to increase their use of computers. She suggested that school library media specialists:

> 1. Make sure there are a good number of female teachers who are comfortable with computers. They serve as good role models for both sexes.
> 2. Have plenty of female [computer] lab monitors. It is too easy for boys to make girls feel unimportant or dumb. In turn, train the boys not to hover or supply help before girls have a chance to figure things out for themselves.
> 3. E-mail is always a cross-gender hit ...
> 4. Make sure that early introduction to the Internet includes the kinds of courses girls tend to like.
> 5. Establish a discussion forum for girls on some shared topic of interest. (p. 291)

Regardless of the extent of the computer use gap, current researchers generally agree that girls tend to use computers differently than boys (American Association of University Women, 1998). Most important, even girls who are frequent computers users tend personally to eschew "computer culture," which makes them less likely to pursue careers as computer scientists and technology designers. Thus it seems that the computer use gender gap persists, but it is now more of a qualitative gap than a quantitative gap.

Another significant difference in use patterns is that boys use computer games at higher rates than girls. Girls' reduced game use has been tied to women's reduced participation in computer science because, as Graner Ray (2003) explained, "we cannot expect women to excel in technology tomorrow if we don't encourage girls to have fun with technology today" (p. 6). I discussed this topic of a computer game gender gap in a recent literature review (Agosto, 2004). I suggested that librarians could encourage girls to catch up with boys by selecting games likely to be of high interest to girls. Based on the research I reviewed, I suggested that girls prefer computer games that:

- feature female characters in strong positive roles;
- enable girls to play with and communicate with other players, either online or by sharing the same computer;
- avoid the conflict between good and evil;
- emphasize storylines and character development and focus on human relationships;
- use real-life locales;
- enable users to play the role of main character;
- offer some educational value, as opposed to those designed purely for entertainment;
- contain nonviolent action;
- reflect girls' common play patterns; and
- feature abundant high quality graphic and multimedia components.

## Computer Attitude Gender Gap

Closely tied to the gender and computer use gap is research concerning a gender and computer attitudes gap. Most researchers have concluded that boys tend to be more confident and feel more comfortable using computers than girls. Durndell et al. (1995) and Margolis and Fisher (2002) are two often-cited education research studies that discuss this gap in attitudes. Durndell et al. found that, in addition to being more likely to own home computers than girls, male Scottish secondary students were likely to view computers more positively than female students. Working with undergraduate students in the United States, Margolis and Fisher conducted extensive interviews with computer science students at Carnegie Mellon University. They found that social, educational, and familial factors led girls and boys to view computer science as a male domain, a view that acted as an attitudinal deterrent to girls' pursuit of computer science degrees.

In the field of library and information science, Jacobson (1991) conducted a study of high school seniors' library use anxiety, computer use anxiety, and anxiety in using library computers for research, using gender as her main variable. She found that the boys had significantly higher library anxiety and that the girls had significantly higher anxiety with computer and computers for library research use. Even after a "library immersion experience," the gender gaps remained. Jacobson concluded that the library "seems to be a 'friendlier' environment for girls" and that "computers are friendlier for boys, in spite of an instructional intervention like [a] computer literacy course" (p. 275).

Leong and Hawamdeh (1999) studied Singaporean grade 5 students' attitudes toward computers. They found that the boys spent more time using home computers for games and had more computer experience, although the girls expressed more positive attitudes about classroom instruction using the Web. The girls also preferred working collaboratively, whereas the boys preferred working individually, a finding that echoes a number of earlier studies. It follows that school library media specialists can experiment with allowing girls to work in pairs or groups in the library to help reduce their discomfort with computer use.

More recently, Dobosenski (2001) discussed girls' computer clubs as a method that school library media specialists could use to build girls' computer skills and improve their attitudes about computers. She collected survey data to show that her grade 5 female computer club members exhibited increased positive attitudes toward computer technology after having taken part in a series of club activities.

## Gender and Computer Information Behavior

Another area of research interest in library and information science has involved gender and computer information behavior. Schacter, Chung, and Dorr (1998) examined the effects of task structure on information seeking on

the Internet. They asked 32 grades 5 and 6 students to perform one well-defined search task and one ill-defined search task. Although gender was not the main focus of their study, they did find that gender had an effect on searching. In general, the boys browsed more than the girls. The authors suggested, "boys were either scanning the documents they encountered faster than girls, or boys were not reading the majority of information they filtered through" (p. 847).

Although gender was not a major variable in her study, Hirsh (1999) found that elementary school girls were more interested in graphic material (pictures) than boys when making relevance decisions to gather information for homework assignments. More significantly, Large, Beheshti, and Rahman (2002b) studied gender differences in grade 6 students' collaborative Web searching techniques in a Canadian elementary school. They found that boys working in same-sex groups moved more quickly from link to link and explored more links overall than girls working in same-sex groups. They also found that the boys performed a greater number of searches and gathered more information than the girls. The authors concluded that future research is needed to develop Web interfaces designed to support gender-based variances in search techniques.

### *Gender and Computer Resource Design*

Last, a few library and information science studies have addressed gender and computer resource design. Much of my own research (discussed below) falls into this category.

Passig and Levin (1999, 2000) studied how Israeli kindergarten students reacted to design features of interactive multimedia stories. They found that the boys were more familiar with computer games, a familiarity that assisted their navigation through the stories, whereas the girls were more likely to ask for help. They also found that the girls were the most satisfied with stories that emphasized "writing, colours, drawings, help and a calm game" (1999, p. 181), and that the boys were the most satisfied with stories that enabled "control over the computer, sharp moves and many movements on the screen" (1999, p. 181). The authors suggested, "Most [educational computer] games are built with the emphasis on 'control,' 'choice' and fast 'navigation,' which may be the reason they appeal to boys more than to girls" (2000, p. 69).

Based on focus group interviews with children aged 10 to 13, Large at al. (2002a) found that children's Web portal preferences varied according to gender. The girls' favorite Web portal was LycosZone, due primarily to its visual design and ease of use, whereas the boys' favorite was Yahooligans, due mainly to a combination of visual design and retrieval capabilities.

## GirlsTech: Selecting Computer Resources of High Interest to Girls

My own research in the area of gender and educational technologies has focused on the study of girls' preferences in digital resource design. My earlier work, which involved group interviews (Frey & Fontana, 1991) with adolescent girls interested in science and technology, led to the creation of the GirlsTech Web site. Located at http://girlstech.douglass.rutgers.edu/, GirlsTech offers an evaluation framework for librarians, teachers, and other adults to select Web sites of high interest to girls. The framework includes eight evaluation criteria related to gender: confidence, collaboration, personal identification, contextuality, flexibility/motility, social connectivity, inclusion, and graphic/multimedia concentration. Web sites that are strong in many of these eight areas are likely to engage girls' interest, which makes them excellent teaching/learning tools for girls.

*Confidence.* Web sites that encourage and support young women's confidence in their abilities can counteract gender-related self-doubt. To assess confidence, ask:

1. Does the Web site use a tone of respect in regard to users' abilities?
2. Does it support and nurture young women's confidence in themselves and in their abilities?

*Collaboration.* For school-related work, girls tend to prefer working together in pairs or small groups. To assess collaboration, ask:

1. Does the Web site encourage exploration and inductive learning?
2. Does it lend itself easily to pair or small-group use?

*Personal Identification.* Girls exhibit increased interest in Web sites that relate somehow to their personal lives, such as an anatomy education site that features a teen female narrator or a biography site that profiles people from their home towns. To assess personal identification, ask:

1. Is it likely that the target audience will find a connection between their personal lives and the content of the Web site?
2. Does the site encourage role-playing?

*Contextuality.* Girls also tend to prefer Web sites that present information in a narrative or story format, as opposed to sites that list data in chart, graph, or encyclopedic format. To assess contextuality, ask:

1. Are information contexts (histories, stories, explanations, backgrounds, etc.) emphasized?
2. Is information presented as a story or narrative?

*Flexibility/Motility.* Girls exhibit preferences for Web sites that enable them to select their own navigational paths, as well as sites that enable them to move objects around the screen space. To assess flexibility/motility, ask:

1. Does the Web site allow the user to direct his or her navigational path?
2. Does it enable the rearrangement of objects within the screen space?

*Social Connectivity.* Key to engaging girls' interest in technology is finding resources that enable them to interact with other users. To assess social connectivity, ask:

1. Does the Web site emphasize the importance of its topic matter to human relationships?
2. Is there a method for contacting other people, such as a chat room for speaking to experts, or an email address for obtaining further information?

*Inclusion.* To help girls of all demographic groups to feel included in the technological revolution, school library media specialists should choose Web sites that represent people of as many diverse racial, ethnic, and gender groups as possible. To assess inclusion, ask:

1. Are women and men represented in roughly equal numbers in narrative, graphic, audio, and video content, and when women are represented, are they represented in positions of respect and influence?
2. Are people of diverse racial and ethnic backgrounds depicted?

*Graphic/Multimedia Concentration.* Visual design is of extreme importance in attracting girls to technology. School library media specialists should seek out Web sites with large percentages of quality graphic, audio, and video content. To assess graphic/multimedia quality, ask:

1. Is there a large percentage of quality graphic and multimedia content?
2. Are the graphics clear and easy to understand?

## Gender and Girls' Preferences in Educational Technology Design and Content

More recently, my research has moved from the examination of biological sex and information behavior (as reported in Agosto, 2001) to the consideration of gender schema and information behavior. This research is based on the idea that the male-female biological sex division might present an incomplete view of gender and its effect on information behavior and information resource design preferences. Gender schema theory (Bem, 1974) suggests that among the population as a whole, women tend to have dominantly "expressive" personalities; that is, they tend to focus on emotions and human relationships. Men tend to have dominantly "instrumental" personalities; that is, they tend to focus on actions and task completion. Gender schema theory suggests that strongly gender-schematic individuals view the world as largely bifurcated into feminine (expressive) and masculine (instrumental) components and that they tend to think of themselves largely in feminine or masculine terms.

To test the utility of gender schema theory in studying ET gender inequities, I conducted a qualitative research study in which 11 14- and 15-year-old girls completed the Children's Sex-Role Inventory (CSRI, Boldizar, 1991), a tool for measuring gender schema in children and adolescents (for a more detailed discussion of the study, see Agosto, in press.). The girls then spent

50 minutes evaluating a set of five test Web sites, after which they participated in semistructured group interviews about their Web site design and content preferences. They were divided into two groups for the interviews based on their CSRI scores. The feminine-high group (FH) had higher expressive/feminine scores on the CSRI, and the masculine-high group (MH) had higher instrumental/masculine scores on the CSRI.

During the two 50-minute group interviews, I asked the participants to discuss their opinions of the test Web sites they had evaluated and to discuss their use of the Web in general independent from the research study. I then used iterative pattern coding (Miles & Huberman, 1994) with QSR NUD*IST NVivo software to analyze the Web evaluation session notes and group interview transcripts. Similar to the constant comparative method (Glaser & Strauss, 1967; Lincoln & Guba, 1985), iterative pattern coding involves reading the data over and over, rearranging them into categories as themes begin to emerge. I arranged the resulting category codes into two models of the participants' Web site evaluation preferences, one for each interview group, represented in Figures 1 and 2 below. The categories and subcategories appear in the models in descending order of significance to the study participants, with upper-case letters for major categories and lower-case letters for subcategories.

Looking at the two models, a major difference between the FH and MH group evaluation preferences becomes clear. The FH group placed the most emphasis on site design characteristics, whereas the MH group placed the most emphasis on content characteristics.

For the FH group, GRAPHIC QUANTITY, GRAPHIC QUALITY, VISUAL ENGAGEMENT, MULTIMEDIA QUANTITY, and MULTIMEDIA QUALITY were of primary

(1) GRAPHIC QUANTITY
- (1.1) concentration
- (1.2) diversity

(2) GRAPHIC QUALITY
- (2.1) color preferences
- (2.2) detail
- (2.3) art style preferences

(3) VISUAL ENGAGEMENT
- (3.1) movement
- (3.2) composition/design manipulation

(4) MULTIMEDIA QUANTITY
- (4.1) audio/video concentration
- (4.2) audio/video diversity

(5) MULTIMEDIA QUALITY
- (5.1) audio/video clarity
- (5.2) audio/video workability

*Figure 1. Design evaluation criteria (feminine high group).*

(1) INFORMATION ENGAGEMENT
- (1.1) subject interest
- (1.2) interactivity

(2) INFORMATION QUANTITY
- (2.1) depth
- (2.2) supplemental information

(3) INFORMATION QUALITY
- (3.1) contextual explanation
- (3.2) topicality
- (3.3) clarity
- (3.4) functionality

(4) INFORMATION ACCESSIBILITY
- (4.1) organization
- (4.2) ease of use

*Figure 2. Content evaluation criteria (masculine high group).*

importance in determining whether they would evaluate a Web site favorably. If the visual design of a Web site did not appeal to the members of this group, they tended to rate it negatively overall, regardless of their interest in the site's subject matter.

The opposite was true for the MH group members, who placed primary importance on site content. The MH group evaluated sites according to INFORMATION ENGAGEMENT, INFORMATION QUANTITY, INFORMATION QUALITY, and INFORMATION ACCESSIBILITY. Although the MH group members did occasionally discuss Web site design characteristics, design elements served as evaluation criteria only if they were crucial to advancing or obscuring the meaning of the subject content. If the contrast between a background color and a font color made reading the text difficult, for example, then the MH group might critique a site color. Otherwise, design characteristics were generally considered superfluous to Web site quality assessments.

Overall, then, the FH participants viewed the Web as a visual medium, and quality visual design as key in creating a quality site. The FH group members reacted negatively to sites that were plain text with few graphics and little color, giving them low evaluations regardless of other site qualities. The MH group viewed the Web as an information medium, regarding visual content as adornment, not information.

Why is this research of interest to school library media specialists? Although most research into gender and the design of educational technologies has used the female-male division as the basis for analysis, this research indicates that a simple binary division cannot reveal the full variety of gender-related preferences in Web site design. To select Web sites of interest to both FH and MH female students, then, school library media specialists should offer multiple choices, keeping in mind that some female students will value visual content and others will value textual content.

## A Call for Continued Research

This small body of library and information science research has helped to bring the issue of gender and ET equity to light in our field. This theme issue is intended to continue the discussion and to serve as a call to researchers to continue this important work.

Together, the three articles in the theme section can serve as a framework for a future research agenda. Based on research conducted in an Icelandic school, Sólveig Jakobsdóttir, Bára Mjöll Jónsdóttir, and Torfi Hjartarson's article returns to the idea of measuring gender and computer use, attitudes, and skills gaps. The authors offer encouraging results, indicating that students' ICT skills improved over a four-year period, especially girls' skills. Jakobsdóttir, Jónsdóttir, and Hjartarson also consider the role of the school library media center in promoting ICT skills development and explain the general role of school libraries in the Icelandic education system. This work paves the way for future examinations of the school library as a central force in promoting gender and ET equity and reiterates the importance of monitoring the gender and ET gaps.

Rebecca Scheckler analyzes online discussion threads to show that gender plays a role in the power structure of an online teaching forum for preservice and inservice math and science teachers, much as many earlier researchers have shown that gender exerts influence in face-to-face classrooms. The results indicate that men dominated the online discussions and that men's discussion posts were much more likely to receive responses than women's. The author discusses the implications for school library media service, leading the way to future research into the effects of gender in mediated teaching practices in both virtual and face-to-face formats.

Finally, Lesley Farmer discusses "megasites," or Web sites that list groups of thematically connected Web links. To investigate the utility of megasites to school library media specialists interested in increasing girls' active participation in technology, the author conducted a systematic Web search for megasites dealing with teenage girls and technology. She presents the results of her search and discusses related implications for school library service. She concludes by presenting an annotated list of some of the best and most frequently used technology-related megasites for girls. This work reminds us that one of the traditional strengths of library and information science research has been our particular knowledge of how to use information resources for educational purposes, knowledge that we can put to use in our efforts to achieve gender equity with educational technologies.

## The Role of School Library Media Specialists

This really is the heart of the issue: How can school library media specialists work to ensure that girls and boys share equally in the benefits of educational technologies? This question has dominated the library and information science gender and ET literature for the last 20 years, and it will probably

continue to drive this research. The good news is that owing to the influence of the World Wide Web, girls are using technology more than ever before. In fact, in the US women are using the Web at higher rates than men (US Department of Commerce, 2002). The frustrating news is that this more equitable use of technology has not yet translated into more equal participation of girls in computer science. Since 1996 in the US and Canada, the percentage of female undergraduate computer science graduates has been falling. In the US, females obtained just 28% of computer science bachelor's degrees during 1999-2000 ("Earned Degrees Conferred," 2002). In Canada, the Canadian Information Processing Society found that women comprised fewer than 25% of computer technology graduates in 2001 (Clow, 2002).

This is why school library media specialists must be concerned with equality issues relating to gender and educational technologies. The *amount-of-use* gap appears to be narrowing, but a *types-of-use* gap persists. Girls and women are increasingly becoming technology users, but boys and men still dominate as technology creators and designers. School library media specialists need to be aware of these use differences and take an active role in making the creation and design of technology more attractive to all demographic student groups, especially those defined by gender.

As a school library media specialist, you can have a significant effect on girls' attitudes about technology by supporting and nurturing their budding technology interests. The various equity strategies discussed throughout this introduction remain relevant. Above all, school library media specialists must be aware of persistent gender and ET inequities and work to end them. The success of today's girls in tomorrow's technological world just might depend on it.

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## *Author's Note*

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