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Gender Bias in Computer Software Programs: A Checklist for Teachers

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Selection of appropriate software plays a vital role in facilitating children's desire to use computers. The discrepancy between girls' and boys' use of computers is enhanced by the scarcity of gender bias-free software programs. Analysis of the extant literature and rating of children's software indicates that gender bias is reflected in terms of characters, content and reward systems in the software program. A checklist is developed and pretested in this article. This checklist can be used to generate awareness of the subtle but pervasive gender bias in children's software programs and can be used by teachers in the selection and use of appropriate software programs in their classrooms.

Providing equitable learning experiences for girls and boys is an important educational goal. Studies indicate that a gender gap exists in terms of computer use, competency, and attitudes toward computers (Kirkpatrick & Cuban, 1998; Reinen & Plomp, 1997; Wilson, 1999). For educators, this is a matter of acute concern. Computers competency is a necessary tool in any profession in today's environment. Providing computer based educational experiences that both girls and boys can relate to is vital to address the issue of gender equity (Knupfer, Rust, & Mahoney, 1997; Turkle & Papert, 1990).

What is it that makes computer usage inequitable? There is little significant difference between girls' and boys' abilities in the use of computers in elementary school (Chapman, 1997). The differences become apparent as children enter the higher grades. The idea that computers are a boys' technology is a learned phenomenon (Calvert, 1999). A detailed report by the

American Association of University Women endorses the important need to get more girls from riding on the train to driving it in terms of the computer skills (American Association of University Women, 2000). Research indicates that differences in computer usage between boys and girls can be attributed to attitudes of girls and boys toward computers, attitudes of parents and teachers, and biases reflected in software (Bhargava, Kirova-Petrova, & McNair, 1999).

Selection of software that relates to girls' interests and shows that computers and software are "female/girl friendly" can encourage girls to use computers in a variety of ways, and become confident users of technology. The environment can be shaped differently to encourage children of both genders to become competent at computer use (Sutton, 1991). Since children experience and learn computer skills through software, this selection is instrumental in developing appropriate attitudes.

Building upon the existing research on gender bias, this article begins with the various characteristics in software programs that alienate and marginalize girls' experiences in software programs. Reviews of the current methods of evaluating children's software either capture specific details (type of program or platform) or generic evaluation (ease of use, educational value, or kid appeal) (see Buckleitner, 1999, for a detailed review). This article provides a checklist aimed at a systematic method of evaluating children's software for gender bias. The checklist is pretested among a sample of teachers and provides indications of its utility. The article concludes with the discussion of what needs to be done next to expand on this research.

LITERATURE REVIEW

Effects of Computer Software Selection

The pattern of gender bias previously documented in textbooks and other curriculum materials in terms of language, content, and illustrations is now present in computer software as well (Biraimah, 1993; Mangione, 1995; Sanders, 1997). As biases in books and curriculum materials affected children, similarly gender bias in existing software, even when subtle, can have a powerful impact on children's learning and development.

The booming software industry has inundated the market with a variety of software programs. The kind of software available to young children significantly influences their development in key areas as well as in important behaviors that affect learning (Haugland & Shade, 1994). Haugland's 1992

study found that children exposed to appropriate software had significant gains on measures of intelligence, nonverbal skills, structural knowledge, long-term memory, and complex manual dexterity. This study highlights the far-reaching consequences of ensuring equitable learning experiences for all children.

From a Constructivist perspective, knowledge is determined by the individual but grows out of one's experiences and interactions with the physical and social world. Young children take materials that have been presented to them and link it to information already stored in their memory (Calvert, 1999). If their memories contain gender stereotypic information, children are more likely to link this new information with the previously existing knowledge base, thereby perpetuating the already existing bias. Therefore, if much of the content in computer software programs reflects gender stereotypes, children construct the idea that computers are more relevant to boys than to girls.

As educators we need to be aware of the "harmful gender messages contained in fluffware (stereotyped software for girls)" (Linn, 1999, p. 16) and it's detrimental effects on young girls. Since software programs transmit messages about activities, status, and occupational roles that girls and boys can assume, programs like Barbie's hairdressing salon reinforce sexist messages and perpetuate sexist attitudes and behaviors. From a Constructivist perspective therefore, there is a need to "reorganize pedagogy to honor women's ways of knowing/viewing computers and technology so the practice of technology is no longer male dominated" (Christie, 1997, p. 147). Careful evaluation of software programs for elements of gender bias is essential before programs are selected for use in the classroom.

Evaluating Software for Gender Bias

Software evaluation is an important research as well as commercial undertaking. There are a number of sources both commercial and noncommercial rating children's software. Buckleitner (1999) provided a detailed list of the sources as well as an analysis of the ratings of these services. Recent developments include Internet-based sources that include user feedback in such evaluations (e.g., Amazon.com).

Given the extensiveness of the work, it is unfortunate that inadequate attention has been paid to gender equity issues. One indication of the gap in the existing research is to search the ERIC database. Using the key words "software" and "evaluation" for the period 1980 to 2001 this database contained 1705 journal articles. Adding key terms "gender bias" reduced these

to three articles, "equity" to seven and equal education to eight articles clearly indicating the need for further work.

Selecting software that is designed to meets the needs of young children is possible through the use of checklists such as Haugland and Shade (1994) and Haugland's *Developmental Software Scale* (1999). These reflect a developmental approach to learning that focuses on child related features, teacher related features, and technical features. Larson (1999) presented a general checklist for evaluating electronic material covering items such as the human roles, illustrations, language, and so forth, among others. The checklist uses a yes/no scale with a certain number of checks indicating "equitable" material.

While the existing checklists are good tools for software evaluation, there is need for an instrument that focuses primarily on evaluating software in terms of gender bias. Such an instrument can ensure that software is appropriate for both girls and boys, ensuring that both genders have equal desire to use and become proficient computer users. The teachers' role in selecting appropriate software is therefore critical; teachers must evaluate software prior to its use by children. An important role that a simple checklist can provide is to serve as a basis of discussion among students in the class. The relevant literature related to this checklist is detailed next.

DEVELOPING A CHECKLIST

Based on the analysis of the extant literature and the evaluation of the children's software discussion on gender bias covered three major areas. These include:

- bias in terms of the characters depicted covering issues such as the roles, representation, and so forth;
- the content reflecting the language and other preferences; and
- reward systems.

Each of these areas of concern is reviewed next.

Characters in the Software Program

Results from evaluating computer software programs indicate that a majority of the main characters are gender identifiable, and of these the largest percentage are male. In addition, females and males are depicted in stereotypic roles (Biraimah,1989; Chapman, 1997; Linn, 1999). A stereotypic image being one in which characteristics (male or female) are generalized, and often with derogatory implications, for example girls are depicted as being helpless and interested only in clothes and cosmetics. Characters are also stereotyped according to gender with males as doctors and females as nurses. Females are represented in traditional roles, primarily as caregivers and homemakers, while high status positions involving decision-making and active roles are assigned to males. In addition, male characters often portray science and technology related roles. Hodes (1995) reported that even in the elementary mathematics software, of the 41.7% of the programs that had gender identifiable main characters, only 12.5% were females.

The question of who is doing what and what is the relationship between people is also significant. Females are depicted in subservient and passive roles with males the active “doers” and females as the inactive observers (Purcell & Stewart, 1990; Sidel, 1990; Whatley, 1991). Thus girls are helpless victims waiting to be saved by Prince Charming. Sex roles thus became critical rather than incidental to the theme. Consequently the achievement of girls and women is based not on their own initiative and intelligence but is attributed to their physical appearance.

Research also indicates that even when software programs used androgynous figures, children, particularly boys, tended to assign a male gender to the “neutral” figures (Bradshaw, Clegg, & Trayhurn, 1995). Very young children have limited classification skills and their beliefs about gender stereotypes are very rigid. In addition, use of sexist language, for example mailman instead of mail-carrier perpetuates stereotypic roles and attributes. Five statements that describe these characteristics have been developed and included in the checklist. See Figure 1 for details.

Checklist for Evaluating Software in Terms of Gender Bias

Name of Program_____
Publisher_____
Age of Children for which program is appropriate: From _____ to _____
Curricular/Interest area_____
Comments_____

Please read the statements given below and tick the appropriate box.

Characters in the Software Program	Often	Some-times	Never	Not Appli-cable
Female and male characters are equally represented	☐	☐	☐	☐
The intensity of physical actions assigned to female is equal to those assigned to male characters	☐	☐	☐	☐
Female characters are presented in problem solving and leadership roles	☐	☐	☐	☐
The characters are not stereotyped by occupational roles (female baby sitters and male police persons).	☐	☐	☐	☐
The types of emotional statements attributed to females and males are not stereotypic	☐	☐	☐	☐
Content of the Program	Often	Some-times	Never	Not Appli-cable
The program is free of sexist language	☐	☐	☐	☐
The extent and frequency of aggressive and/or destructive behaviors is limited or non-existent	☐	☐	☐	☐
Content and overall style of the program appeal to both girls and boys.	☐	☐	☐	☐
Non human objects are not assumed to be male	☐	☐	☐	☐
The number of elements of competitiveness vs. cooperation among characters is balanced	☐	☐	☐	☐
The software program provides opportunities for group interactions at the computer	☐	☐	☐	☐
Rewards in the Software Program	Often	Some-times	Never	Not Appli-cable
Both female and male oriented rewards for correct answers are used	☐	☐	☐	☐
Rewards include both words and graphics	☐	☐	☐	☐
Program allows children to chose their own token reward system	☐	☐	☐	☐

Figure 1. Checklist for evaluating software in terms of gender bias

Content of the Software Programs

An analysis of the content of computer software programs suggests that the content "typically reflects male interest patterns" (Calvert, 1999, p. 61). A majority of the software available is designed with a male perspective and tends to be game oriented with a focus on adventure and sports. Many software programs also include content involving aggression and violence. This reveals that many of the products today are targeted to the male market (Biraimah, 1993; Chapman, 1997; Mangione, 1995; Oldenburg, 1994). Lately, more effort is being made to target both females and males, however software specifically designed for females still remains limited (Calvert, 1999). The lack of software appropriate to girls' way of learning, affects their attitudes toward computers.

Computer programs reflecting male interest patterns are more likely to appeal to boys than to girls. Littleton, Light, Joiner, Messer, and Barnes' (1992) study showed that software content makes a greater difference to girls than to boys. Girls performed worse than boys in a "masculine" adventure game, but their performance was similar when the content was more gender neutral. Even computer software titles appeal more to males than females. In the 1980s, Muira and Hess' (1984) study of 75 computer software titles classified 37% of the titles as exclusively for males, and only 5% as exclusively for females. In the 1990s, the picture remains somewhat the same. Of the 82 popular video games examined, 61 (74%) were directed at the male perspective, 18 (22%) at both genders and only three (4%) were directed specifically at girls (Oldenburg, 1994). This suggests that computer software programs are still geared primarily towards males.

There is also a lack of computer application skills that appeal to girls, for example while boys are interested in what the computer can do, girls are more interested in the things the computer can do for them. In addition, software that requires a high level of familiarity with computer functions further frustrates inexperienced users. Thus, in addition to competing with boys for computer time, when girls find that the available software does not meet their learning styles or interests they are even less likely to use it or remain interested in it. A relationship exists between positive experiences with computers and future facility and interest with them (Mark & Hanson, 1992). Students are more likely to be engaged when the content appeals to them. It is thus recommended that more computer activities and software be designed to encourage "group learning, social interaction, and cooperative problem solving" (Sanders & Stone, 1986, p. 26). These correspond more effectively to a female way of learning.

Gender-stereotyped content is evident in educational software as well. According to Mangione (1995), "the actuality of educational software design

is that although the audience may be mixed, the programs are designed with male characteristics" (p. 270). Many software products emphasize visual spatial characteristics that are more appealing to boys. In addition, computers are often introduced in math and science classes and this perpetuates the idea that there is a connection between math, science, and computers. This raises a problem, because traditionally math and science have been perceived as "male" subjects leading to the association of computers with technological progress and male power (Pryor, 1993). The gap between girls and boys that was evident in math and science classes is thus being replicated in computer classes as well (American Association of University Women, 2000; Chapman, 1997). Six statements that describe these characteristics have been developed and included in the checklist. See Figure 1 for details.

Rewards in the Software Program

The final issue that has largely been ignored in the literature on evaluating software examines the system of rewards, which appear to be male oriented for correct answers. For example a blond-haired princesses as the reward for success, or the football flying through the air sailing over a goal post or cars racing across the screen to display scores have a definite male appeal. Evidence exists that a majority of girls do not respond positively to traditional male symbols for motivation and reinforcement (Gilligan, 1982). There is, therefore, a need to incorporate a system of rewards that appeals to both girls and boys.

The congratulatory sound effects that follow the attainment of a goal are also aimed at a male audience. Many software programs do not include words and graphics as part of the reward system. Nor do they provide the opportunity for children to choose their own token reward system. Once again this is reflective of an approach that appeals more to boys than to girls.

Three statements that describe these characteristics have been developed and included in the checklist. See Figure 1 for details.

THE CHECKLIST

While teachers play a critical role in the types of programs accessible to young children, selecting appropriate, high quality software for young children is a tremendous challenge. Based on the literature reviewed and other existing instruments, a small number of sentences were developed to measure each of the constructs detailed previously (Figure 1). Simple feedback

revealed that in using software, it is difficult to be categorical in the response (yes/no indicated by a checkmark). This checklist uses a scale (often to never) to get at the issue of degree of bias.

In terms of bias regarding characters, the checklist focuses on an equal representation of male and female characters. It also draws attention to action roles assigned to males versus females as well as depiction of females in problem-solving and leadership roles. This section of the checklist also highlights the importance of nonstereotypic portrayals of occupational roles as well as ensuring that emotional statements are attributed to both genders.

In terms of content, the checklist highlights factors that make the software program male or female friendly in terms of overall content and style. These include ensuring that the software is free of sexist language and the extent of aggressive behaviors is limited. The content and style should appeal to both girls and boys, thus elements of competition versus cooperation should be balanced. In addition, the program should provide opportunities for group interaction at the computer.

Finally, in terms of rewards, the checklist focuses on the need to provide a reward system that appeals to both girls and boys. This includes the use of words and graphics as well as the opportunity for children to select their own reward system.

PRETESTING THE CHECKLIST

As part of a pilot study, the checklist was pretested among a sample of teachers working with children between the ages of 3 to 12 years. The teachers selected use a variety of software programs in their respective classrooms. The participants were given the checklist (Figure 1) and asked to fill out information about the software programs that they were using. The participants also had an opportunity to include comments about the program. Thirty-five teachers rated 65 software programs.

None of the teachers reported that they had any significant difficulty in using this checklist. The qualitative responses mostly indicated feedback about the program. Teachers' responses revealed that in addition to the three categories (often, sometimes, and never), there was a need to add a "not applicable" category as 2.62% of the completed surveys were marked as NA (not applicable). This has been incorporated in the checklist.

To illustrate the utility of the checklist, responses were assigned a score of 1 (often), 2 (sometimes), and 3 (never) for each of the software rated. These scores were then averaged for each category in terms of character, content, and rewards. Some of the ratings of the selected software are summarized in Table 1 for illustrative purposes. The ratings showed a wide

dispersion in the scores, the range of scores for the scale varied form 1.00 to a maximum of 2.83. Interestingly, the highest bias score (2.83 out of a maximum of 3), was assigned to a program designed primarily for girls. This indicates that the checklist can be used to evaluate bias towards both females as well as males.

Table 1

Selected Examples of Software Ratings

Name of Program	Age	Curricular	Character	Content	Reward	Total
Magic Schoolbus Rainforest	6-10 years	Science/reading	1.00	1.00	1.00	1.00
Reader Rabbit First Grade	5-7 years	Reading/Math	1.00	1.00	1.33	1.11
I can be an Animal Doctor	6-10 years	Life Skills, animal care	1.20	1.17	2.00	1.46
Oregon Trail	9-12 years	Social Studies	1.40	1.83	1.67	1.63
American Sign Language Dictionary 2.0	9-12 years	Reading English	2.00	1.83	1.33	1.72
I spy Junior	3-5 years	Language, Arts, thinking skills	1.20	1.00	3.00	1.73
Colonial America	9-12 years	Social Studies, history	2.00	1.33	2.00	1.78
Barbie Fashion Designer	6 and up	Life skills, fashion	1.50	1.50	3.00	2.00
Disney Learning Pre-school	2-4 years	Music, Math and language	2.80	1.50	2.00	2.10
Cat in the Hat	2-6 years	Language Arts	1.60	1.83	3.00	2.14
Finger Spelling for Windows	5 and up	All	2.00	1.50	3.00	2.17
School House of Rock! Thinking Games Deluxe	6 and up	Critical thinking	2.40	1.83	2.33	2.19
Candyland Adventure	3-6 years	Colors and mouse skills	2.20	2.17	2.33	2.23
Thomas and Friends	2 and up	Shapes, counting, sorting, music etc.	3.00	1.33	3.00	2.44
Dream Doll designer	6 and up	Self awareness	3.00	2.50	3.00	2.83
	Average		1.89	1.56	2.27	1.90
	Minimum		1.00	1.00	1.00	1.00
	Maximum		3.00	2.50	3.00	2.83

Note: These are ratings of programs by one teacher. These scores are meant to illustrate the checklist only. The ratings are from 1=Often to 3=Never. Higher number represents more gender bias.

Six software programs were evaluated by more than one individual and included programs on games, reading, and math. These programs were considered suitable for children between the ages of 9 months and 12 years. Each response was assigned a score of 1 (often), 2 (sometimes), and 3 (never). These scores were then averaged for each category (character, content, and rewards) and are summarized in Table 2. The scores show that there is consistency among multiple raters for the same programs. Given, the small sample size, more work needs to be done but these results are an encouraging indication for the checklist. Overall, the results are quite encouraging given that this is the first pretest of the checklist.

Table 2
Average Ratings of Gender Bias Scale

Software Rated	Teacher 1	Teacher 2	Difference
Backyard Baseball	1.33	1.22	+ 0.11
Jumpstart Kindergarten Reading	1.83	1.72	+ 0.11
Learning in Toyland	1.98	1.98	+ 0.00
Math Blaster	1.64	1.88	- 0.23
Reader Rabbit Playtime for Baby	1.40	1.54	- 0.14
Reader Rabbit Preschool	1.67	1.80	- 0.13
Average	1.64	1.76	- 0.12

Note: The ratings are from 1=Often to 3=Never.
Higher number represents more gender bias.

DISCUSSION

Appropriate software is found to be one of the key factors in ensuring that all children have aspirations to use computers and become proficient in its usage. Teachers need to become aware of the subtle nature of gender biases in existing software programs and make a conscious effort to select software that does not reflect stereotypic attitudes and images.

Teachers play a critical role in the types of programs accessible to young children. The selection of developmentally appropriate gender bias free software is integral to the integration of computers in classrooms and must be in keeping with sound pedagogical principles. NAEYC's position statement (1996) on the use of technology in classrooms focuses on the need for teachers to use professional judgment in determining that technology is appropriate for the children they work with.

Consideration of equity issues is integral when teachers design and plan effective education for their students. Teachers need to design learning environments that appeal to both girls and boys. According to NEAYC (1996), educators must find ways to "incorporate technology into their classrooms that preserve equity of access and minimize or even reverse the current trend" (p. 13). Teachers must therefore, include computer software that encourages both girls and boys to enjoy using computers and become competent in its usage.

This research develops a checklist that focuses on gender equity and captures dimensions that have been discussed in the extant literature. It extends various checklists by specifically focusing on three important dimensions of gender bias. A limited test demonstrates that it is easy to use, and shows adequate variation between dimensions and across programs. This illustrates that the checklist can be used to examine gender related bias in programs.

This article echoes sentiments presented in the current research on gender equity (Hodes 1995; Adler, 1999) for further work in this area. "To get girls 'under the hood' of technology, they need to see that it gets them where they want to go. And for a large part of the population, that process must start in the classroom." (American Association of University Women, 2000, p. 3). While it is logical to develop a valid and reliable checklist for use by teachers, this checklist may also be used to stimulate broader discussion among students on gender related issues in education and be used by companies to guide future changes and development in design.

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