Kim, S. H., & Bagaka, J. (2005). The digital divide in students' usage of technology tools: a multilevel analysis of the role of teacher practices and classroom characteristics. *Contemporary Issues in Technology and Teacher Education, 5* (3/4), 318-329.

The Digital Divide in Students' Usage of Technology Tools: A Multilevel Analysis of the Role of Teacher Practices and Classroom Characteristics

Seung H. Kim
Lewis University

Joshua Bagaka
Cleveland State University

Abstract

The study examined the role student, teacher/classroom, and school characteristics play on the "digital divide" in access and utilization of various technology tools among elementary school students. Survey data was collected from 1,027 fourth- and fifth-grade students in 48 classrooms in northeastern Ohio. A two-level hierarchical linear model (Raudenbush & Bryk, 2002) was used to examine the extent to which teacher/classroom, school, and home variables can predict the average classroom usage of specific technology tools. Data analysis in this study by specific type of computer tools showed that, in general, students tend to use technology tools for individual/personal practices rather than for instructional activities. Students' usage of word processing, interactive, and productivity tools was significantly lower in schools located in urban and rural areas than those in suburban communities. The results also indicated that school location, school technological support, and teachers' beliefs about technology were significant predictors of the classroom student usage-gap of productivity tools between those who have and those who do not have access to computers at home. Teachers' level of experience was also found to relate significantly to the students' usage of computer tools.

Over the past two decades, there have been significant increases in the access and use of technology in U. S. schools. While one instructional computer was available for every 20 students at the start of 1990s, currently most schools possess more than one instructional computer for every five students in primary and secondary schools in the U.S. (Kleiner & Farris, 2002; National Center for Education Statistics [NCES], 2005). However, access is not equal for all students to be prepared effectively for the information-rich world (Coley,

Cradler, & Engel, 1997). Although all students are expected to develop technological fluency, if students come from school and home backgrounds where technology is not widely accessible or used, they will be at a disadvantage for technology-based tasks and miss out on tremendous educational opportunities with technology resources. Historically, students in rural areas have had limited access to computers compared to urban or suburban communities. According to the National Telecommunications and Information Administration report (U.S. Department of Commerce, 2002), between 1998 and 2001, people living in urban areas were significantly more likely to have Internet access than were people living in rural areas. In most of the 50 states, the poor and minority students in rural areas are already falling behind their counterparts in wealthier schools, although "the ratio of students to instructional computers with Internet access was higher in schools with the highest poverty concentration than in schools with the lowest poverty concentration (5.1 to 1 compared with 4.2 to 1)" (NCES, 2005, p. 7). Students from families who do not have access to today's computer technology will have a hard time catching up in tomorrow's technological job market.

The U.S. Department of Commerce referred to this gap between people who have access to computer technology and people who do not as the "digital divide." The digital divide is also often mentioned as the gap between those who are able to participate fully in the technology agenda and those who are not (Bracey, 2000). The gap in type of technology usage has been revealed in different groups of students by gender, ethnic status, and socioeconomic level. Inequity in student experiences with technology can be seen in schools across the district (Kleiman, 2000), within the school, and among the students themselves (Haugland, 2000).

Many educators have pointed out that the major issues in the digital divide are related to a lack of interest in technology as well as a lack of access to technology. For example, although computers are available to schools or classrooms, many teachers or students do not sufficiently utilize them. Even when access to technology and connectivity exists, students may have unequal learning experiences. If their teachers choose not to use technology in their teaching, students cannot be equally prepared to become knowledgeable workers and to function well in society. According to the Department of Education report (Kleiner & Farris, 2002), computer usage in schools primarily populated with underserved students is limited to teaching of basic skills, as contrasted with affluent schools where computers are likely to be used to teach higher order literacy and cognitive skills.

On the other hand, many prior studies have shown that disparities exist by gender, as well as socioeconomic backgrounds in both the use and proficiency with computers (Huber & Schofield, 1998; Kelly, 2000). Some literature concerning gender equity indicates that there is no significant difference in the amount of time spent at computers between boys and girls at the early ages of 4 and 5 years (NCES, 2001, 2004). However, when children reach fourth grade, there is a significant difference: boys spend more time at computers than girls do (Haugland, 2000). Armitage (1993) reported that in the elementary grades there is not much evidence of a gender gap in mathematics, science, and technology. Yet, girls start to avoid the computer when they reach the middle school level, and the gender gap widens as students enter high school and increases further into college and graduate school (Gehring, 2001). According to a report of gender inequity by the American Association of University Women (AAUW) Educational Foundation (2000), girls are significantly underrepresented in computer science and technology fields.

Previous studies on the "digital divide" have utilized either students (Becker, 2000) or teachers (Bracey, 2000) as units of analysis. However, research that examines the role that school, classroom, and teachers play on the digital divide in student technology

access and usage is still scarce. It is important for institutions to identify some of the school/classroom infrastructural characteristics, as well as teacher practices, that may minimize the disparities in access and usage of technology among students.

The purpose of this study is twofold: First, to examine the inequities in access and utilization of technology among students in elementary schools in northeastern Ohio and, second, to examine school contextual, classroom, and teacher characteristics that may be related to the disparities in student access and usage of technology. Specifically, the following research questions were addressed in the study:

- Do significant differences exist in the students' access to technology tools by school location?
- Do significant differences exist in the students' usage of technology tools between those who have access to computers at home and those who do not?
- Do significant differences in the students' usage of technology tools exist by school locations, student's gender, and grade level?
- To what extent do teacher and classroom characteristics such as teacher's gender, teaching experience, percent of minority students, and computer access in the classrooms, significantly predict inequities in the type of technology usage among fourth and fifth graders?

Method

Participants

The student participants were 1,027 fourth and fifth grade students from 48 classrooms in northeastern Ohio. Fifty one percent (n = 523) of the students were from the 24 suburban classrooms, 18% of the students (n = 180) were from the nine rural classrooms, and 31% (n = 320) of the students were from the 15 urban classrooms. On average, 59% of the urban students were minority, compared to 28% of the suburban students and less than 1% of the rural students. The fourth- and fifth-grade teachers who participated in the study consisted of 15 males and 33 females, with teaching experience raging from 1 to 39 years and a mean teaching experience of 10.35 years. Those who agreed to participate were mailed a package containing one teacher and 25 student questionnaires, together with a self-addressed, stamped, return envelope. The participating teachers were asked to complete the teacher questionnaire and administer student surveys in their classroom. Forty-eight out of a total of 75 survey packages (or 64%) were returned.

Instrumentation

Two surveys were used to collect data for the study. The student survey assessed the frequency of students' usage of computer technology tools per week (1 = none, 1-3 times, 4-5 times, 6-10 times, 11 or more times), computer access at home, hours spent on computers at home and in school, and types of computer tools used. The teachers' survey questions focused on (a) individual characteristics such as gender, teaching experience, beliefs about technology, and type/level of computer usage, (b) classroom characteristics such as class size, number of computers in the classroom, and percentage of minority students in the classroom, and (c) school contextual characteristics such as school location (urban, suburban, or rural).

In the development of the students' questionnaire, three classroom teachers, knowledgeable in the field of technology and experienced in classroom teaching reviewed the instrument. Each teacher reviewed the instruments for clarity and gave specific

suggestions on how to improve each of the items. Based on these suggestions, items in the survey instruments were revised or eliminated. A pilot study of 65 students in three classrooms from one private and two public schools was also utilized to refine the students' questionnaire.

Variables and Measures

Two levels of variables (student-level and teacher-level) corresponding to the units of analysis were identified for the study. The student-level variables provided information about the students' use of the following computer tools: word processing, drawing, presentation/PowerPoint, spreadsheet, typing practice, games, reading software, encyclopedia, computer test, Web searching, and e-mail. Through principal component factor analysis, the following four groups of computer tool usage and their Cronbach's reliability alpha (a) were identified: (a) individual tools consisting of typing practice, reading software, and encyclopedia (a = .63, mean = 2.26); (b) interactive tools consisting of drawing, Web searching, computer games, and email (a = .62, mean = 2.91); (c) productivity tools consisting of PowerPoint and spreadsheet (a = .52, mean = 1.83); and (d) word processing (mean = 2.43). These four groupings of computer tool usage were utilized as the primary dependent variables of the study. Other student characteristics, such as gender, grade level, and home computer access, were also utilized as independent variables of the study.

The teacher/classroom-level variables provided information about the teachers' instructional and personal usage of computer technological tools. Other teacher variables, such as teaching experience and teachers' technological beliefs, were also collected in addition to classroom and school characteristics, such as percentage of minority students, classroom computer access, and school location. In order to use school location in the regression model, the variable was dummy coded into two groups (urban/rural = 0, suburban = 1). Since data shows that students in urban and rural schools are economically disadvantaged compared to those in suburban schools (NTIA, 2002), by combining rural and urban locations, these variables may also capture aspects of school social economic characteristics.

Data Analysis

Data analysis in this study followed two phases. In Phase 1, the analysis of variance model (ANOVA) was used to determine the extent to which students' usage of computer technology tools vary by students' characteristics such as gender, access to computers at home, grade level, and school location. In Phase 2, a two-level hierarchical linear model (Raudenbush & Bryk, 2002) was used to explain variation in students' usage of various computer tools as a function of teachers' characteristics, as well as school contextual variables. Through this model, we are able to access the role teacher, classroom, and school variables play in the students' computer tools usage-gap, which may exist by student's access to a computer at home, student's gender, and student's school location. Hierarchical linear modeling (HLM) can explain the between- and within-classroom variances simultaneously (Raudenbush & Bryk, 2002). The HLM™, version 5.04 was used in conjunction with the Statistical Package for the Social Sciences (SPSS-11.0) in the Windows XP Environment for data analysis in this study.

Findings

Phase 1

Difference in the number of hours students spend on computers at home and school and their level of usage of specific computer tools by their individual characteristics such as gender and home computer access was examined using analysis of variance. The results for these analyses are presented in Table 1 through Table 4.

Table 1
Analysis of Variance Results for the Differences in Students' Access to Computer Resources by School Location

Variable	Suburban		Rural/Urban		*F*
	M	*SD*	*M*	*SD*	
Average # of hours per week students' spent on computers					
in school	1.38	2.51	0.76	1.89	16.50**
at home	3.05	6.07	1.90	2.74	11.30**
Tools					
Word processing	2.55	1.34	2.29	1.34	9.28**
Interactive tools	3.01	1.02	2.81	1.08	8.93**
Individual tools	2.28	0.94	2.25	0.91	0.24
Productivity tools	1.99	1.05	1.67	0.96	26.29**

* p < .05. ** p < .01.

Table 1 presents ANOVA results for the differences in students' level of usage of computer resources by their school location. From these results, it is evident that the average number of hours per week students spend on computers in school ($F = 16.50$, $p < .01$) and at home ($F = 11.30$, $p < .01$) were significantly different by school location. Students in schools located in suburban communities, on average, spent more hours on computers both at home and in school than did their rural/urban counterparts.

In terms of student usage of specific computer tools, the data revealed that statistically significant differences exist by school location in student usage of word processing ($F = 9.28$, $p < .01$), interactive tools ($F = 8.93$, $p < .01$), and productivity tools ($F = 26.29$, $p < .01$). In each of these tools, students in schools located in suburban communities had significantly greater usage of each of these three computer tools than did those students in schools located in urban or rural communities.

Table 2 presents ANOVA results for the differences in students' usage of computer resources by gender. Although boys were found to spend significantly more time on computers at home than did girls ($F = 15.44$, $p < .01$), no statistically significant differences were observed in students' usage of specific computer tools by gender, nor the average number of hours they spend on computers at school.

Table 2
Analysis of Variance Results for the Differences in Students' Access to Computer Resources by Gender

Variable	Boys		Girls		*F*
	M	*SD*	*M*	*SD*	
Average # of hours per week students' spent on computers					
in school	1.14	2.43	1.20	2.22	0.22
at home	2.51	3.66	2.11	2.44	15.44**
Tools					
Word processing	2.35	1.34	2.51	1.50	3.48
Interactive tools	2.89	1.06	2.94	1.05	0.78
Individual tools	2.25	0.93	2.28	0.91	0.25
Productivity tools	1.85	1.03	1.81	1.01	0.48

* p < .05. ** p < .01.

Table 3 presents ANOVA results for the differenc es in students' usage of computer resources between those with and without access to computers at home. As expected, students with access to computers at home, on average spent significantly more time on computers at home than did those without ($F = 17.22$, $p < .01$). However, similar significant variations were observed in the average number of hours they spend on computers in school ($F = 14.70$, $p < .01$).

Statistically significant differences were observed between students with access to computers at home and those without access in the usage of word processing ($F = 23.20$, $p < .01$), interactive tools ($F = 42.81$, $p < .01$), individual tools ($F = 15.52$, $p < .01$), and productivity tools ($F = 19.99$, $p < .01$). In each case, students who have access to computers at home had a significantly greater usage of all four tools than did those who have no access to computers at home.

Table 3
Analysis Variance Results for the Differences in Students' Usage of ComputerResources Between Those With and Without Access to Computer at Home

Variable	Without		With		*F*
	M	*SD*	*M*	*SD*	
Average No. of hours per week students' spent on computers					
in school	0.70	1.83	1.34	2.48	14.70**
at home	1.56	4.84	3.08	5.30	17.22**
Tools					
Word processing	2.09	1.30	2.55	1.35	23.20**
Interactive tools	2.56	1.00	3.04	1.05	42.81**
Individual tools	2.07	0.85	2.33	0.94	15.52**
Productivity tools	1.60	0.92	1.92	1.04	19.99**
* p < .05. ** p < .01.					

Table 4
Analysis of Variance Results for the Differences in Students' Access to Computer Resources by Grade Level

Variable	4th grade		5th grade		*F*
	M	*SD*	*M*	*SD*	
Average No. of hours per week students' spent on computers					
in school	0.76	1.89	1.38	2.51	16.50**
at home	1.90	2.74	3.05	6.07	11.30**
Tools					
Word processing	2.03	1.28	2.63	1.33	80.80**
Interactive tools	2.59	1.10	3.08	0.99	56.30**
Individual tools	2.19	0.95	2.30	0.91	3.41
Productivity tools	1.80	1.10	1.85	0.97	0.40

* p < .05. ** p < .01.

Differences in students' usage of computer tools and the average number of hours per week they spend on computer at home and at school were examined by grade level (see Table 4). From these findings, it is evident that fifth-grade students have a significantly greater usage of word processing ($F = 80.80$, $p < .01$) and interactive tools ($F = 56.30$, $p < .01$) and spend significantly more hours per week on computers at home ($F = 11.30$, $p < .01$) and at school ($F = 16.50$, $p < .01$) compared to their fourth-grade counterparts. However, no significant differences were observed between fourth- and fifth-grade student's usage of productivity ($F = 0.40$, $p >. 05$) and individual tools ($F = 3.41$, $p > .05$).

Phase 2

In Phase 2, a two-level hierarchical linear model (Raudenbush & Bryk, 2002) was used to explain variation in students' usage of each of the four computer tools as a function of teachers' characteristics and practices, as well as school contextual variables. By using hierarchical linear modeling, parameters estimated at the student-level (level-1) model are allowed to vary for each classroom. Each of these parameter estimates serve as outcome variables at the classroom-level (level-2) model. Of particular interest are the parameter estimates for the intercept ($ß_{0j}$) and the coefficients associated with the student-level predictor variables, access to computer at home ($ß_{1j}$). The estimate for the parameter $ß_{0j}$ represents the adjusted average computer tools usage for classroom *j*. The estimates for the parameter associated with the dummy coded predictor, access to computer at home (1 = yes, 0 = no) represent the predicted usage-gap between those students with access to computers at home and those without. Level-2 of the HLM will then serve two purposes. First, to determine the extent to which teacher characteristics and practices, as well as school contextual variables, can predict the adjusted classroom average computer tools usage. Second, the model will be used to access the role teacher characteristics and practices, as well as school contextual variables, play on the student computer tools usage gap (digital divide) between those students with and those without access to computers at home.

Table 5 presents the hierarchical linear model results for the prediction of the adjusted classroom average students' usage of computer tools by various teacher/classroom variables and school location.

Table 5
Two-Level HLM Results for the Prediction of the Adjusted Classroom Average Student Computer Tools Usage by Teacher Practices, Characteristics and Schools Contextual Variables

Variable	Productivity Tools	Interactive Tools	Individual Tools	Word Processing
Teacher gender (1 = female, 0 = male)	*ns*	*ns*	*ns*	*ns*
Teaching experience	0.021**	*ns*	*ns*	*ns*
Beliefs in technology	*ns*	*ns*	*ns*	*ns*
Technology support	*ns*	*ns*	0.177**	*ns*
Instructional use	*ns*	*ns*	*ns*	*ns*
Personal use	*ns*	*ns*	*ns*	*ns*
% minority students in the classroom	-0.005*	*ns*	*ns*	*ns*
No. of computers per 10 students	-0.332**	*ns*	*ns*	*ns*
School location (1 = suburban, 0 = other)	-0.349*	*ns*	*ns*	*ns*

* p < .05. ** p < .01.

The results showed that students' classroom adjusted average student usage of productivity tools was significantly predicted by teachers' years of experience (? = 0.021, $p < .01$), number of computers per 10 students in the classroom (? = -0.332, $p < .01$), school location (? = -0.349, $p < .05$), and percentage of minority students in the classroom (? = -0.005, $p < .05$). The adjusted classroom average usage of productivity tools was positively related to teachers' years of experience, but negatively related to number of computers in the classroom and percentage of minority students in the classroom. In addition, students in schools located in urban and rural communities were predicted to use productivity tools less often than those whose schools are in suburban communities.

In this study, the coefficient associated with the dummy predictor, access to computer at home, represents a measure of the "digital divide" in student computer tools usage between students with and those without access to computers at home. This coefficient was significantly positive across all four types of computer tools (see Table 3). The digital divide across the 48 classrooms for each type of computer tools was then treated as dependent variable, with teacher practices and characteristics, together with school contextual variables as independent variables.

Table 6 presents the HLM results for the prediction of the digital divide in student computer tools usage by teacher practices and characteristics, as well as certain school variables.

Table 6
Prediction of the Classroom Computer Usage-Gap Between Students Who Own and Those Who Do Not Have Access to Computer at Home by Teacher and Classroom Variables

Variable	Productivity Tools	Interactive Tools	Individual Tools	Word Processing
Teacher gender (1 = female, 0 = male)	*ns*	*ns*	*ns*	*ns*
Teaching experience	*ns*	*ns*	*ns*	-0.019*
Beliefs in technology	-0.306*	*ns*	*ns*	*ns*
Technology support	0.160*	*ns*	*ns*	-0.197**
Instructional use	*ns*	*ns*	0.227*	*ns*
Personal use	*ns*	*ns*	-0.234*	-0.259**
% minority students in the classroom	*ns*	*ns*	0.004*	0.005*
No. of computers per 10 students	*ns*	*ns*	*ns*	*ns*
School location (1 = suburban, 0 = other)	0.324*	*ns*	*ns*	*ns*

* p < .05. ** p < .01.

Different patterns emerged for the four tools. School location (? = 0.324, $p < .01$), school technological support (? = 0.160, $p < .05$), and teachers' beliefs in technology (? = -0.306, $p < .05$) were significant predictors of the classroom student usage-gap of productivity tools between those who have and those who have no access to computers at home. In classrooms where teachers had more positive beliefs in technology, the digital divide tended to be narrower than in those classrooms where teachers had less positive beliefs about technology. The data also showed that the gap in the usage of productivity tools was significantly wider in the suburban classrooms than in either the rural or urban classrooms. Teachers' personal usage of computers significantly narrows the students' usage gap in both individual tools (? = -0.234, $p < .05$) and word processing tools (? = -0.259, $p < .01$). An increased percentage of minority students in the classroom was also found to widen the classroom student usage gap significantly in individual tools (? = 0.004, $p < .05$) and word processing tools (? = 0.005, $p < .05$). In addition, teachers' level of experience was found to narrow the classroom student usage gap significantly in word processing tools (? = -0.019, $p < .05$).

Discussion

The study revealed that while the digital divide in physical access to computers in schools was not significantly different by school location, students in suburban schools had significantly greater access to computers at home than did their rural/urban counterparts. Students in suburban classrooms spent significantly more time on computers both at home and in school than did the rural/urban students. Data analysis in this study by specific type of computer tools showed that, in general, students tended to use technology tools for individual/personal practices rather than for instructional activities. Students' usage of word processing, interactive, and productivity tools was significantly lower in schools located in urban and rural than in those in suburban communities. These findings suggest that access to computers at home is an important factor in students' utilization of computer resources. Moreover, providing physical access to computers in schools may be insufficient to close the digital divide in computer

technology by school location. Even when schools provide equal access to computers for all students, the digital divide in students' usage of technology tools still remains, due to differing students' home environments. This phenomenon is a reality that research has identified for several decades. For instance, Sutton (1991) indicated that computer technology exaggerated existing inequalities in educational input and output, particularly by social economic status, minority status, and gender. In order to interrupt these trends, school districts, teachers, and teacher education programs should be more deliberate and innovative in their attempt to reduce such handicaps that children face as a function of factors beyond their control (Coleman, 1977).

Although the study found no statistically significant evidence of a gender gap among students in fourth- and fifth-grade levels in usage of computer tools in the classroom, boys on average spend more hours on computers at home than do girls. The findings of this study also indicated that a significant digital divide exists in students' usage of technology tools between those who have access to computers at home and those who do not. This difference in home usage of computers by gender, if unchecked, may lead to a gender digital divide later on in their school life. Educators should make an effort to identify more institutional and societal factors that may lead to the widening of this gender digital divide, as well as incorporating gender equity strategies in the curriculum of teacher training programs.

The role of teacher and institutional variables such as a teacher's level of experience, their beliefs, and their practices in closing this gap should be of paramount importance to educational researchers. Therefore, the higher education community, including teacher education programs, should establish a partnership with school districts that show limited practice with technology tools to ensure equal opportunities for all students. In this collaborative relationship, professors and teachers could tailor teacher education courses to integrate technology tools into specific subject areas and develop an effective teacher training program that can be implemented in each subject area. Teacher training should focus on educational applications or innovative uses of technology tools for each subject area rather than on technology proficiency skills in isolation.

Other findings in the study revealed the importance of teachers' beliefs and practices in technology in relation to the digital divide in students' usage of specific computer tools. Specifically, teachers' positive beliefs about technology, their teaching experience, and their personal usage of computers were all found to narrow significantly the digital divide between students who have access to computers at home and those who do not. In addition, teaching experience was positively related to students' usage of productivity tools that are often integrated into the curriculum, but not with interactive or individual tools that are typically used in isolation. This finding may imply that when teachers are more proficient in technology and have more experience, they integrate technology tools into their teaching. As a result, their students are given the opportunities to use technology, regardless of their technological environment at home.

Limitations of the Study

Although some students' characteristics and practices were found to be significant predictors of student usage of technology tools, the proportion of variance in student usage accounted for by these factors was rather low, ranging from 2.5% in productivity tools to 8.1% in interactive tools. Other factors not considered in the present study need to be identified.

The study also focused on the quantitative rather than qualitative measures of technology usage. The study attempted to determine how often students used computer tools in

school and at home without accounting for the length of time spent each time. Due to the age of student participants in the study, it was difficult to determine the level of sophistication in their usage of computer tools.

The study utilized a nonrandom sample of 48 teachers/classrooms in the second level of a hierarchical linear model. A larger sample of teachers/classrooms in a wider U. S. region could provide a more robust estimate of teacher and classroom effects on the digital divide. However, the study utilized an instrument that focused on typical tools used in a wide range of schools in the U.S. The findings in this study would benefit teachers and teacher educators to identify factors that may reduce the digital divide in students' usage of specific types of computer tools by gender, school location, or social economic background.

References

American Association of University Women Educational Foundation. (2000). *Tech-savvy: Educating girls in the new Computer Age*, Retrieved October 20, 2005, from http://www.aauw.org/member_center/publications/TechSavvy/TechSavvy.pdf

Armitage, D. (1993). Where are the girls? Increasing female participation in computer, math, and science education. In D. Carey, R. Carey, D.A. Willis, & J. Willis (Eds.), *Technology and teacher education annual.* (pp. 14-18). Charlottesville, VA: Association for Advancement of Computing in Education.

Becker, H. J. (2000). Findings from the teaching, learning, and computing survey: Is Larry Cuban right? *Education Policy Analysis Archives* [Online], *8*(51), Retrieved Sept. 28, 2005, from http://epaa.asu.edu/epaa/v8n51/

Bracey, B. (2000, Spring). A different divide: Teachers and other professionals. *Edutopia,* 4-5.

Coleman, J. S. (1977). What is meant by 'an equal educational opportunity'? *Oxford Review of Education, 1*(1), 27-29.

Coley, R., Cradler, J., & Engel, P. K. (1997). *Computers and classrooms: The status of technology in U.S. Schools* (Policy Information Report). Princeton, NJ: Educational Testing Service. (ERIC Document Reproduction Service No. ED412893)

Gehring, J. (2001). Not enough girls. *Education Week, 20(*35*),* 18-19. Retrieved October 20, 2005, from http://counts.edweek.org/sreports/tc01/tc01article.cfm?slug=35girls.h20

Haugland, S. W. (2000). Early childhood classrooms in the 21st century: Using computers to maximize learning. *Young Children, 55(*1*),* 12-18.

Huber, B. R., & Schofield, J. W. (1998). "I like computers, but many girls don't": Gender and the sociocultural contexts of computing. In H. Brornley & M. W. Apple (Eds.), *Education/technology/power.* Albany, NY: State University of New York Press.

Kelly, K. (2000). The gender gap: Why do girls get turned off to technology? In D. T. Gordon (Ed.), *The digital classroom*. Cambridge, MA: Harvard Education Letter.

Kleiman, G. M. (2000). Myths and realities about technology in K-12 schools. In D. T. Gordon (Ed.), *The digital classroom*. Cambridge, MA: Harvard Education Letter.

Kleiner, A., & Farris, E. (2002*). Internet access in U.S. public schools and classrooms, 1994-2001.* Retrieved September 29, 2005, from National Center for Education Statistics Web site: http://nces.ed.gov/pubs2002/2002018.pdf

National Center for Education Statistics. (2001). *Computer and Internet use by children and adolescents in 2001.* Washington, DC: Author.

National Center for Education Statistics. (2004). *Trends in educational equity of girls and w omen: 2004.* Washington, DC: Author.

National Center for Education Statistics. (2005). *Internet access in U.S. public schools and classrooms: 1994–2003.* Washington, DC: Author.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applicatio ns and data analysis methods (*2nd ed.*).* Newbury Park, CA: Sage Publications.

Sutton, R. E. (1991). Equity and computers in the schools: A decade of research. *Review of Educational Research, 61(*4*),* 475-503.

U.S. Department of Commerce. (2002, February). *How Americans are expanding their use of the Internet.* Retrieved October 20, 2005, from the National Telecommunications and Information Administration Web site: http://www.ntia.doc.gov/ntiahome/dn/anationonline2.pdf

Author Note:

Seung H. Kim
College of Education
Lewis University
KimSe@lewisu.edu

Joshua Bagaka
Curriculum and Foundations
Cleveland State University
j.bagakas@csuohio.edu