
New Perspectives: An Analysis of Gender, Net-Generation Children, and Computers

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ABSTRACT

In the Project CATE (Children's Access to and Use of Technology Evaluation), based on grades 4–8 children's responses from surveys, focus group participations, and observations in the Saint Louis Public Library, girls' attitudes toward computers and toward their skill level were equally as positive as those of their male counterparts. Girls differed little from boys in what they wanted to learn and how they used computers, with games the largest portion of observed computer use for both genders. Eighty-five parents queried by survey and ten by focus group responded very similarly about their children's attitudes and use. Juxtaposing this study with other contemporary research findings suggests that some former research results, as well as conventional wisdom about gender differences in relation to computers, no longer hold true for net-generation youth. The need for moving on beyond these already-addressed issues into more sophisticated analyses is established. The Project CATE study is unique in speaking to these gender-related questions in a public library setting. The results draw attention to the public library as a venue for studying informal use of computers and for self-generated information seeking and recreation, as well as home-work-related use, in a gender-neutral environment.

INTRODUCTION

Gender differences in children's attitudes about and use of computers have been the focus of many studies since the mid-1980s. Most of the research on this topic has come from the fields of computer science, education, women's studies, psychology, sociology, and the gaming industry.

LIBRARY TRENDS, Vol. 56, No. 2, Fall 2007 ("Gender Issues in Information Needs and Services," edited by Cindy Ingold and Susan E. Searing), pp. 360–386
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Researchers in the field of library and information studies (LIS) have conducted few studies on this subject. Even fewer studies have been conducted in libraries, and almost none have taken place in public libraries. Yet the opportunity for research in this setting is ripe because both boys and girls frequently use computers in public libraries. A report by the Henry J. Kaiser Family Foundation, *Children, the Digital Divide, and Federal Policy* (2004), notes, "public libraries are the third most common place that children go online" (p. 5). This report, it should be noted, provides the statistics for public library computer use broken out by race and ethnicity, but not by gender. Another advantage of the public library is that it allows for observing computer use by youth in the type of informal setting called for by Dresang (1999). Thus, this research study, based on an analysis of data collected from the Saint Louis Public Library, provides insights about the interaction of gender with children's attitudes about and use of computers in a largely unexamined setting.

Children's Access to and Use of Technology Evaluation (Project CATE) was a multifaceted research and demonstration project formulated as a collaboration between the Saint Louis Public Library (SLPL) and the Florida State University (FSU) College of Information. Project CATE was supported by a research grant from the Institute for Museum and Library Services, 2001–2003. The three researchers—Eliza T Dresang and Melissa Gross, faculty members in the College of Information at FSU, and Leslie Holt, director of youth services for the Saint Louis Public Library (and with university research experience)—had a mutual interest in how best to provide for children's access to and use of computers in a public library setting. The focus of this report, the interaction between the gender of net-generation youth and computers in a public library setting, was only one strand of the Project CATE research. Reports on additional facets of the Project CATE study can be found in other publications (Dresang, 2005; Dresang & Gross, 2001; Dresang, Gross, & Holt, 2003, 2006; Gross, Dresang & Holt, 2004).

Saint Louis provided a suitable research site for several reasons. Data from the National Institute for Education Statistics (Debell & Chapman, 2003) shows that low-income children and African American children are both more frequent users of computers in public libraries than their counterparts from other racial and economic groups. Child participants in this research project were demographically representative of the Saint Louis community, in which, at the inception of the study, 65.8 percent of the 89,657 children under age eighteen were classified as African American. In 2001, more than 36 percent of children in Saint Louis lived below the government-determined poverty line (Annie E. Casey Foundation, n.d.). Moreover, the SLPL was in the midst of a comprehensive planning process focused on youth and technology and wanted to use an outcome-based approach, something important to the FSU research team. SLPL was one of

the original libraries to receive computers from the Gates Foundation, so computers were relatively plentiful. Finally, SLPL users were accustomed to participating in focus groups and other research studies.

RESEARCH QUESTIONS

The following gender-related research questions were addressed in this study:

- What perspectives about gender reflected in net-generation children's attitudes toward and use of computers can be gained from a public library setting?
- How do these findings fit with research about gender, net-generation children, and computers in other studies?

Although not the primary focus of the study, the researchers also considered some of the perspectives about gender reflected in parents' observations about their children's attitudes toward and use of computers.

The limited library and information science research that does deal with youth, gender and computers falls into "four major thematic categories: computer use . . . , computer attitude . . . , gender and computer information behavior, and gender and computer resource design" (Agosto, 2004a, p. 40). *Attitudes* here are considered stated emotions, feelings, or perceptions about computers, and *use of computers* is considered the observed frequency and types of activities that girls and boys choose to carry out on computers. Note that gender-related impact of the computer as a physical object has not been a theme studied by LIS researchers, despite the suggestion of some existing research that physical appearance may relate to gender differences in attitude or use (Carr-Chellman, Marra, & Roberts, 2002). Also addressed in the LIS literature but not in this study, and nonetheless important, are *information behaviors* such as the comparative success of boys and girls in using computers, their search techniques or approaches, or their ability to determine relevance, and a fourth area, the comparative interaction of youth with the information architecture or *resource design* of the sites they access. The published research findings in the two areas on which Project CATE focused, gender in relation to attitude and use, have changed significantly in the past two decades, with a considerably different understanding of the topics addressed in 2006 than even one decade ago.

METHODOLOGY

Multiple data collection and analysis methodologies were used to address the research questions. The researchers prepared a manual and held training sessions for library staff, who in-turn did all of the data collection. Data were collected from student public library users in Grades 4–8 through surveys, focus groups, and in-library observations at six SLPL locations.¹ Surveys were administered, focus groups were conducted, and

in-library data were collected near the beginning of the study in order to provide baseline data for determining students' desired outcomes of technology use in the library. Surveys and focus groups were conducted over several weeks in the summer and early fall of 2001, and the in-library observations analyzed here took place in August 2001, during a week that was considered representative of normal use for the summer. Students were asked to check their gender on the surveys. Gender was recorded through observation in the focus groups (audio and videotapes of which were transcribed) and in the in-library observations, during which data were collected using Palm Pilots with forms created with Pendragon software. The in-library observations also included a short survey to inquire whether a child was using the computer for imposed queries, self-generated queries, or play. Non-probability sampling was used to secure participants in the data collection with an effort to represent all ages of youth within the parameters of this study as well as both genders; the in-library data collection attempted to cover all users during a specified time period. Only the surveys included non-users, who were among respondents solicited during public librarian visits to schools in the service areas of the six study locations. Among the survey respondents, 72.3 percent reported being in the library once a month or more. Minimal library users (26, or 12.6 percent) and non-users (31, or 15.0 percent) were also represented in the survey sample. Table 1 shows the number and percentage of youth participants that each type of data collection represents in this study, broken down by gender.

Of the four youth focus groups, one included one middle school female only, and another one middle school male only. The other two groups consisted of both genders and a mixture of middle and elementary students. The researchers chose these configurations with the thought that boys might intimidate the girls. This presumption was not supported. In one mixed focus group the two girls responded more on an average than the six boys. These same two elementary school females also spoke more on-average than did the female students in the all-female middle school group (See Table 2). The lack of evidence for this supposition foreshadowed other areas in the Project CATE study that did not follow conventional wisdom.

Other data used in the analysis came from surveys and focus groups for which parents were the respondents. Surveyed parents were asked to identify the gender of their child in grades 4–8 (and to choose only one child if they had more than one in these grades). Subsequently, they were instructed to answer questions with this child in mind. Eighty-five parents replied to the survey; 40, or 47.1 percent, responded about a male child and 45, or 52.9 percent, responded about a female child. The parents were not necessarily those of the youth who took the survey, although some were. However, no correlation between individual parents and children was attempted.

Table 1. Gender of Youth by Data Collection Instrument

Data Collection Instrument	No of Participants / Observations	No. of Females	% of Females	No. of Males	% of Males
Survey	200*	114	57.6%	84	42.4%
Focus Groups	37	17	45.9%	20	54.1%
Observations of in-library use	346	183	52.9%	163	47.1%

*Two participants did not mark their gender.

Table 2. Focus Group Participant Comments by Gender

Participants/Comments	Males*	Females**
# of Participants	6	2
# of Comments	142	78
# of Comments/Participants	23.67	39

*3 elementary and 3 middle school

** 2 elementary school

Ten parents participated in focus groups, providing information about their children or live-in grandchildren. These parents were also asked to identify the number and gender of their children in Grades 4–8, and to focus on one child of the appropriate age. Six children were male and four female.

Quantitative data were analyzed using SPSS to generate descriptive, cross-tabulation tables in order to compare survey responses by gender. Qualitative data were studied using NUD*IST software to identify various themes that appeared throughout and their contexts.

The authors' purpose in this article is to provide an analytical overview of baseline data collected by three different types of research instruments during one time period. Comparison of the current analysis will be made in the section on "use" to findings in a previously published study based on Project CATE in-library observations (Gross et al., 2004). That study focused on only three of the six SLPL locations analyzed here. However, there the authors compared activities among the three branches rather than aggregating the data, and they also cumulated the findings from three different data collections, using a method proposed by Walter (1992) to project library use over a full year. Although the previous article did not center on gender alone, several gender-related observations were made that will also elucidate this look at the data.

Finally, a thorough literature review was conducted, and selected studies were chosen for comparisons of results to Project CATE outcomes in order to respond to the second research question; most of these studies

have subjects in the approximate age range of those in Project CATE; where they do not, the age of the subjects is indicated. The cited studies, mostly outside the LIS field, were selected as representative of numerous other research accounts reporting similar results. The settings of the comparative studies are largely but not entirely schools. No comparable studies were located that reported parental opinions about children's attitudes toward or use of computers in public libraries.

FINDINGS ON ATTITUDES

One interesting factor is that most of these studies treat attitude as an independent variable (children's attitudes toward computers as either impetus or barrier affecting some feeling or action) while some look at attitude as a dependent variable (attitude as influenced by factors in the context of computer use). No differentiation between attitude as an independent or as a dependent variable is made in reporting the research below.

Traditional Perspectives on Gender

Conventional wisdom, casual observation, and many research studies have found that boys have a more positive attitude toward computers than girls and are more confident than girls are about their ability to use them. Studies in the 1980s and well into the 1990s agreed with Chen (1985) that boys in general have a notably more positive attitude toward computers than girls. Jacobson (1991) conducted one of the early LIS studies on gender differences in computer anxiety, focusing on high school seniors in a school media center. Although boys had significantly higher general library anxiety, girls had significantly higher computer anxiety. Eight years later, with computers far more prevalent, Brunner & Bennett (1998) reported from a study conducted by the Center for Children and Technology that "girls are more ambivalent about technology than boys" (p. 56). Kiawe (2002) described studies conducted in the 1990s that found gender-related differences at every age from kindergarten through secondary school. These differences included "how they perceive their level of skill in using computers" with significantly lower perception of skill level by females (p. 16).

New Perspectives on Gender

A recent and growing body of research, including Project CATE, questions certain established tenets and suggests some new perspectives on the issues of gender, net-generation children, and computers.

Project CATE Results Contrary to the youth in the majority of studies conducted in the last two decades of the twentieth century, in Project CATE, girls expressed as much confidence about computers as boys in their responses to survey questions (See Table 3).

When asked to select one response to this statement about confidence—"Most of the time when I am using a computer, I: (*Check the one that fits you*

Table 3. Confidence by Gender (Surveys)

Confidence Rating	Girl (109)		Boy (78)	
Feel Very Sure	61	56.0%	51	65.4%
Feel Pretty Sure	36	33.0%	18	23.1%
Not Sure	5	4.6%	5	6.4%
Need Help	7	6.4%	4	5.1%

Table 4. Skill Level by Gender (Surveys)

Skill Level	Girl (111)		Boy (79)	
Expert	18	16.2%	12	15.2%
Very High	19	17.1%	15	19.0%
High	22	19.8%	21	26.6%
Okay	34	30.6%	22	27.8%
Beginner	6	5.4%	6	7.6%
I Don't Know	12	10.8%	3	3.8%

Note: Surveys with no response were eliminated from the calculations

best)”—89 percent of the girls and 88.5 percent of the boys said they felt confident or pretty confident. Analysis of the cross-tabs showed almost no difference between what these girls and these boys responded about their confidence level.

Another survey question, illustrated in Table 4, asked the students to respond to this statement: “I think my skill level on the computer is . . .” Again there was little difference in how the boys and the girls responded to this prompt. An almost identical percentage rated their skill level as expert or very high, that is, 33.3 percent of the girls and 34.2 percent of the boys. And, again, the cross-tab analysis found little difference between responses of girls and boys. It can be concluded that this particular group of youth are equally confident about general computer use as well as about specific computer skills.

An examination of the survey data from Project CATE parents reveals similar attitudes toward competence with little difference in their responses. Parents had high regard for their children's confidence levels with 87.5 percent of girls' parents and 85.6 percent of boy's parents choosing “sure” or “pretty sure.” The overall percentage of parents expressing confidence in the skill level of their female children was lower than that of the girls themselves with 22.9 percent of girls' parents and 32.5 percent of boys' parents who selected “expert” or “very high” when they described their male and female children. This is the only incidence in which parents' attitudes differed substantially from their children.

Project CATE youth and parental focus groups analyses also revealed a lack of distinction between girls and boys in confidence and perception

of skill level for computers.² In one of the mixed gender focus groups, all youth rated themselves "good" or "very good." When asked why she said "very good," an elementary school female replied, "I really know a lot of stuff. I even help my daddy on the computer. . . . I help my family get into it. . . . and I know a lot of places to go" (7/12/01). A middle school female explained confidence in her competence this way, "Because I use computers every single day at school and then when I come home, I'm using them at home" (7/19/01). A middle school male replied, "because I know a lot of expert things to do" (7/12/01). Similar ratings and rationales appeared in all focus group transcripts. Males and females were also evenly dispersed among those who did not consider themselves quite so competent. Parents spoke without making distinction of both their sons and daughters as helping them use computers. Several parents credited the library with their children's skills. "And my children learned at the Julia Davis library. And they taught them how to get in, get out, go to what they want. They are more computer literate than I am" (10/13/01). Although this analysis does not disaggregate students by both age and gender, there were no consistent differences in attitudes toward competence or skill level across the Grade 4–8 range.

Other Research Reports Project CATE is one of a number of attitudinal studies that either contradict or expand upon the traditional findings about attitudes by gender. Miller, Schweingruber & Brandenburg (2001), who surveyed 512 middle school students in Houston, report findings similar to those in Project CATE. When students were asked whether they knew how to use a computer (skill), there was little difference between male and female—97.6 percent of the females and 98.2 percent of the males responded affirmatively; likewise, when asked if they "liked using a computer," students of both genders were equally positive (p. 2). The authors concluded "gender gaps that once existed with regard to computer access, use, and perceived expertise are narrowing significantly" (p.1). In another study of youth similar in age to those in Saint Louis, North and Noyes (2002) assessed gender influence on computer attitudes in 104 children ages eleven and twelve via self-report questionnaires. They found no support for the literature that suggests males hold more positive attitudes toward computers than females. Van Eck (2006) designed a two-semester study of fifth and sixth graders for "assessing the attitudes of girls and boys towards technology" (para. 4). Comparing prescores and postscores on the Pupil's Attitude Toward Technology survey, he reported that "after considering the findings of existing research, we expected that girls would view technology more negatively than boys. Surprisingly, this was not the case in our study. Girls ($m = 28.2$) and boys ($m = 28.9$) initially indicated similar attitudes toward technology, and this pattern did not change during the study" (para. 15). A question on the Computer Attitude Survey administered to 462 middle and high school students found "no significant difference in the self-ratings of

computer skills, with slightly more than half of all students rating themselves as 'great' or 'pretty good'" (Young, 2000, p. 207). Another study focused on seventy-three boys and girls ages twelve and thirteen, finding no apparent attitudinal differences. "The computer attitude scale results indicate no significant sex differences in attitudes to computers" (Oosterwegel, Littleton, & Light, 2004, p. 224). The results of this study "do not establish that perceptions held by boys are in any significant way different from those held by girls" (p. 224). In a study commissioned by the Girl Scouts of the USA (Roban, 2002) to investigate the impact of the Internet on the social and emotional life of teenage girls, data was collected from 1,246 girls (ages thirteen through eighteen) using focus groups, journals, and surveys. Sixty-two percent of the girls in this nonprobability sample were self-described as frequent users and 58 percent identified themselves as the most computer savvy person in their family, while only 12 percent said brothers were the most savvy and 11 percent named their fathers (Roban, p. 9). No statistics were provided on how many girls had brothers and no comparable study was found on males, but this study does highlight another group of young women who consider themselves highly capable on the computer.

Some studies continue to pose a caveat to these findings. Recent research with students in both elementary and secondary school has found that attitudes of girls toward technology are as positive as boys until they reach adolescence. One such study, which surveyed 213 and interviewed 48 students in seven primary and secondary schools in the Netherlands, found the only notable difference among attitudes of primary school students was that boys expect to get a better job in the future if they can use computers.³ The researchers reported, "we found no other gender differences in computer attitude" (Volman, van Eck, Heemskerk, & Kuiper, 2005, p. 45). However, they did find that "in secondary education, there are differences in the attitude of girls and boys regarding computers on a number of points" (p. 46). Christensen, Knezek, and Overall (2005), in a study of ten thousand Texas public school students found "from Grade 1 through Grade 3, there appeared to be no consistent differences between males and females on attitudes toward computers. At Grades 4 and 5, girls were significantly ($p < .01$) higher than boys in computer enjoyment. . . . From Grade 6 through Grade 12, males appeared to be consistently more positive in their attitudes toward computers than females. . . ." (pp. 27-28). However, an interesting caveat was that boys' and girls' attitudes become similarly positive again by the end of secondary school (p. 23).

Volman and van Eck (2001) raise other issues in studying attitudes related to gender including a lack of theoretical or conceptual base for the study, a lack of considering context and locality, and differences in attitude toward specific ICT applications rather than general attitude toward technology. One researcher, who did compare context and locality in relation to attitude, found that in an uptown more affluent New York City school, on

the Computer Literacy Assessment Tool, "the attitudes of girls and boys toward computers were about the same (51% of girls and 50% of boys claimed to 'love computers'), where girls expressed a slightly higher view of their competence (64% of the girls and 61% of the boys selected 'much skill' or 'expert'). . . ." (Hackbarth, 2004, p. 197). A subsequent study in a midtown New York, lower socio-economic area demonstrated "a much higher incidence of those claiming to have 'little skill' at this midtown school. . . . It became clear that the lack of confidence was concentrated among . . . females 'of color'" (Hackbarth, 2004, p. 197). Gender was a factor related to attitude only in the lower socioeconomic portion of the study. However, Hackbarth found differences in a number of contextual issues that correlated with the less positive attitude, including less exposure to computers. The midtown students who had access to computers in the library, as well as at home, had a more positive attitude. A correlation between low income, lack of access, (but not gender) and subsequent lower skill has been demonstrated by Holloway and Valentine (2001).

FINDINGS ON USE

Traditional Perceptions of Gender

The second set of gender-related findings focuses on the use of computers. Here again, many previously published research studies focusing on youth tend to agree that boys and girls do not use computers in the same manner. Van Schie & Wiegman (1997) and Yelland & Lloyd (2001) are among the researchers who find that girls and boys approach computers to perform different tasks. Specifically, boys are cited as showing a greater affinity for video games than girls (Provenzo, 1991), while girls are more likely to have a work orientation and prefer e-mail, as reported in a yearlong qualitative study of seventh and eighth graders conducted by Christie (2005). One study conducted with fourth to sixth graders in the early 1990s found the ratio of girls to boys using computers was 1:4 (Sakamoto, 1994). Another study noted "in Grades 6 and 7, girls appear to have more hours of use than boys. At the eighth grade level the reported use is roughly equal for boys and girls. . . . The girls continue to decline into the ninth grade" (Christensen et al., 2005, p. 30).

Another research-identified gender difference is the desire to work collaboratively. Burdick's (1996) study of information search styles and gender and Leong's and Al-Hawamdeh's (1999) research on Web-based science lessons, identified girls as wanting to work collaboratively while boys preferred more solitary work.

New Perspectives on Gender

Project CATE Results Project CATE adults, boys, and girls, when queried in focus groups, offered the opinion that boys and girls have different interests in activities on computers. One middle school girl, for example,

said, "I think girls look up music and stuff and their favorite bands, and boys will try to look up video games to play on the computer" (7/12/01). Another middle school girl put it this way, "I can't explain it, but I know . . . girls and boys have different interests and stuff" (7/19/01). Comments of other participants agreed with these. One elementary boy said, "Usually boys know how to play a videogame better than girls because they might have one of their own" (07/12/01). A few students, both male and female, did not see gender issues in a black and white manner, making the caveats of "sometimes" and "on some things." For example, one elementary school girl explained, "I think girls can do some things better than the boys, and the boys can do some things better than the girls" (07/12/01). One parent spoke more about learning style than interests, noting that "they don't learn the same way. Their attention span is different" (10/13/01).

Unanticipated results came when the focus group data were compared to that from the surveys and the in-library observations. The results from the data collected with these two unobtrusive measures of gender disagreed with those from the focus groups. The differences in boys' and girls' interests expressed by almost all youth and parents in the focus groups, which coincide with the traditional patterns reported in research, did not show up on the surveys or the observed activities during the in-library observations. Playing games was not relegated chiefly to males, but was a prevalent activity for both boys and girls, as well as the computer activity about which both girls and boys were most confident. When asked what they can do at the library (meaning what they have the ability to do, not what they have permission to do), 81.1 percent of the girls and 88.8 percent of the boys chose "find/play games." When asked what skills they wanted to learn on the computer, interestingly, 25.5 percent of the girls compared to 12.8 percent of the boys (12.7 percent more girls than boys) checked "find/play games." Another unexpected finding was that parents' perceptions of whether their children can play computer games at the library matched almost exactly what the youth (of other parents) said. Similar statistics appear from the parents' survey. Like their children, 80 percent of the girls' parents and 87.5 percent of the boys' parents reported their children can play games at the library. Those parents saying their children want to learn how to play games are very close in percentage to youth respondents also, 23.1 percent for parents of girls and 11.1 percent for parents of boys. The other activities that both boys and girls marked highest in the "want to learn" category were the (OPAC) library catalog, search engines, e-mail, and chat. Although girls showed the highest interest in each category, boys showed interest in the same skills at only slightly lower percentages.

Survey data collected (See Table 5) allowed for checking more than one activity, but in-library observations (See Table 6) recorded only the activity in which a child was engaged when the data were collected.

Table 5. Computer Skills Students Can Do and Want to Learn in Library (Surveys)

Computer Use*	Girl (106)** Can Do		Boy (80) Can Do		Girl (71) Want to Learn		Boy (47) Want to Learn	
Computer games	86	81.1%	71	88.8%	18	25.5%	6	12.8%
Use SLPL (computer) catalog	64	60.4%	45	56.3%	31	43.7%	15	56.3%
Online communication: e-mail	64	60.4%	38	47.5%	32	45.1%	18	38.3%
Online communication: chat	58	54.7%	37	46.3%	33	46.5%	18	38.3%
Search Engine	55	51.9%	48	60.0%	31	43.7%	13	23.7%

* These categories are not mutually exclusive. Girls and boys were allowed to check all categories that applied to what they can do or want to do at the public library. Therefore number and percentages will not add to any expected sum, and the same children may be represented in various categories.

** Although 200 students were surveyed only 186 girls and 118 boys chose to respond to these questions. Percentages are of those who responded, not of those surveyed.

Results from the in-library observations show that girls and boys use the computers in similar ways. When the children were observed for the in-library data collections, playing games described the largest portion of computer use for both genders and a majority of use by both girls and boys. Online communication was only occasionally used by either gender, with 4.4 percent of the girls and 2.5 percent of the boys using e-mail or chat.⁴ In the surveys, more boys than girls expressed an interest in learning how to use the online catalog, although more girls said they could use it. However, very few children of either gender used the OPAC during this data collection. The time spent on computers (not shown in the table) was virtually the same for boys and girls.

The in-library observations in the previously published Project CATE study took place at Buder, a regional branch, and at Barr and Divoll, two neighborhood branches, designated as "youth libraries" (Gross et al., 2004).⁵ Overall, computer use was similar by boys and girls:

At all three libraries, the use of games describes the largest portion of computer uses for both genders. In the category of communication uses (e.g., chat, e-mail, and word processing), girls and boys use e-mail and chat in similar proportions. (Gross et al., 2004, p. 328)

A few differences surfaced. One relevant to this study occurred at Barr, one of the youth branches in a more upwardly mobile area than Divoll, where girls' use of games was substantially lower than that of boys but games were still the most popular choice.

Whether boys' and girls' motivation for use of the computer in the public library reflected their own interests, that is, recreation or personal information seeking, or those imposed by others, in this case homework,

Table 6. In-library Use of Computers by Gender (Observations)

Computer Use*	Gender			
	Girl (183)		Boy (163)	
Computer games	92	50.2%	101	62.0%
SLPL catalog	28	15.3%	10	6.1%
Online communication: e-mail and chat	8	4.4%	4	2.5%
Other (search engine, subscription database; word processing, educational CD)	30	16.4%	16	9.8%
Web site other than SLPL catalog	25	13.7%	32	19.6%

* Figures here are mutually exclusive. They resulted from observations of computer use at a given point in time. Percentages total 100 and numbers total the students who were using computers during the week of data collection.

was addressed with the current study's surveys and in-library data collection instruments. The categorizations used for this investigation were taken from the imposed query model developed by one of the Project CATE researchers (Gross, 1999, 2005, 2006). The survey data showed that 83, or 79 percent, of the girls and 47, or 61.8 percent, of the boys who responded to this question said they use the computers in the public library for homework. As observed on nearly all other queries, the parents, responding for their children, responded in almost identical percentages: 34 parents of girls, or 79 percent, and 22 parents of boys, or 62.9 percent, indicated that their children used the public library for homework. Other choices were "play games," "pass the time," or "find items of interest." From the responses of children, a total of 197 female choices and a total of 154 male choices were made for these recreational or self-imposed categories (various percentages of boys and girls responded to each choice). As noted previously, the surveys did not require mutually-exclusive answers.

In the in-library data collection, which took place in the summer, understandably, almost no students were using the computers for homework (three girls and no boys). Therefore, the motivation for almost every use of computers was for self-generated inquiries or to play games. The largest percentage of use for both boys and girls related to playing games. Self-generated activities might have been either recreational or informational; 83 of 183, or 45.4 percent, of the girls and 58 of 163, or 35.5 percent, of the boys were observed in a variety of activities including using the SLPL catalog, going to a Web site other than the catalog, using word processing, using a search engine, accessing a subscription database, or using an educational CD-ROM.

In contrast, but to be expected, the Project CATE analysis of in-library use at the Buder, Barr, and Divoll branches (Gross et al., 2004) found more use of computers related to imposed queries, usually homework; however, use for homework was not as high as expected from other studies of the

purpose for children's activities in public libraries or as might have been predicted from the survey responses. For example, research places from 64 percent to 90 percent of children's reference questions in the homework-related category (Gross et al., p. 330). The highest use of computers at Buder, Barr, and Divoll branches was either playing games or pursuing self-imposed information interests, not doing homework. At Buder, the regional branch where reference sources are more plentiful and the service area larger, and thus where the highest percentage of imposed query or homework-related use might have been expected, it was the lowest (only 1.7 percent) with 18 percent at Divoll and 23 percent at Barr. It is important when using this data not to equate "educational use" with "imposed query." Although in these observations, all imposed queries were homework related and therefore educational, many of the self-imposed information searches may well fall into the educational category also.

A final characteristic of use that emerged from the Project CATE data analysis is a preference by both boys and girls to use computers collaboratively and to share with and learn from others, a finding that emerged largely in the focus groups. At the time of the study, the policy of the SLPL was one child/one computer. Therefore, most children observed in the Project CATE in-library study worked individually. Moreover, in the focus groups both girls and boys urged staff to organize a computer club based on the exchange of knowledge among peers. A fifth grade boy explained, "I think they should have clubs where you can get together and talk about video games or computer games that you like, and people can suggest good things to get . . . instead of having to rent games and stuff, to hear ratings from other people your age" (07/12/01). A middle school boy articulates the same sentiment, "We could share web sites with each other and different things on the computer" (07/12/01). A fifth grade girl had a slightly different agenda, "If we do have a computer club, I think that we—I want to TEACH the younger kids, like if I have some cousins or something I can teach them" (07/12/01). Some students suggest rewards or prizes to get people to come and stay. They also seem to want the clubs to be for a wide age range, from preschool to senior citizen.

Other Research Findings Computer gaming, a use of the computer that held much interest for the Project CATE youth is also the subject of a great many provocative studies related to gender issues and computers. In 1996, a conference was held at MIT, in the wake of the first bestselling, mass market girls' game, *Barbie Fashion Designer*; the conference resulted in the volume edited by Cassell & Jenkins (1998), *From Barbie to Mortal Kombat: Gender and Computer Games*. This groundbreaking book provided a thorough review of the research at the time, incorporating chapters from cultural and educational theorists, developmental psychologists, academic technologists, computer game industry representatives, and female game players. The authors of this compendium did not corroborate that girls find computer gaming

less appealing or that, given the opportunity to play, they are less skilled than boys; they do corroborate that marketing and assumptions about games as a male domain started shifting to a more gender-conscious environment in the late 1990s, which created its own problems of stereotyping girls.

A decade later, a National Science Foundation-sponsored invitation-only workshop (*Beyond Barbie and Mortal Combat: New Perspectives on Gender, Games, and Computer*, 2006) for forty participants, including Cassell and Jenkins of the 1996 MIT workshop, was held at UCLA, followed by a half day public conference (*Girls 'N' Games*, 2006). The purpose of the workshop and the conference was to "examine new issues around gender, games and computing and develop an agenda for the next generation of research informed by current national and international issues and perspectives" (*Beyond Barbie*, 2006). A *Beyond Barbie and Mortal Combat* book was published in 2007, as a follow-up to the workshop.

Themes drawn from the complete video record of the conference (*Girls 'N' Games Video*, 2006) and from a summary of the conference panels made up of academic researchers and game industry representatives (Dillon, 2006) foreshadow the insights and proposed research agendas the *Beyond Barbie* volume will hold. Several important ideas touched upon at the conference have emerged in the past decade of research, observation, and experience. For example, firm evidence exists that an ever increasing number of females of all ages are enthusiastic participants in the gaming culture and that certain characteristics appeal to both masculine and feminine interests, for example, adventure without gratuitous violence, puzzles, a variety of choices that players can make about their character and identity: constructivist and creative opportunities. At the beginning of the "games for girls" movement, a backlash was aimed at producers of these games—illustrated by a "chess for girls" parody on *Saturday Night Live* which, according to Brenda Laurel of the Purple Moon Art Center, was aimed at her game creations—but it proved to be temporary because "games for girls" changed in nature and character. Instead of a superficial "pinkening" of the games, many game producers have turned away from considering masculine as the norm with a growing sophistication about the wide range of gender appeal. And with this came a realization that "Barbie" and "Mortal Kombat" are "gendered" extremes with a vast area of sometimes overlapping male/female interests and representations in between. With the realization that girls need to be involved in design came the acknowledgement that there is no such thing as a game that all girls will like, that they are vastly different one from the other, and also that they, like males, change over a six month period of time, so market research reliability is short-lived. Understanding of gender differences and similarities across cultures, both nationally and internationally, has also grown more sophisticated. One trend that has become evident is the appeal of "casual" games to females (those that can be played in short

sittings, learned easily, but mastered over a period of play); some see this as ghettoizing girls while others see it as recognizing the reality of women's multitasking life demands that preclude long involved periods of gaming.

And a factor observed by the conference and panel participants that affects both males and females is a dip across the past decade in games for learning followed by what seems to be a current and possibly future rise in this much-needed market. The John D. and Catherine T. MacArthur Foundation five-year and fifty million dollar initiative, (*Digital Media and Learning*, 2006), coupled with the report from the Federation of American Scientists (*Harnessing Video Games for Learning*, 2006), stemming from an October 17, 2006 summit on educational gaming, serve as additional indicators of this future direction. Exactly what the implications of these initiatives are related to gender will be determined as they unfold.

The most pessimistic note at the *Girls 'N Games* conference came from academics who report only one or two females in their college classes on gaming and the continuing "male culture" of the gaming industry; the premise is that as long as the makers of the games are predominantly male, the female influence and therefore appeal will not be as high as it might be. Numerous other studies lament the continuing absence of females, despite their rising interest and participation in gaming, first in computer science classes and subsequently in the gaming industry (Schoenberg, 2001).

In *Tech-Savvy: Educating Girls in the New Computer Age*, a report from a commission under the auspices of the American Association of University Women Educational Foundation (2000), the optimism as well as the complexities of the interaction between girls and technology becomes apparent. There is no simple conclusion such as "girls don't like to use computers to play games." "The commission makes it clear that girls are critical of the computer culture, not computer phobic," said Sherry Turkle, professor of sociology at MIT and cochair of the commission (American Association of University Women Educational Foundation, 2000). Miller et al. (2001) found that "in contrast to previous research, both males and females indicate that games dominate the home use. . . . [Also] in contrast to previous research in which girls preferred less violent, more open-ended types of games . . . we now see similar categories of preference among males and females" (p. 137).

A number of other research studies document that a wide variety of digital technologies appeal to girls—in some ways that appear gender-related and some that do not. One of the most insightful is a sophisticated, in-depth yearlong ethnographic study conducted by a university-based researcher and a teacher researcher exploring two seventh grade girls' use of digital technology (Chandler-Olcott & Mahar, 2003). This study not only emphasizes use of technology in both an academic and a non-academic environment, but it also uses two theoretical lenses, the New London Group's conception of multiliteracies and an activity theory-influenced

framework. While a number of studies rely on reports of students about their computer use rather than documentation or observation, this research collected data from multiple sources, including in-person observations as well as interviews, focus groups including peers of the two girls, and communications and documents produced by the girls online throughout the year. Both girls, contrary to previous expectations of this as a male focus, demonstrated interest in how technology works and its use as a tool—when it served their purposes. At the same time, they both created “richer and more satisfying social lives than they had in real time” (Chandler-Olcott & Mahar, p. 379). No comparable in-depth study of boys was located.

Some studies have found that girls prefer the communication aspects of the computer more than boys, but Colley and Comber (2003) found that “applications such as e-mail, accessing the internet and using CD-ROMs showed no overall gender difference in frequency of use” among eleven and twelve year olds (p. 155). Volman et al. (2005) reported “no differences between boys and girls at primary school in the extent to which they participate in the computer activities. . . . In secondary education girls do e-mail at school more often than boys, while boys play computer games more often than girls” (p. 41). No recent studies were found that analyzed gender and children’s use of an online library catalog.

Large, Beheshti, and Rahman (2002) in an empirical study into gender differences in collaborative Web searching undertaken by sixth graders in same sex groups, six of boys and ten of girls, observed that there was no statistical difference found in the time spent online between the girls and the boys, although there were some differences in information seeking behavior. Likewise, Miller et al. (2001) found “no gender difference in heavy use” (p. 3). Anderson, Hilton, and Woulden-Miller (2003) found that young children, videotaped at various activities, played more cooperatively at the computer center than any of the other three centers provided for them. Additional research by Dresang (2005) related to her Radical Change theory points to the connectivity of the digital world and to its appeal for net-generation youth. Little of this recent research relegates connectivity to a predominately female preference.

DISCUSSION AND CONCLUSIONS

The discussion responds to the two previously stated research questions:

- What perspectives about gender reflected in net-generation children’s attitudes toward and use of computers can be gained from an urban public library setting?
- How do these findings fit with research about gender, net-generation children, and computers in other studies?

The few findings about parents are also discussed.

Attitude

The young people participating in the Project CATE study exhibited gender-related attitudes toward computers in the public library that are similar to those of children in several other recent studies, differing from those in previous studies that found girls had a more negative attitude toward computers than boys. Recent studies point to a narrowing of the gender gap that existed in the 1980s and throughout much of the 1990s. In fact, a gender analysis of Project CATE youth responses showed no identifiable trends in girls' or boys' attitudes or uses. As in Project CATE, in most contemporary research, children in this particular age group (Grades 4–8, approximately ages nine through fourteen) almost universally have positive attitudes toward computers and their skills to use them. Some studies show that this attitude becomes less positive for females at around age fourteen or ninth grade, just after the Project CATE age cut-off, but in one study the girls' attitudes improved again by the end of high school. There are enough studies with similar results, at least for children up to high school age, to suggest that the disparity between boys and girls in how they feel about computers and their perceived ability to use them has lessened, almost to the point of disappearing.

Volman & van Eck (2001) call for several refinements in the study of attitude. One is to consider context and locality in analyzing attitude. The Project CATE study contributes in many ways to the placement of gender studies in context and locality. Clearly young people have a very positive attitude toward computers in the context of the public library, or at least of the SLPL. Looking at another contextual element, contrary to the study by Hackbarth (2004) in midtown Manhattan, neither the lower socioeconomic level of the youth in Saint Louis nor the minority status of many of the females negatively affected their attitude toward computers or their abilities.⁶ There were extenuating factors, including lack of equal computer access at school, in the New York midtown environment that did not exist for Project CATE participants, so it appears that environmental factors are important independent variables to consider.

Starting as soon as the gender gap related to computers was recognized, researchers, educators, parents, and others have made efforts to narrow it. The proliferation of computers in U.S. schools and libraries, bringing less competition for their use, may have aided this effort, as time on computers, equally available for boys and girls in Project CATE, is one major recommendation for helping girls gain skills and feel more positive. Several studies, including those by Volman & van Eck (2001) and by Hackbarth (2004), found greater access to computers correlated with a more positive attitude toward them. The public library in Project CATE provided a gender-neutral zone for access.

No other studies of parents' perceptions of their children's attitudes toward computers by gender were found. The unanticipated result from this

comparison is that parents and youth (even though they were not responding as family units and often were unrelated) answered in most cases in almost exactly the same percentages about girls' and boys' attitudes toward their competence and skill in using computers in the public library.

Use

From the focus group data, it appears that Project CATE youth and parents shared the traditional point of view that boys like to play games and girls prefer other activities on the computer. The value of multiple data points was demonstrated when the surveys and in-library observations provided evidence that the perception about this particular use is not necessarily correct. Girls and boys chose playing games as a favored activity both when asked what they would like to do and when they were observed using computers. This held true for two different analyses of the Project CATE data, the current one across surveys and observations and the other that focused on individual branches over a lengthier period of time. More girls than boys expressed an interest in learning about games, but girls wanted to learn more in every category on the survey, so this is not a unique finding. Again parents and youth were close together in their perceptions.

The comparable contemporary research, again in contradiction to the past, fits with the findings in Project CATE related to game play. Although girls and boys may not play games in exactly the same numbers or percentages, games are clearly no longer largely a male domain. In the Saint Louis Public libraries when the study took place, games were the territory of youth of both genders. The one departure from this, at the Barr branch, where the percentage of girls playing games was 15 percent lower than that by boys, nonetheless followed the pattern of the other branches where games represented the largest portion of computer use by both genders. No other contextual factor was identified that could explain the difference, but there may have been one.

Why were both parents and youth wrong in their perceptions of what boys and girls might like to do with computers in the library? Perhaps the remnants of conventional wisdom and former practice plus male-dominated ads for computer games might explain the difference between what the participants said they thought the use of computers would be by gender and what they chose on the surveys and actually did. Other unidentified reasons may also exist.

Project CATE research did not go beyond recording the type of activities in which girls and boys were engaged, so there is no data on whether their choices of game content or genre differed. Many of the themes addressed at the *Girls 'N' Games* conference (Dillion, 2006; *Girl 'N' Games Video*, 2006) point to a level of sophistication in the current and future research that leaves behind the "do girls like games" question and focuses

on what elements of games appeal to a wide variety of players, both male and female. A number of research studies have cataloged girls' expressed interests in game content (Agosto, 2004b), but the topic is complex, and, as the *Girls 'N' Games* panels noted, more in-depth studies need to be conducted. One panelist, Nicole Lazzaro, XEODesign, researches the feelings that youth want from games, approaching design from that perspective rather than a male/female one.

Project CATE participants, boys and girls alike, expressed interest in e-mail and chat rooms, but because of the policies of the SLPL at the time, few used these communication opportunities. So this particular use of computers cannot be compared with confidence to other existing research. Older research notes that girls are more likely to use e-mail and other communication functions of the computers, but in some of some recent studies, there is no difference by gender. It appears that boys as well as girls are capitalizing on the communicative nature of the computer.

One might predict that Project CATE youth would enthusiastically participate in online communities, if they had the opportunity. Youth of both genders in this study expressed a strong preference for collaborative (or at least cooperative) use of computers—sharing of knowledge and experience. Even when they had individual tasks to accomplish, children wanted to work in pairs or groups at computers. Numerous suggestions were made, coming equally from males and females in the focus groups, for ways that boys and girls could come together to share ideas, use computers, and teach what they know to older or younger users. This finding is particularly important to answering the first research question because the public library may be one of the best places for this interactive use of computers to take place, as it is an environment without the constraints of school and provides an opportunity for youth to gather in small groups. And since it has shown itself, at least in the SLPL, as gender neutral and a friendly place for both boys and girls, it is a space to promote the use of technology.

Another Project CATE finding that highlights the public library is both the boys' and girls' desired and actual use for self-generated rather than imposed queries. Once again youth and parents saw boys and girls using the public library for homework and for their own play or other interests in equal percentages. Both adults and children responded in much higher percentages on the surveys that the library is used for homework than actually took place in the summer data collection or in the yearlong collection from the Buder, Barr, and Divoll branches (Gross et al., 2004). However, when given a choice, the youth in this study used the public library for their own information needs or recreational preferences. This is in line with the self-generated or recreational emphases that are imbedded in many public libraries' missions.

Why were unrelated parents and youth so similar in their perceptions in this and all other compared topics? There is no research to turn to for

the answer to this question or no clear explanation for this high level of agreement in responses about both attitude and use. This is a topic for further research.

Summary of Discussion

Project CATE contributes to the direction of much recent research on computers, net-generation youth, and gender, in that it corroborates contemporary findings pointing to the narrowing or even disappearance of the gender gap for these children in certain areas, while at the same time raising more sophisticated and complex gender-related questions. This analysis of Project CATE data does not provide concrete reasons for the gender gap's reduction, although greater access for both boys and girls to computers and the opportunity to use them is presumed by some to be one of the factors. Another important contribution of this study underscores the public library as a place with a great deal of latitude for boys and girls to do what they choose with activities that are not adult-directed and do not carry gender expectations.

IMPLICATIONS AND RECOMMENDATIONS

Research

Based on Project CATE and other research related to gender, net-generation children, and computers, the following recommendations are made:

- Research on attitudes is not as important as it once was. Negative attitudes of girls toward computers and toward their skill levels are not the major problem they once were. Research focus must move on to issues of greater concern.
- Research on use, on the other hand, needs to become much more sophisticated, following some of the themes suggested by the *Girls 'N' Games* conference. The definition of "use" must be clear and not confused with information behavior or design. Library researchers can help others with this distinction. Research should also move forward in the areas of information behavior and information architecture, not addressed in this review.
- Research needs to have a theoretical or conceptual basis. For example, studies of gender in relation to girls will be enhanced if viewed through the lens of feminist theory. The disagreement among feminists that emerged after girls' games appeared and that is still voiced at the *Girls 'N' Games* conference and elsewhere would be better understood in the context of feminist theory. The debate over whether there should or can be games specifically for girls would be more easily articulated through the lens of competing feminist theories (Tong, 1998). Only a few studies, e.g., Agosto's use of gender schema theory (2004a, 2004c), Chandler-Olcott & Mahar's (2003) use of Multilitera-

cies theory and Activity theory, and Dresang's (2005) and others use of Radical Change have demonstrated the application of theory or conceptual frameworks. These and the few others like them should serve as models and become the norm instead of the exception.

- Research needs to be designed to take into account both stated attitudes and behavioral observations, quantitative and qualitative aspects, such as occurred in Project CATE, in order to provide more depth to the analyses of findings. Too many studies depend on self-reporting and self-perception alone.
- Research that relates to the active involvement of youth in production and creation of computer experiences needs to be expanded.
- Research on parents' (possibly similar) attitudes toward and knowledge of their children's use of computers provides fertile ground for examining the net-generation's intergenerational communication in relation to computers.
- Research must pay more attention to context, including more research situated in the public library.
- Research on youth in collaborative environments, on and offline and with adults as well as with peers, is needed and easy to accomplish with the net-generation users.
- Research must continue to probe why girls are increasingly engaged in computer use with attitudes equally positive to those of boys, yet the percentage of girls who engage in college-level computer studies or who seek technology positions as adults has not risen comparably.

Professional Practice in Public Libraries

The results of this study provide rich information for librarians working with youth in public libraries:

- Professional practice must include gender-neutral access, opportunities, and environments. No assumptions or comments must be made about what boys or girls will like or want to do on computers, as there are no clear and specific gender-related answers.
- Professional practice must recognize the appeal of games, including online games, to both girls and boys and make them readily available for computer use. Although not focusing on gender, Sandvig (2000, 2001) demonstrated that youth choose game playing over any other activity in the public library and noted why it should be encouraged. Therefore the validity of game playing for youth as more than simply passing time must be recognized.
- Professional practice must capitalize on the desire of net-generation youth to participate in communities of practice and in learning communities (again on and offline). The argument for collaborative use was so strong from both boys and girls in the focus groups that the

SLPL administration, near the end of the study, changed its policy to allow more than one user at one computer. In addition, the SLPL instituted Club Tech, a six-week-long repeated activity that integrated skill development with the type of learning communities the youth desired (see Dresang et al., 2006, for details about Club Tech). Librarians must work to integrate on and offline activities to take advantage of this need for "connectivity." Professionals must be sure that library policies do not work against this opportunity. "Communal" activities must not be relegated to girls alone.

- Professional practice must resist legislation that disrupts the ability of youth to experience online or offline collaboration. Although Internet safety issues were not addressed in this analysis, due to the lack of gender-related data, much has been written on the topic (Roban, 2002) and library professionals must consistently endorse educational strategies for dealing with these issues rather than denial of access.
- Professional practitioners must realize that youth come to the public library motivated by their self-generated needs and play interests, as well as for homework, and provide plenty of time and space for both uses of computers.

Parting Thoughts

While researchers must continue to pose and seek answers to as-yet-unanswered questions, professionals must make the most of what this research demonstrates. It is essential to keep up with ongoing research since clearly this is an area of extremely rapid change and challenge to long-held assumptions. Although this is only the starting place for what needs to be known and put into practice about gender, youth, computers, and the public library, it should be put to good use for positive professional practice.

NOTES

1. The terms "youth, children, and students" are used interchangeably to refer to the young people Grades 4–8 who participated in the study. Following the lead of Tapscott (1999), the term "net-generation" applies to all these children, who have never known a world without computers and who have all had access to the Internet.
2. Focus group data is qualitative. Therefore numbers are not as important as a thematic analysis of what has transpired. No presumption is made that these participants are representative of the Saint Louis Public Library users or non-users.
3. There is general agreement in the literature consulted that northern European and North American youth have similar interests and preferences in relation to computers. This is an unproved assumption that lies behind quoting this and other European-based studies.
4. Although the SLPL did not ban e-mail and chat rooms at the time of the study, neither were they encouraged. This, along with limited computer access at home and in the schools, explains the large discrepancy between the desire to know how to use these communication methods and their actual use.
5. See detailed description of the settings and methodology in Gross et al., pp. 316–320.
6. Data were not disaggregated by race because most of the youth were African American, so this statement is made because the levels of confidence are similar to those in studies with largely majority youth participants.

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