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ABSTRACT

Multimedia computer learning activities, when designed according to what is known about children's preferences, may help close the gender gap in attitudes about computer usage in schools. This paper includes: a brief overview of gender-gap research; a description of one response--the UCI (University of California Irvine) Computer Arts program, aligned with ISTE (International Society for Technology in Education) NETS (National Educational Technology Standards for Students); and dissertation research--410 coded observations of 76 4th and 5th grade students over six weeks while they worked in same and mixed sex pairs on multimedia learning activities. The study revealed that females were as active, if not more so than males, when they were involved in constructivist, cooperative, curriculum based, multimedia learning activities, and both groups were more active in same-sex pairings. (Contains 37 references.) (Author/MES)

UCI Computer Arts: Building Gender Equity While Meeting ISTE NETS

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UCI Computer Arts:
Building Gender Equity While Meeting ISTE NETS

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Abstract

Multimedia computer learning activities, when designed according to what we know about children's preferences, may help close the so called" gender gap" in attitudes about computer usage in schools. This paper includes a brief overview of gender-gap research, a description of one response: the UCI Computer Arts program (aligned with ISTE NETS: National Educational Technology Standards for Students), and the author's dissertation research: 410 coded observations of 76 4th and 5th grade students over six weeks while they worked in same and mixed sex pairs on multimedia learning activities. The study revealed that females were as active, if not more so than males, when they were involved in constructivist, cooperative, curriculum based, multimedia learning activities, and both groups were more active in same-sex pairings.

The Gender-gap Problem

The persistence of a gender gap in computer usage in education has been well documented: females continue to be under-represented in computer science programs in high schools and colleges, and later in computer related careers (AAUW, 1992 & 1998). Females are reported to use computers less often, with less enthusiasm, and differently than males (Bunderson & Christensen, 1995; Christie, 1997; Kirkpatrick & Cuban, 1998; Mitra, 1998; Sanders, Koch, & Urso 1997). This gap first appears in the elementary grades and widens as students move through middle and high school, into college and beyond (D'Amico, Baron & Sissons, 1995; Durndell, Glissov & Siann, 1995; Nathan & Baron, 1995). While in the early grades (i.e, 1-5), females and males demonstrate similar attitudes about, and abilities in, computer usage (Armitage, 1993). However as females advance through the middle, secondary, and postsecondary grades, they are under-represented in computer science courses while they are over-represented in computer applications courses such as word processing and data management courses (Becker, & Sterling, 1987; Bunderson & Christensen, 1995). These trends have raised the specter of unequal participation by females in the economic and cultural life of the information age (AAUW, 1998).

In a recent article, Heather Kirkpatrick and Larry Cuban asked, "should we be worried?" about this gender gap, given the importance of computers in the 21st Century: "The research strongly suggests that if females do not gain experience with computers, they will not be as positive about computers or be as proficient on computers as their male peers (Kirkpatrick & Cuban in Jossey-Bass, 2000, p 160)." Students' attitudes about computers are shaped by the amount, as well as quality, of previous computer experience, "Hence a self-perpetuating cycle exists..." (Kirkpatrick & Cuban, 1998, p. 58). More positive experiences with computers generate better attitudes and so forth (Mitra, 1998; Sacks, Bellisimo & Mergendollar, 1993-94; Shashaani, 1994). Males acquire more experience with technology than females, inside and outside of the classroom, and they tend to have better attitudes about computer usage overall (Kirkpatrick & Cuban, 1998; Proost, et al., 1997). Therefore, we need more positive educational computer learning experiences for females as well. The following section deals with some of the causes of the gender gap in computer usage, their influences on student attitudes, and efforts to address this problem in schools.

Responses to the Problem:

In a report to the President of the United States, the President's Committee of Advisors on Science and Technology alluded to the paucity of research in this area: "A modest amount of research has attempted to identify factors that might account for gender-specific differences in the appeal and effectiveness of certain types of programs and of various environments and contexts for computer use..."(1997, p. 79). For example, researchers have examined gender preferences for various types of educational programs, computer-assisted instruction (CAI) software (tutorials, drill and practice, games and simulations), and various types of learning activities and settings (Braun & Giroux, 1998; Durndell, Glissov & Siann, 1995; Fiore, 1999; Hood & Togo, 1993-94; Huff & Cooper, 1987; Jakobsdóttir, Krey & Sales, 1994; Nathan & Baron, 1995). This research has tended to reveal what has been called females' "deficiencies" in competitive educational games and mixed sex computing environments (AAUW, 1998). Therefore recommendations have tended to be compensatory, such as designing software and Web sites to appeal to girls. This approach has been problematic. For example, Fiori tested female students' reactions to instructional game-like programs with features that had been assumed to appeal to female users. Instead, she found that the females consistently preferred "paint", not game programs (1998). This illustrated the difficulty with making assumptions about female preferences for software features and types.

Other research in computer lab settings have revealed that females may be intimidated by the presence of males when using game format, competitive software thus putting them at educational disadvantage (Cooper, Hall & Huff, 1990). A response to this has been to recommend single sex computing environments (Fiore, 1998; Sanders, 1998). The critique of this approach is that it may further distance females and males in both expectations and understanding. Thorne has been critical of the segregation of females and males in elementary schools, in classrooms and on playgrounds. She calls for more "border work", female and male children learning to work with each other through mixed sex cooperative activities (Thorne, 1998).

A promising area of research has been the analyses of socially-constructed sex role expectations and stereotyping behaviors that occur in schools and influence female attitudes about computer use. Female attitudes are influenced by family, schools, and society (Brown & Gilligan, 1992). These influences also affect their attitudes about computers (Papert, 1993). By the time that girls enter the middle grades (i.e. 5-9), many of them have "read their environments" and have identified computer usage with boys:

> Girls live in the same world that you and I live in. They look around and see Daddy at the computer at home, boys in the computer room at school, boys in the video arcade, and men in the computer ads. They notice that computer hackers are almost invariably male. They see boys responding in droves to the thrill of computerized weaponry and war. When girls reach puberty, these observations begin to matter. At the middle-school age, they're sorting out what it means to be a woman in this society: what is appropriate behavior? What are appropriate interests? It is hardly surprising, given what girls see in the world around them that they conclude computers are not quite the proper thing for a real girl to do (Sanders, 1998, p. 163).

These attitudes carry over into the schools. While there may be no explicit signs that girls are not welcome in school computing, they get that message all the same.

All to often classroom teachers are unaware that they may be inadvertently contributing to sex-role stereotyping in the use of computers, an aspect of the "hidden curriculum" of schooling (Apple, 1997). This is a curriculum that instructs females by various "signs "that the use of computers is a male pastime: computer labs dominated by males, game-like instructional software that appeals to males, and computing responsibilities assigned to males. Teachers can ameliorate this by employing a variety of strategies including: establishing and maintaining "safe" computer use settings (Cooper, Hall & Huff, 1990; Saunders, 1988), the use of productivity rather than game-like software (Fiore, 1999; Kafai, 1995) and assigning curriculum-based multimedia presentations (Burge, 1999), the use of cooperative groupings (Slavin, 1995), and other gender equity strategies, such as acknowledging the contributions of females and males equally (Horgan, 1995).

The following section describes a program designed to appeal to females and males alike.

UCI Computer Arts Program: 1997–2001

This program was in alignment with all six areas of the Technology Foundation Standards for All Students (ISTE, 2000, pp 14-15), and involved university undergraduate students in the UC Irvine undergraduate Minor in Educational Studies, who tutored pairs of upper-grade (4-6) elementary students in the development of multimedia (PowerPoint and Internet) projects in academic content areas (such as language arts, social science, and science), over six weeks. The design of the program was informed by gender research in computer usage. The objectives included developing computer, online and traditional research and presentation skills, and awareness about university life. The elementary students prepared curriculum-based PowerPoint classroom presentations, and in the process operated computers and peripherals, conducted research on the World Wide Web, combined electronic resources with classroom texts, cited sources and sought Web master permissions (where appropriate), used color and design elements in the development of informative presentations, and made oral presentations to peers in their classrooms. The UCI Computer arts program employed constructivist methods including cooperative learning and encouraged both individual expression and between-student interaction (Adams & Hamm, 1990, Perkins, 1995). Research in cooperative learning has suggested that females tend to prefer cooperative to competitive learning environments (Sanders, Koch and Urso, 1997). These and other gender effects of computer learning behaviors were the foci of the author's dissertation research.

The Study

The author designed a research study that looked at the gender related behaviors of 4^{th} and 5^{th} grade students while they engaged in UCI Computer Arts multimedia learning activities over six weeks in 1998-1999. Seventy-six students (36 females and 40 males) met for about one hour each week in a school computer lab, in same or mixed sex pairs, with university student tutors while they planned, designed and created PowerPoint presentations about curriculum-based social studies topics. The study employed a non-experimental observational research design that employed quantitative methods in the collection and analyses of 410 coded observations, and qualitative data (i.e., observer comments, journal entries, and online discussion forum transcripts), that were used to explain the quantitative findings. Trained observers recorded frequencies data for 24 behavior measures organized in six behavior categories: Verbal-Linguistic, Visual-Spatial, Logical-Mathematical, Bodily-Kinesthetic, Interpersonal and Intrapersonal (Gardner, 1983, 1993). The primary hypotheses were that (1) there would be significant gender related differences in students' behaviors in multimedia computer learning activities, but that (2) there would not be significant overall differences favoring one gender in this type of complex learning activity.

Unexpectedly, females were found to be significantly more active than males in several measures (Burge, 1999).

Findings

One-way ANOVAs revealed significant or nearly significant differences for behaviors favoring females: Listens (p=.056,.042), Reads (p=.008,.006), Writes (p=.025,.002), Uses color, line, texture (p=.021), Controls mouse or keyboard (p=.010,.004), Points gestures (p=.053,.010), Assertive (p=.026, .015), and Motivated(p=.067), and (2) favoring males: Chooses graphics (p=.081), and Moves graphics (p=.027,.061). Two-way ANOVAs revealed effects of gender pairing in the following categories: Listens (p=.055), Reads (p=.032), Motivated (p=.009), and Unmotivated (p=.045). This suggesting that when the partner was the same sex, frequencies of some behaviors increased, and the first three of these four favored female gender pairs.

The following table provides summaries of the one-way ANOVA findings that are significant or nearly significant at or near the <.05 level:

Table 4.9: Summary of the Significant or Nearly Significant Relationships Between Gender and Behaviors

Behaviors	Wks	n: F/M	Gender Mean	SD	F Ratio	df	p-Value
Verbal-Linguistic							
AQ6 Listens	1-6	204/206	F 2.55	1.150	3.685	408	.056*
			M 2.23	1.056			
	1-3	102/100	F 2.833	1.211	4.20	200	.042*
			M 2.50	1.096			
AQ8 Reads	1-6	204/206	F 1.779	.840	7.205	407	.008*
			M 1.56	.769			
	4-6	102/106	F 1.971	.928	7.782	205	.006*
			M 1.629	.835			
AQ9 Writes	1-6	204/206	F 1.936	1.060	5.054	408	.025*
			M 1.714	.942			
	1-3	102/100	F 2.01	1.029	10.04	200	.002*
			M 1.59	.842			
Visual-Spatial							
BQ10 Uses color line, texture	4-6	102/106	F 1.725	.810	5.431	206	.021*
			M 1.491	.636			
BQ11 Chooses graphics	1-3	102/100	F 1.755	.849	3.069	200	.081*
			M 1.990	1.049			
BQ12 Moves graphics	1-6	204/206	F 1.505	.726	4.949	408	.027*
			M 1.694	.977			
	1-3	102/100	F 1.637	.842	3.547	200	.061*
			M 1.9	1.124			
Bodily-Kinesthetic							
EQ20 Controls mouse or keyboard	1-6	204/206	F 2.907	1.181	6.613	408	.010*
			M 2.597	1.256			
	4-6	102/106	F 2.990	1.104	8.669	206	.004*
			M 2.509	1.244			
EQ21 Points, gestures	1-6	204/206	F 2.549	1.380	3.772	408	.053*
			M 2.286	1.358			
	1-3	102/100	F 3.020	1.414	6.697	200	.010*
			M 2.490	1.494			
Interpersonal							
FQ25 Assertive	1-6	204/206	F 1.745	.867	4.984	408	.026*
			M 1.568	.734			
	4-6	102/106	F 1.833	.797	6.031	206	.015*
			M 1.585	.660			
Intrapersonal							
GQ29 Motivated	1-6	204/206	F 1.955	.771	3.382	408	.067*
			M 1.815	.775			

* Indicates a p-Value that is significant at or near the.05 level or below.

Source: Burge, 1999.

Implications

While the size and scope of this study was limited, the initial results were promising for the development of computer learning experiences that appealed equally to females and males. The one-way ANOVA results suggested that multimedia computer learning activities may encourage female participation in computer usage with the same or even greater frequency as with males. The two-way ANOVA results (table not included) suggested that the same sex pairs were more active than the mixed sex pairs. The implications of the findings in this study for instructional planning were that when thoughtfully implemented, multimedia computer learning activities can engage females equitably, if differently, with males in computer usage.

In subsequent tutoring sessions (2000-2001) the university tutors made informal observations consistent with the 1999 study, that females usually shared the tasks of developing the PowerPoint projects, and focused on the verbal-linguistic elements of their presentations. Male students tended to lose interest when not in control of the mouse, and were attracted to the colors, graphics and animation features. However there appeared to be no gender gap in student motivation. The overwhelming majority of students, females and males alike, in same or mixed sex pairings, demonstrated high levels of persistence and pride in the multimedia presentations which are often exhibited in classrooms for their peers. Multimedia learning activities clearly had the potential to engage and challenge students to do their best work. It remains to be seen whether longitudinal research will reveal lasting effects on closing the gender gap in student usage of computes in the upper grades and beyond.

Conclusion

While there has been considerable attention to the problem in recent years, females continue to be underrepresented in the use of computers both inside and outside of educational settings (AAUW, 1992, 1998). Research has revealed features of computer-based educational settings that appeal to females: the use of productivity software, cooperative settings and constructivist methods. This paper described how the author used these findings to select the features of the UCI Computer Arts program: academic content analyses and organization, online and traditional research methods, intellectual property considerations and electronic citations, multimedia planning, design and presentation, and cooperative learning skills. The author conducted a year-long study that found that, when computer learning activities were designed to appeal to females and makes alike, that the females were as active, if not more active, than the males in computer usage. The findings from this and other research suggests that by "paying attention" to the needs and expressed interests of females, teachers can design learning environments that will encourage females and males alike in using computers.

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