# O

UNIVERSITY OF OREGON

**APPLIED INFORMATION MANAGEMENT**

# The Digital Divide in K-8 Education: Contributing Factors and Mitigating Teaching Strategies

CAPSTONE REPORT

**D. Kelly Farley**
**Support Center Specialist**
**University of Nevada, Reno**

**December 2005**

Approved by

_____
Dr. Linda F. Ettinger
Academic Director, AIM Program

**Abstract**

**for**

**The Digital Divide in K-8 Education:
Contributing Factors and Mitigating Teaching Strategies**

Lynch (2002) defines the Digital Divide as "the gap between those who have access to and can effectively use information technologies and those who cannot" (Lynch, 2002 p.2). This paper examines a primary factor, socio-economic status (Chen and Wellman, 2003), along with Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) in K-8 education. Literature published between 1995 and 2005 is analyzed to suggest ways to successfully mitigate the Digital Divide in the classroom.

# Table of Contents

## List of Figures and Tables

**Figures**

**Tables**

**Chapter I**

**Brief Purpose**

In 2000, Birdsall defined the Digital Divide as the separation between "those who have access to the Internet from those who do not" (Birdsall, 2000, p.1). Two years later, Lynch (2002) expanded the Digital Divide definition to "the gap between those who have access to and can effectively use information technologies and those who cannot" (Lynch, 2002 p.2). Various authors describe the divide in relation to different contexts, including businesses, communities, countries or even "teledensity", i.e., the number of telephone lines per square mile, as well as the number of personal computers (PCs) or websites in a country (Bridges.org, 2004).

The purpose of this paper is to further explicate one part of the definition; the piece that deals with "the gap between those who have access to and can effectively use information technologies and those who cannot" (Lynch, 2002 p. 2). Focus is on one of the factors often used to define the gap, i.e., socio-economic status (Chen and Wellman, 2003) including related sub-factors of age, (Hargittai, 2002), race (Chen and Wellman, 2003), and income (Barbatsis et al., 2003 and Becker, 2000). This factor is examined in relation to academic success among K-8 students (Gorski, 2001) and teacher technological skills (Castells, 2002), as presented in selected literature. The concept of "academic success" is defined as academic grades (Finn and Rock, 1997), measured by individual class grades and test scores. In addition, this study presents potential mitigating teaching strategies to address this factor within the educational system, as presented in selected literature (Goolsbee and Guryan, 2003).

This study is conducted as a literature review (Leedy and Ormrod, 2005). Material is gathered from previous research studies, articles, journals, books and other published material between 1995 and 2005 related to the Digital Divide, K-8 education, classroom technology, academic success, internet usage and related subjects. Selected literature is subjected to conceptual analysis (Palmquist et al., 2005). The conceptual analysis is conducted in two phases, following a selective reduction process (Palmquist et al., 2005) that is designed to identify reported effects within the K-8 educational context of the factor "socio-economic status" (Chen and Wellman, 2003) and related potential mitigating teaching strategies for this factor for some students who appear to be at risk within the educational system (Goolsbee and Guryan, 2003).

The results of the study are framed as a table and bulleted list. The table, (Appendix A: Factors of the Digital Divide) focuses on the socio-economic factors of age (Hargittai, 2002), race (Chen and Wellman, 2003), and income (Barbatsis et al., 2003 and Becker, 2000) as well as two other factors: Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) as related to the academic success of K-8 students (see Appendix A: Factors of the Digital Divide). Factors are framed in terms of "risk factors" (Booth and Dunn, 1996). The bulleted list (Appendix B: Mitigating Teaching Strategies) reports a set of mitigating strategies that have been used to assist students who appear to be at risk within the education system.

The final outcome of the study is framed as a table (Table 2: Socio-economic Risk Factors and Mitigating Teaching Strategies) that aligns the risk factors (see Appendix A: Factors of the Digital Divide) with identified mitigating teaching strategies (Foss, 2003) (see Appendix B: Mitigating Teaching Strategies). A narrative discussion accompanies

Table 2, Socio-economic Risk Factors and Mitigating Teaching Strategies, and is designed to explain and expand upon the strategies represented within the table.  The final outcome is intended to assist educators (Price, 2003) who may need strategies that mitigate this factor, i.e. teachers serving lower income students (Becker, 2001).  The study may also be of interest to educational advocates (Booth and Dunn, 1996) for K-8 children.

**Full Purpose**

The U.S. National Telecommunications and Information Administration under the Clinton administration first referred to the gap between those who do and do not have access to computers and the Internet as the Digital Divide in the mid 1990s (Warschauer, 2003). Many factors contribute to the divide (Hargittai, 2002 and Hoffman and Novak, 1998) and the gap can extend to a wide variety of contexts, including nations, states, communities, and individuals (Chen and Wellman, 2003). Some of the factors that appear in the literature to define the gap in relation to K-12 students include age (Hargittai, 2002), race (Chen and Wellman, 2003), and income (Barbatsis et al., 2003 and Becker, 2000), Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002). In addition to these factors, tightening school budgets have forced many school districts across the country to put the brakes on technology spending (Sandham, 2001), thus inhibiting the closure of the divide. This study is therefore limited in focus to the socio-economic factor (Chen and Wellman, 2003) and related sub-factors of age and race (Hargittai, 2002) as well as two other factors: Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002).

Definitions of the Digital Divide, including one by Birdsall (2000) and another by Lynch (2002) (see Appendix C: Definitions) may vary widely from author to author. Additionally, Lynch (2002) refers to the Digital Divide: "The gap between those who have access to and can effectively use information technologies and those who cannot". The purpose of this paper is to further explicate the Digital Divide as defined by Lynch (2002) within the K-8 context (Lynch, 2002 p. 2). This study focuses on just one factor often used in association with the gap, i.e., socio-economic status (Chen and Wellman,

2003) as well as two other factors: Internet access (Birdsall, 2000) and teacher

technological skills (Castells, 2002) as related to the academic success of K-8 students

(see Appendix A: Factors of the Digital Divide).  Since socio-economic status is such a

broad term, the study is limited in scope to just three aspects including, age (Hargittai,

2002), race (Chen and Wellman, 2003) and income (Barbatsis et al., 2003 and Becker,

2000), specifically those with annual incomes of $25,000.00 and less per year (Barbatsis

et al., 2003).

Lynch's definition provides the foundation of this study since it includes focus on

technology skills as well as simply access to technology (Lynch, 2002 p.2).  Castells

asserts that learning how to use the Internet, specifically how to retrieve information

online, is a requirement of an Internet based society and economy and further adds that

school systems in the US as a whole are not as yet up to the challenge of educating

students on this new forum (Castells, 2001 p. 259).  Furthermore, while many children

who have access to the Internet need to learn to apply the technology they have at hand

(Foss, 2003), many teachers lack the proper ongoing training in technology needed to

provide adequate instruction (Bryant et al., 2001).

According to Barbatsis et al., (2003), only 25% of households with incomes of

$25,000 or less have access to the internet while 80% of households with incomes of

$75,000 or more are connected (Barbatsis et al., 2003).  Additionally, in this same study,

it was revealed that educational differences also have an effect with 80% of those with a

bachelor's degrees or higher are connected compared to just 40% of those with only a

high school diploma.  Additionally, in 2000 only 30% of blacks and 28% of Hispanics

were online (Chen and Wellman, 2003).   In her 2002 study, Hargittai (2002) concluded

that younger people, i.e. those in their late teens or early twenties, have an easier time navigating the Internet than do people older than 30. In addition to these factors, many school districts find themselves slowing down on classroom technology spending due to rising federal requirements of the NCLB act of 2000 forcing other spending priorities (Sandham, 2001).

This literature review study (Leedy and Ormrod, 2005) is conducted using material gathered from previous research studies, articles, journals, books and other works published between 1995 and 2005. These sources were chosen based on their relevance in relation to the Digital Divide, K-8 education, classroom technology, academic success and internet usage. A literature review was chosen in order to offer an overview of the numerous and significant literature published on the topic of the Digital Divide (Leedy and Ormrod, 2005).

Selected literature is subjected to conceptual analysis (Palmquist et al., 2005 and Leedy and Ormrod, 2005) because this method was most suitable to organizing and digesting the relevant literature and presenting the findings into a usable report. The conceptual analysis is conducted following a selective reduction process (Palmquist et al., 2005) that is designed to identify reported effects within the K-8 educational context of the factor socio-economic status (Chen and Wellman, 2003) as well as related potential mitigating strategies for this factor for those students who appear to be at risk within the educational system (Goolsbee and Guryan, 2003). In particular, phase one of the conceptual analysis identifies instances of the factor that is the focus of the study, i.e., socio-economic status (Chen and Wellman, 2003) including three sub-factors: (a) age-related factors of the Digital Divide, in relation to academic success in grades K- 8

(Gorski, 2001); (b) race-related factors within this age group (Hargittai, 2002); and (c) income (Barbatsis et al., 2003 and Becker, 2000) as well as two other factors: Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) as related to the academic success of K-8 students (see Appendix A: Factors of the Digital Divide). Phase two identifies related potential mitigating strategies, which are defined as any tool or resource used to connect K-8 students and technology in a way that will increase school performance (Pugmire, 2001).

Results of the study are framed as a table (Appendix A: Factors of the Digital Divide) and a bulleted list (Appendix B: Mitigating Teaching Strategies). Appendix A, Factors of the Digital Divide, focuses on the socio-economic factors of age (Hargittai, 2002), race (Chen and Wellman, 2003), and income (Barbatsis et al, 2003 and Becker, 2000) as well as two other factors: Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) as related to the academic success of K-8 students. These factors are framed in terms of "risk factors" (Booth and Dunn, 1996), meaning those factors that inhibit academic success among youth particularly in literacy skills (Stoicheva, 2004), math skills, and science skills (Anguin and Castaneda, 1998). The bulleted list (Appendix B: Mitigating Teaching Strategies) reports a set of mitigating strategies that have been used to assist students who have been identified as at risk because of one or more of the identified risk factors within the K-8 education system. A preliminary reading of the literature suggests that a mitigating strategy might refer to any number of interventions, including employing technology academic standards, (Pearson and Swain, 2003), equipping teachers with technology skills, (The Journal, 2000),

providing adequate technological access (Pugmire, 2004) and  designing curriculum that applies technological knowledge (Becker, 2000).

The outcome of the study is framed as a table (Table 2: Socio-economic Risk Factors and Mitigating Teaching Strategies) that aligns the risk factors (see Appendix A: Factors of the Digital Divide) with identified mitigating strategies (Foss, 2003) (see Appendix B: Mitigating Teaching Strategies).  The table is framed by the socio-economic factors in order to focus on the mitigating strategies aligned with the risk factors identified in Appendix A: Factors of the Digital Divide.  The narrative discussion that accompanies Table 2: Socio-economic Risk Factors and Mitigating Teaching Strategies, is framed to focus attention on the various mitigating strategies that have been used inside and outside of the classroom in order to lessen the effects of the divide on individual students.  The outcome is designed to assist educators (Price, 2003) who need to (1) identify the risks that can be associated with the factor designated as socio-economic status and two other factors related to technology (Internet access and teacher technological skills), as these are all related to the academic success of K-8 students; and (2) identify strategies that have the potential to mitigate these factors.  The study may also be of interest to parents of 6 to 12 year olds affected by the Digital Divide or those who wish to serve as educational advocates (Booth and Dunn, 1996) for children within this age group.

**Significance**

This study focuses on just one factor often used to define the Digital Divide, i.e., socio-economic status (Chen and Wellman, 2003) – including related sub-factors of age (Hargittai, 2002) and race (Chen and Wellman, 2003), and income (Barbatsis et al., 2003 and Becker, 2000). The literature points to socio-economic status as the overriding factor responsible for the Digital Divide among 6-12 year old children  (Becker, 2000; Chen and Wellman, 2003; Gorski 2001 and Hargittai, 2002).

According to Chen and Wellman, socio-economic status is "the most important factor determining Internet access" (Chen and Wellman, 2003 p.8). In addition, the study conducted by Barbatsis et al., states that "income is a strong predictor of Internet access" (Barbatsis et al, 2003 p.2) and Hargittai (2002) in her study of how people find information online found that younger people were able to find what they were looking for more quickly and easily than those people over the age of thirty primarily because of a  "comfort with the technology they are using and not necessarily based on elaborate techniques they have mastered specifically with respect to the Web" (Hargittai, 2002, p. 15).

The CEO Forum on Education and Technology was founded in 1996 to help ensure that America's schools effectively prepare all students to be contributing citizens and productive workers in the 21st Century. Although the Forum closed in late 2001, it issued an assessment of the nation's progress toward integrating technology into America's classrooms. The Forum's five-year project revealed that educational technology can improve student achievement (Bryant et al., 2001). Furthermore, it is important to not only know who has access to technology but also to know how they are

using the technology (Hargittai, 2002) if teachers are going to make a difference in the educational outcomes of their students. In a preliminary review of selected literature, Becker (2000) reports that, while most schools have access to technology, schools serving lower income areas actually allow their students more time on computers than do the schools serving higher income families. However, while the lower income students received more time on the computers than their upper income counterparts, much of what they did could only be classified as drills, as apposed to meaningful projects that applied higher level thinking skills (Becker, 2000).

This disparity among users makes it more difficult for students who are affected by the divide to achieve success (Barbatsis et al., 2003). It is the hope of this researcher that acknowledging the disparity as well as presenting planning and training strategies that the study will assist teachers, advocates and school administrators in mitigating the effects of the divide (Bryant et al., 2001). Ultimately, the beneficiary of such information will be K-8 students, since becoming more technologically proficient can help their achievement in all areas of study (Becker, 2000).

**Limitations**

*Focus:* This study is limited in focus to the socio-economic factor (Chen and Wellman, 2003) and related sub-factors of age, (Hargittai, 2002) race (Chen and Wellman, 2003), income (under $25,000.00) (Barbatsis et al., 2003 and Becker, 2000) Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) as related to K-8 students (Becker, 2001). The literature points to socio-economic status as the overriding factor responsible for the Digital Divide among six to twelve-year old children (Becker 2001; Chen and Wellman, 2003; Gorski 2001 and Hargittai, 2002). Therefore, this factor is examined in relation to how it affects academic success among K-8 students (Gorski, 2001), as presented in selected literature. Only those factors that appear most frequently in the literature are discussed and are limited to the top three to five factors identified in the literature (Leedy and Ormrod, 2005).

*Method:* This study is conducted as a literature review (Leedy and Ormrod, 2005) and subjected to a conceptual analysis (Palmquist et al., 2005). Literature review is selected as the method in order to offer an overview of the numerous and significant literature published on the topic of the Digital Divide (Leedy and Ormrod, 2005). Content analysis is selected as the data analysis strategy because this method was most suitable to organizing and digesting the relevant literature and presenting the findings into a usable report.

*Time Frame:* Since the Digital Divide was first identified during the dot-com boom in the mid 1990s (Warschauer, 2003), material from research studies, articles, journals, books and other published works are limited to the time frame from 1995 through 2005.

*Literature search:* Literature is selected as it relates to the following search terms: Digital Divide, K-8 education, classroom technology, academic success, Internet usage, and related terms.  These terms were chosen based on preliminary results from Internet and library searches of terms and combinations of terms including; Digital Divide, education, K-12 education, academic success and achievement, digital gap, education, parents, inclusion, classroom, kids, technology, measures and Internet usage.

**Problem Area**

Since the mid 1990s, the Digital Divide has been a widely discussed and redefined topic (Warschauer, 2003; Birdsall, 2000 and Lynch, 2002).  The term has been used to describe technological gaps between nations, states, communities, regions, individuals, and groups of individuals (Chen and Wellman, 2003).  The term Digital Divide has also been used to describe the difference between having access to the Internet and being able to effectively use the technology to further or enhance ones knowledge or participate in a cyber society (Castells, 2002).

The Apple computer company launched the first graphical user interface computer in 1983 and technology has been steadily infiltrating our education system ever since (Wolfe et al., 2004).  Once the first computers were introduced to students in the public school system, the goal has been to better prepare students for their future and to use the machines as yet another tool in the teacher's tool box (Haugland, 2002).  However, since the mid 1990s, disparities in computer access and computer use have been identified among students in public education (Barbatsis et al., 2003).  This Digital Divide has been most notably attributed to socio-economic status of, not only the

individual student, but also of the population an individual school may serve (Becker 2000; Chen and Wellman, 2003; Gorski 2001 and Hargittai, 2002).

Today, educational technology is a multi-billion dollar per year industry (eSchool News, 1998). Companies such as Pearson Publishing, a long time provider of educational materials including text books, have been providing software to schools for a number of years for student records, educational tools geared for students to access directly, and online systems for distance learning (Pearson, 2004). While these numerous educational software titles and systems are valuable tools enabling educators to reach more students and a wider variety of learning styles (Montgomery, 1995), it is difficult for students who are affected by the divide to practice these skills at home because of a lack of access (Castells, 2002).

Studies have shown that technological access, coupled with proper instruction, can have a profound effect on the academic success of students (Bryant et al., 2001 and Haugland, 2000). Schools in higher income neighborhoods give students the chance to practice and become proficient in computer and Internet usage as opposed to their lower income counterparts (Becker, 2000). However, while students in lower income areas may receive as much practice or drill (Becker, 2000) on computers, they are not being challenged to apply this knowledge in higher level, critical thinking tasks (Becker, 2000).

Strategies have already begun to be implemented in an attempt to close or lesson the Digital Divide. In Minnesota, schools have started an aggressive plan to provide more access to technology than ever before (Pugmire, 2004). This strategy has already showed payoff in student success (Pugmire, 2004). Additionally, strategies that focus on educational technology standards have been adopted in an effort to bring in technology in

as a staple of public education (Pearson and Swain, 2003). Studies have also shown that providing students an opportunity to apply technological skills may also have an impact on grades and test scores, (Becker, 2000).

By making teachers and school administrators aware of socio-economic factors that may affect academic success as well as potential mitigating strategies to address these effects, this researcher hopes to better enable teachers, school administrators and educational advocates the ability to recognize the divide within the K-8 environment and utilize identified strategies that can address risks faced by students within the Digital Divide.

**Chapter II**

**Review of References**

The following is a review of the key references used to frame the Purpose, Problem Area, and Method as well as provide data for this study. All of the references are presented alphabetically as an annotated bibliography.

**Barbatsis et al., (2003):** *Internet Use in Low-Income Families: Implications for the*

*Digital Divide*

**Retrieved September 28, 2005 from**

**http://www.stanford.edu/group/siqss/itandsociety/v01i05/v01i05a07.pdf**

This resource is a study conducted by Michigan State University. The study is centered on Internet use in the homes of low income families. The study also examines some aspects of race within the defined income level. The results of the study suggests that the Digital Divide be reclassified as a "use" divide as opposed to an "access" divide since there seems to be a disparity between ethnic groups on use of the Internet despite the fact that they have equal access during the time of the study.

The resource also details how low income families use the Internet as well as explores some of the factors that contributes to or inhibits a successful Internet experience. One of the most significant of those factors is experience and "self-perceived Internet skills". This resource contributes to the data analysis set as well as provides background information that is used in identifying break points for income used in the Problem Area and Limitations portion of the study. This reference is selected based on

the number of qualified researchers who took part in the study. All nine are professors at Michigan State University.

**Becker, Henry J (2000)** *Who is Using technology and Who is Not*

**Retrieved October 6, 2005 from**

**http://www.teacherlib.org/articles/becker.pdf**

Becker provides an abundant amount of information relative to the Digital Divide in classrooms. Topics covered in this reference include: access to the Internet by students; how students use computers in general, broken down by general income terms; and teacher skills as measured by "active user of analytic or product-oriented software". The article also compares student access in the classroom with access at home.

This article supports the Problem Area as well as Significance sections of the study primarily due to the recognition of the important role of teacher skills and the identification of computer usage in the classroom. In addition, information from this source is also used as part of the data set selected for content analysis. This reference was chosen for its highly relevant content to the focus of this study as well as the credibility of the author. Dr. Becker is a Professor of Education at the University of California, Irvine and has had several other articles published as well as many speaking engagements on the subject of technology in education.

**Birdsall, William F. (2000)** *The Digital Divide in the Liberal State: A Canadian*

       *Perspective*

       **Retrieved September 18, 2005 from**

       **http://www.firstmonday.org/issues/issue5_12/birdsall/**

Birdsall defines the Digital Divide and provides a foundational aspect for this

study.  While Birdsall defines the divide, he only goes so far as to examine it in terms of

"access" and does not explore how technology is used.  This reference points out that

technology "haves" and "have-nots" will be in very different circumstances in that the

"have-nots" will rely on public access.  Birdsall argues that those in the "have-not"

category are at a disadvantage to those that are not. He concludes that the problem is a

social one that should be addressed by the government since private industry is not

equipped for the task.

       This reference provides a foundational example of the definition of the Digital

Divide and is used as a starting point for this study.  Birdsall's definition helps to frame

the Purpose of the study.

       Birdsall is Executive Director of Novanet, Inc., a consortium of academic libraries

in Nova Scotia, Canada, and has published several papers on the subject of technology.


**Bryant et al., (2001)** *School Technology and Readiness Report*

       **Retrieved September 6, 2005 from**

       **http://www.ceoforum.org/downloads/report4.pdf**

The CEO Forum on Education and Technology was founded in 1996 to help

ensure that America's schools effectively prepare all students to be contributing citizens

and productive workers in the 21st Century.  This report, issued in 2001 shortly before

the forum closed, concludes that educational technology can improve student

achievement.  Their recommendations include: focusing on education technology

investment with specific educational objectives, making the development of 21$^{st}$ century

skills a key educational goal, aligning student assessment with educational objectives and

include 21st century skills, adopting continuous improvement strategies to measure

progress and ensuring equitable access to technology for all students.

Information from this resource is used to not only frame the Problem Area but

also contribute to the data set that is analyzed.  Specifically, the findings of technology

can, if properly utilized, have a positive impact on overall student academic achievement.

This source is selected based on the nature of its comprehensive study the numerous

contributors to the forum.  All of the forum members are technology industry or

educational leaders including; John Wilson, Executive Director National Education

Association, William Rodrigues, Vice President and General Manager, Education and

Healthcare, Dell Computer Corporation and Anne L. Bryant, Executive Director National

School Boards Association, to name just a few.


**Chen, Wenhong and Wellman, Barry (2003)** *Charting and Bridging Digital Divides:*

       *Comparing Socio-economic, Gender, Life Stage, and Rural-Urban Internet*

       *Access and Use in Eight Countries*

       **Retrieved September 10, 2005 from**

       **http://www.chass.utoronto.ca/~wellman/publications/index.html**

This article focuses on the Digital Divide in relation to a number of different aspects including, socio-economic, gender, life stage and race. As part of their findings, Chen and Wellman conclude that there is not just one divide but many Digital Divides that affect people. This effect, they conclude, is essentially the same for all: exclusion from the knowledge economy. The authors further conclude that disparities exist along racial lines, which may also be attributed to global location, i.e. country as well as socio-economic condition.

This source is used extensively in supporting the Problem Area as well as providing a definition of race related factors of the Digital Divide. The reference is chosen based on its comprehensive study of the Digital Divide and the fact that the authors have several other studies published related to the same subject matter. In addition, other authors cite their work in relation to the Digital Divide.

**Foss, Jessine (2003) *The Schoolhouse "Digital Divide"***

       **Retrieved October 6, 2005 from**

       **http://www.connectforkids.org/node/433?tn=lc/ra**

This article focuses on technology use in the classroom. The article looked at various factors including income level of the area the school served and the use of computers to aide in student achievement in other subjects such as math and science. Foss reports that students in lower income areas used computers more for drill and that such use actually contributed to lower test scores over time. The author's conclusion was that teachers needed to be better trained in the use of technology and that computers needed to be integrated into core curriculum.

The reference is used primarily as data, specifically as a source of mitigating strategies used to lesson the effect of the Digital Divide among K-8 students. The source is also used to add support to the Problem Area with regard to teacher training in the proper use of technology. This resource was chosen because of its method of study as well as the fact that the article came to the same conclusion as another key article by Becker listed above.

**Gorski, Paul (2001)** *Understanding the Digital Divide from a Multicultural Education*
    *Framework*
    **Retrieved September 12, 2005 from**
    **http://www.edchange.org/multicultural/net/digdiv.html**

Gorski examines the Digital Divide from a large socio-economic picture. The reference looks at race, gender, and economic status as well as how technology is being used in schools to determine where the Digital Divide exists and how to close it. Gorski claims that to eliminate the Digital Divide, it must be addressed at every level and that a full understanding of all of the causes of the divide is a crucial first step toward that end.

The article is used as a data source providing data relating to race, gender and income as well as technology usage in schools and mitigating strategies. The resource was chosen because of its comprehensive look at the divide in schools as well as Gorski's credentials. Dr. Gorski has authored several books on the Digital Divide and related subjects and is an assistant professor at the Graduate School of Education at Hamline University.

**Goolsbee, Austan D. and Guryan, Jonathan (2003)** *Closing the Digital Divide:*

*Internet Subsidies in Public Schools*

**Retrieved September 8, 2005 from**

**http://ideas.repec.org/p/nbr/nberwo/9090.html**

This article focuses on the results of a mitigating strategy for addressing the Digital Divide. Specifically, Goolsbee and Guryan focus on the use of E-Rate funds to purchase computers to provide access to California students and the impact of that access on student academic achievement. The article acknowledges that access to technology is critical but even more important is how that technology is used in the classroom. Additionally, teacher technology skills are identified as a factor for student academic success.

The article is used as data to support mitigating strategies of the Digital Divide. Since the resource points out that access is only the first step and that how that technology is utilized is what effects academic achievement, the data suggests that teacher training and curriculum integration is a comprehensive mitigating strategy. The article is chosen based on its relevance to the Digital Divide in the K-8 educational context. Additionally, the authors are both professors at the University of Chicago and have been cited by numerous other researchers on this and other subjects.

**Hargittai, Eszter (2002)** *Second-Level Digital Divide: Differences in People's Online*

*Skills* **First Monday, volume 7, number 4**

**Retrieved September 8, 2005 from**

**http://firstmonday.org/issues/issue7_4/hargittai/index.html**

This is a comprehensive study of the Digital Divide that focuses on the inequalities in Internet usage among varying groups.  Most importantly, Hargittai identifies the differences in Internet usage among various age groups and concludes that younger people have a far better chance of having a successful online experience than older people and therefore may choose to get access more frequently.  The study notes that age plays a factor in finding content online as well as the time spent online.

This study is used extensively to frame age related factors of the Digital Divide in the Problem Area as well as to provide a definition of age related factors of the Digital Divide.   The source is chosen for the comprehensive nature of the study as well as the fact that the author as had numerous other studies published that is closely related to the Digital Divide.

**Morgan, James N. and VanLengen, Craig A. (2005)** *The Digital Divide and*

   *K-12 Student Computer Use*

   **Retrieved October 8, 2005 from**

   **http://proceedings.informingscience.org/InSITE2005/I56f86Morg.pdf**

This study looks at the various ways computers are being used within the educational context.  School computer use is examined, as well as how school age children use computers outside of school.  The authors make several links between computer use at school and at home.  They also examine home computer use where an adult in the household used computers extensively at home and/or for work.  Consequently, several factors are also examined including; gender, race and income, that played a part in non-school computer access.

The study is chosen because the subject matter was closely aligned with the goals of this study.  Determining computer access has been identified as a first step in mitigating the Digital Divide (Goolsbee & Guryan, 2003).  Because of this, this resource is used as data to support the need for access and the impact of that access on academic success among students in the K-8 educational environment.  Both authors are professors at Northern Arizona University College of Business Administration and have published studies related to business management.

**Palmquist et al. (2005)** *Conducting Content Analysis: Writing Guides*

> **Retrieved September 28, 2005 from**
>
> **http://writing.colostate.edu/guides/research/content/index.cfm**

This website provides a comprehensive guideline for researchers to conduct a properly structured content analysis.  The site details the 8 step coding processes used to code and analyze the selected material for this paper.  These processes are employed in Chapter 3 - Method. The source is a recommended resource for the AIM Capstone project.  The site was selected on the basis of the useful nature of the 8 step coding process.

**Pugmire, Tim (2004)** *Closing the Digital Divide in Schools*

> **Retrieved September 8, 2005 from**
>
> **http://news.minnesota.publicradio.org/features/200106/04_pugmiret_computers/**

This very informative newspaper article describes how technology is being integrated into Minneapolis classrooms in an effort to close the Digital Divide. While the article skims over racial and economical factors that affect the Digital Divide, it did report that technology in schools is having a positive impact on student performance. It goes on to say that, while technology access is important, having newer, more capable computers is equally important. The article concludes by noting that keeping schools up to date with technology is a continuing challenge.

This article is chosen because of the correlation it makes between technology access and student academic achievement. The reference is used to support the Purpose as well as the definition for student academic success. The source also provides a limited amount data for the study. The author is an NPR reporter and has published numerous articles related to education and divides of many types, including digital and racial.

**Chapter III**

**Method of Study**

A literature review method of inquiry is chosen for this study (Leedy & Ormrod, 2005) in order to critically analyze a segment of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles (University of Wisconsin Madison, 2004). Specifically, this study utilizes content analysis to analyze selected literature on the Digital Divide as related to the students within the K-8 educational system and socio-economic status (Cooper et al., 2004 and Irving et al., 1999). This method of analysis is used in order to perform a systematic measure of the data collected in order to assure that the process is as objective as possible (Leedy and Ormrod, 2005). During this process, the selected literature is scrutinized for the characteristics of the study (Leedy and Ormrod, 2005), i.e., factors of the Digital Divide as they relate to socio-economic status (Chen and Wellman, 2003) including related sub-factors of age, (Hargittai, 2002), race (Chen and Wellman, 2003) and income (Barbatsis et al., 2003 and Becker, 2000) as well as academic success among K-8 students (Gorski, 2001) and teacher technological skills (Castells, 2002). Once the material is obtained, it is then subjected to an eight step coding and analysis process (Palmquist et al., 2005). Each step of the research process is presented as follows:

**Data Collection**

Literature for this study is collected from previous research studies, articles, journals, books and other published works from 1995 through 2005 related to the Digital Divide as it relates to K-8 education, through searches of the Internet, including Google.com, Google Scholar, Webcrawler.com, Dogpile.com and Metacrawler.com. Additionally searches of the online libraries of the Universities of Nevada Reno and Oregon are conducted to identify all potentially admissible data (Leedy and Ormrod, 2005). Criteria for the admissibility of data are established (Leedy and Ormrod, 2005) based on relevance of search terms related to the Digital Divide. Criteria includes date of publication (must fall within the established date range of 1995 through 2005) and contextual relevance. For example, within the Digital Divide context, data must also be related to K-8 education, technology, Internet, computers, accessibility, or measures for academic success.

In general these searches produced results in a wide range articles related to subjects regarding the Digital Divide. Further searching narrowed the focus to expanded definitions of the divide to include emphasis of socio-economic factors and sources related to schools and teachers that address academic success and risk.

Literature was obtained from the University of Nevada Reno Library, University of Oregon Library and Washoe County Library System, as well as from the following online sources:

- Books 24\7.com
- Masterfile Premier
- Academic Search Premier

These searches generally produced results in a wide range books and articles related to subjects regarding the Digital Divide.  These searches were narrowed to focus on the Digital Divide in education and technology to support academic success.

Keywords phrases and sub-phrases for the search include:

- Technology
    - Computers
    - K-12
    - Classroom
    - Internet
    - Education
    - Kids
- Digital Divide
    - Accessibility
    - Education
    - K-12
    - Higher Education
    - Parents
- Digital Gap
    - Education
    - K-12
    - Higher Education
- Inclusion
- Measures

These search terms produced results on a variety of subjects related to the Digital Divide and over fifty sources were collected. Articles most useful for the study include, Internet Use in Low-Income Families: Implications for the Digital Divide (Barbatsis et al., 2003), Who is Using technology and Who is Not (Becker, 2000), School technology and Readiness Report (Bryant et al., 2001), Charting and Bridging Digital Divides: Comparing Socio-economic, Gender, Life Stage, and Rural-Urban Internet Access and Use in Eight Countries (Chen and Wellman, 2003), Second-Level Digital Divide: Differences in People's Online Skills (Hargittai, 2003) and Social Exclusion: Rethinking the Digital Divide (Warschauer, 2003).

**Data Analysis**

Once the literature is collected, it is reviewed in two phases through a form of content analysis.  Analysis is performed in two phases and in accordance with a conceptual analysis methodology, as per Colorado State University (Palmquist et al., 2005).  The following plan outlines the conceptual analysis process used in this study according to the eight steps provide by Palmquist et al. (2005).

**Coding Guidelines for Phase One Content Analysis**

Phase one of the conceptual analysis process is designed to identify socio-economic factors (Chen and Wellman, 2003) and related sub-factors of age, (Hargittai, 2002) race (Chen and Wellman, 2003) and income (under $25,000.00 per year) (Barbatsis et al., 2003 and Becker, 2000) as well as two other factors: Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) as related to the academic success of K-8 students.

Step one in this phase of the conceptual analysis process is to decide on the level of analysis by determining the set of words and phrases that will comprise a concept. Phrases and sets of key words are selected and are coded into a predefined set of categories based upon the research context of the Digital Divide as related to K-8 students (Palmquist et al., 2005).

Step two determines the relevant concepts to be coded (Palmquist et al., 2005). The following set of terms and phrases are used as a predefined set of categories:

- Income level – over or under $25,000.00 (Barbatsis et al., 2003 and Becker, 2000)

- Age – K-6 and 7 & 8 (Hargittai, 2002)

- Race – White, Asian, Hispanic, Black (Chen and Wellman, 2003)

- Internet Access (Castells, 2002)

- Teacher Skills (Castells, 2002)

- Grades (Gorski, 2001)

In step three, terms and phrases are coded based on occurrence (Palmquist et al., 2005) so long as the terms or phrases appear within the context of the Digital Divide as related to the factors that are the focus of the study, i.e., socio-economic status (Chen and Wellman, 2003) and the three sub-factors:  (a) age-related factors of the Digital Divide, in relation to academic success in grades K- 8 (Gorski, 2001); (b) race-related factors within this age group (Hargittai, 2002); and (c) income (Barbatsis et al., 2003 and Becker, 2000), as well as, the two other factors; Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002).

Step four determines the level of generalization used for each term (Palmquist et al. 2005).  In this study a high level of generalization is allowed so long as the context in which the term or phrase is relevant to the guidelines set forth in step three.

In step five a set of translation rules is created (Palmquist et al., 2005).  For the purpose of this study, each term or phrase must stand on its own within the context in which it was found.  Pulling data out of context for the purpose of making the data fit a particular argument or conclusion is not permitted.

Step six determines how to handle irrelevant data (Palmquist et al., 2005). Irrelevant data, i.e. data that does not meet the criteria is ignored.  Terms and phrases are

sorted into single categories based upon the context in which they appear (Palmquist et al., 2005).

Step seven involves coding the data (Palmquist et al., 2005). Data is coded by hand into an Excel spreadsheet and stored for later retrieval for step eight. In step eight, the data is analyzed for trends and relationships between data sets. Furthermore, thought is given to the process and coding scheme and adjustments to the coding are done if necessary (Palmquist et al., 2005). If recoding is determined to be necessary, steps six through eight are repeated.

**Coding Guidelines for Phase Two Content Analysis**

Phase two of the conceptual analysis process identifies data which are relevant to the potential mitigating strategies of the Digital Divide. A mitigating strategy is defined as any tool or resource used to connect K-8 students and technology in a way that will increase school performance (Pearson and Swain, 2003).

Step one in this phase is to decide on the level of analysis by determining the set of words and phrases that will comprise a concept. As in phase one, phrases and sets of key words are selected and are coded into a predefined set of categories based upon the research context of the mitigating strategies as related to K-8 students and the Digital Divide (Palmquist et al., 2005).

Step two determines the relevant concepts to be coded as related to mitigating strategies of the Digital Divide, (Palmquist et al., 2005). The following set of terms and phrases are used as a predefined set of categories:

- Risk Factors (Gorski, 2001)

- Mitigating Strategies (Goolsbee and Guryan, 2003)

In step three, terms and phrases are coded based on occurrence (Palmquist et al., 2005) so long as the terms or phrases appear within the context of the Digital Divide as related to the potential mitigating strategies, used to connect K-8 students and technology in a way that will increase school performance (Pugmire, 2001).

Step four determines the level of generalization used for each term (Palmquist et al., 2005). In this study a high level of generalization is allowed so long as the context in which the term or phrase is relevant to the guidelines set forth in step three.

In step five a set of translation rules is created (Palmquist et al., 2005). For the purpose of this study, each term or phrase must stand on its own within the context in which it was found. Pulling data out of context for the purpose of making the data fit a particular argument or conclusion is not permitted.

Step six determines how to handle irrelevant data (Palmquist et al., 2005). Irrelevant data, i.e. data that does not meet the criteria is ignored. Terms and phrases are sorted into single categories based upon the context in which they appear (Palmquist et al., 2005).

Step seven involves coding the data (Palmquist et al., 2005). Mitigation strategy data are coded by hand into an Excel spreadsheet and stored for later retrieval for the final steps in the analysis. In step eight, the data is analyzed for trends of successful implementations of strategies. As in phase one, thought is given to the process and coding scheme and adjustments to the coding are done if necessary (Palmquist et al., 2005). If recoding is determined to be necessary, steps six through eight are repeated.

**Data Presentation**

   Once the data are coded, the results of the conceptual analysis are presented in the

form of a table and a bulleted list.  Below, Figure 1 shows a template table for the

reporting of the first phase of the content analysis:

**Figure 1: Template: Appendix A - Factors of the Digital Divide**

| Digital Divide Key Concepts | Digital Divide Key Factors |
|---|---|
| Race – White |  |
| Income Level $0-$25000 |  |
| Grades | Average grades |
| Internet Access | Access % |
| Teacher Skills | Teacher skills (subjective) |
|  |  |
| Race – Asian |  |
| Income Level $0-$25000 |  |
| Grades |  |
| Internet Access |  |
| Teacher Skills |  |
|  |  |
| Race – Hispanic |  |
| Income Level $0-$25000 |  |
| Grades |  |
| Internet Access |  |
| Teacher Skills |  |
|  |  |
| Race – Black |  |
| Income Level $0-$25000 |  |
| Grades |  |
| Internet Access |  |
| Teacher Skills |  |

This researcher intends that teachers will be able to use this table in support of their efforts to understand the impact of the Digital Divide.  Teachers can use Appendix A: Factors of the Digital Divide, to assist in identifying students who are potentially at risk due to factors related to the Digital Divide.  First educators should review each factor listed in the left-hand column as a way to identify students who fall into one or more of those categories.  Once students are identified, information related to the factor presented in the right hand column can be used to further refine and assess a particular student's risk potential and be able to come to a conclusion as to weather or not the student is truly at risk due to factors related to the Digital Divide.

Figure 2 below shows a template for presentation of identified Mitigating Teaching Strategies.  Educators and school administrators may use the information presented in Appendix B, Mitigating Teaching Strategies, to plan, design or modify their own teaching strategies or course curricula in order to lessen the factors identified in Appendix A: Factors of the Digital Divide.  Parents or advocates may also use the information presented in order to assist educators in mitigating the identified factors of the Digital Divide.

**Figure 2: Template: Appendix B - Mitigating Teaching Strategies**

| |
|---|
| • **Teaching Strategies:**<br><br>    List of examples<br><br>• **Tools:**<br><br>    List of examples<br><br>• **Resources:**<br><br>    List of examples |

Data presented in the results of the conceptual analysis are further analyzed in order to develop the final outcome of the study:  The final outcome is presented in Table 2: Socio-economic Risk Factors and Mitigating Teaching Strategies.  Table 2 aligns the identified factors, (socio-economic risks and teaching skills), in relation to academic success (see Appendix A: Factors of the Digital Divide), with identified mitigating strategies (Foss, 2003) (see Appendix B: Mitigating Teaching Strategies).  A narrative discussion accompanies this table.  The final table relates identified risks with potential strategies that may be used to narrow the Digital Divide as it relates to that particular risk factor(s).   The narrative expands on each strategy and discusses how it might be implemented either in or outside of the classroom or how it has already succeeded in narrowing the divide for K-8 students.  However, in order to provide a concise and useful report, only those factors that appear most frequently in the literature are discussed, not to exceed the top five factors identified in the literature (Leedy and Ormrod, 2005).

**Figure 3: Template: Table 2 - Socio-economic Risk Factors and Mitigating Teaching Strategies**

| Risk Factors | Mitigating Teaching Strategies |
|---|---|
| Socio-economic Risk Factor | |
| Internet Access Risk Factor | |
| Grades Risk Factor | |
| Teaching Skill Risk  Factor | |

**Chapter IV**

**Analysis of Data**

**Content Analysis**

As outlined in Chapter III – Method of Study, conceptual analysis is the chosen method of data analysis for this study.  Two phases of content analysis are used to reach the results and thus the outcomes of this study. The following two sections describe in detail the process of each phase of the conceptual analysis.  Thirteen references are used to comprise the dataset for the coding process, located on the following page in Table 1: Content Analysis Data Set.  The data set selected for coding is divided into two sections in order to distinguish between literature most relevant to (1) factors of the Digital Divide, examined during phase one of the coding process (containing twelve of the thirteen references) and (2) mitigating teaching strategies as related to K-8 Education, examined during phase two of the coding process (containing five of the initial thirteen references).

**Table 1: Content Analysis Data Set**

| | |
|---|---|
| References used for Phase One – Factors of the Digital Divide | Barbatsis et al., 2003 |
| | Becker, 2000 |
| | Bryant et al., 2001 |
| | Chen and Wellman, 2003 |
| | Foss, 2003 |
| | Gorski, 2001 |
| | Hargittai, 2002 |
| | Hoffman & Novak, 1998 |
| | Morgan and VanLengen, 2005 |
| | Pearson & Swain, 2003 |
| | Pugmire, 2004 |
| | Stoicheva, 2004 |
| References used for Phase Two - Mitigating Teaching Strategies | Becker, 2000 |
| | Bryant et al., 2001 |
| | Foss, 2003 |
| | Goolsbee and Guryan, 2003 |
| | Morgan and VanLengen, 2005 |

**Report of Phase One Content Analysis**

Phase one of the conceptual analysis process is designed to identify socio-economic factors (Chen and Wellman, 2003) and related sub-factors of age, (Hargittai, 2002) race (Chen and Wellman, 2003) and income (under $25,000.00 per year) (Barbatsis et al., 2003 and Becker, 2000) as well as two other factors: Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) as related to the academic success of K-8 students.

Section one of the data set conceptual analysis is read and relevant factors are hand copied into individual Microsoft Excel spreadsheets, one sheet each for every primary concept based upon the criteria set forth in Chapter III – Method of Study. Steps

one and two of the coding process consist of determining the words or phrases in that

frame the key concepts of the Digital Divide as defined in Chapter III, Method of Study

and determining which relevant concepts are coded (Palmquist et al., 2005).  The

following set of terms and phrases are used as a predefined set of categories that are

determined from the literature as the primary concepts relevant to the Digital Divide and

K-8 education:

- Income level – over or under $25,000.00 (Barbatsis et al., 2003 and

    Becker, 2000)

- Age – K-6 and 7 & 8 (Hargittai, 2002)

- Internet Access (Castells, 2002)

- Teacher Skills (Castells, 2002)

- Grades (Gorski, 2001)

This set of terms/phrases is used as both the initial coding set and as the initial

organizing set for recording of coding results.  Each spreadsheet details identified factors

broken out by Race – White, Asian, Hispanic, Black (Chen and Wellman, 2003) or non-

racial as determined by the literature.  While reading the literature, those factors that are

identified as applying to more than one category are entered into the spreadsheet under all

applicable categories.  Furthermore, a high level of generalization is allowed provided

that the identified factors fall within the context of the Digital Divide as related to K-8

education.  Therefore, pulling data out of context for the purpose of making the data fit a

particular argument or conclusion is not allowed and great care is taken by the researcher

to make sure that all data fits within the context as well as the predefined categories.

After data is entered into the spreadsheet, the data sets are manipulated to look for trends and or relationships within data sets. Once the first phase of coding is completed, thought is given to the process and coding scheme and adjustments are made to the coding scheme. These adjustments include repeating steps six through eight in order to further refine the data to a usable format. Specifically, data is moved from individual spreadsheets that are bases upon the predefined categories of age, (Hargittai, 2002) race (Chen and Wellman, 2003), income (under $25,000.00 per year) (Barbatsis et al., 2003 and Becker, 2000), Internet access (Birdsall, 2000) and teacher technological skills (Castells, 2002) and combined to another spreadsheet that is used to look for patterns and relationships between the data. The results of the analysis can be seen in Appendix A: Factors of the Digital Divide which details the occurrence of factors related to the initial set of concepts.

**Report of Phase Two Content Analysis**

The purpose of phase two, as outlined in Chapter III- Method of Study, is to identify potential mitigating teaching strategies of the Digital Divide. The same eight step process is employed in phase two as is done in phase one of the study. Section two of the data set for conceptual analysis is thoroughly read and key concepts are hand copied into a Microsoft Excel spreadsheet based upon the criteria set forth in Chapter III – Method of Study.

Steps one and two of the coding process consists of determining the words or phrases in that frame the key concepts of the Digital Divide as defined in Chapter III, Method of Study and determining which relevant concepts are coded (Palmquist et al.,

2005).  The following set of terms and phrases are used as a predefined set of categories that are determined from the literature as the primary concepts relevant to the Digital Divide and K-8 education:

- Risk Factors (Gorski, 2001)

- Mitigating Strategies (Goolsbee and Guryan, 2003)

Selected literature is read thoroughly and key factors from the literature are pulled and entered into a Microsoft Excel spreadsheet under the corresponding predefined category.  Some factors apply to more than one category and are entered into the spreadsheet under all applicable categories.  As in phase one, a high level of generalization is allowed provided the identified factors fall within the context of the Digital Divide as related to K-8 education.  Therefore, pulling data out of context for the purpose of making the data fit a particular argument or conclusion is not allowed and great care is taken by the researcher to make sure that all data fits within the context and predefined categories.

After data is entered into the spreadsheet, the data sets are manipulated to look for trends and or relationships within data sets.  Once the second phase of coding is completed, thought is given to the process and coding scheme and adjustments are made to the coding scheme.  Specifically, an additional coding step to separate the initial data set into further categories of  Teaching Strategies, Tools, and Resources that are used to mitigate the factors of the Digital Divide.  The result of the analysis can be seen in Appendix B: Mitigating Teaching Strategies, which details the occurrence of the data related to the key concepts.

**Chapter V**

**Conclusion**

Lynch defines the Digital Divide as "The gap between those who have access to and can effectively use information technologies and those who cannot" (Lynch, 2002 p.2). This definition provides the foundation of this study since it includes focus on technology skills as well as simply access to technology. As revealed in this study, while many children have access to the Internet, many also lack the skills necessary to apply the technology they have at hand (Foss, 2003). Compounding the problem, many teachers lack the proper ongoing training in technology necessary in order to provide adequate instruction (Bryant et al., 2001).

As few as 25% of households with incomes of $25,000 or less have access to the internet while 80% of households with incomes of $75,000 or more are connected (Barbatsis et al., 2003). Additionally, in 2000 only 30% of blacks and 28% of Hispanics were online (Chen and Wellman, 2003). The CEO Forum on Education and Technology issued an assessment in late 2001 of the nation's progress toward integrating technology into America's classrooms. The Forum's five-year project revealed that only properly utilized educational technology can improve student achievement (Bryant et al., 2001).

The literature reviewed in this study suggests that educators need to (1) identify the risks that can be associated with the factor designated as socio-economic status and two other factors related to technology (Internet access and teacher technological skills), as these are all related to the academic success of K-8 students (Price, 2003); and (2) identify strategies that have the potential to mitigate these factors. Furthermore, parents of 6 to 12 year olds affected by the Digital Divide or those who wish to serve as

educational advocates (Booth and Dunn, 1996) for children within this age group also need to be aware of these factors and strategies used to mitigate these factors.

Appendix A: Factors of the Digital Divide, demonstrates several key concepts of the Digital Divide as related to K-8 education. The conceptual analysis reveals that, in several key concepts, there are no race related data to report. However, there are several instances that tied race to socio-economic status (Becker, 2000). For example, Chen and Wellman (2003) assert that younger, well-to-do, white, well-educated, urban and suburban Americans are still more likely to be on the Internet than older, less well-off, black and Hispanic, less educated, and rural Americans (Chen and Wellman, 2003). While it appears that race plays a significant role in the quantity and quality of educational technology access a student may receive, a closer look suggests that socio-economic status is really the determining factor (Becker, 2000).

Appendix A: Factors of the Digital Divide also shows that grades can be impacted with the proper use of technology in the classroom. Studies indicate that teachers in high achieving classes are more likely to use the Internet and to find it essential in their teaching than teachers with "average" classes. Additionally, teachers of average classes were more likely than were teachers with "low" classes to use technology as part of their overall teaching strategy (Stoicheva, 2004). The CEO Forum on Education and Technology study showed that West Virginia experienced increases in statewide assessment scores in basic skills areas (Bryant et al., 2001) when computers were used to compliment math and spelling curriculum.

However, teacher training and providing access to reasonably up-to-date computers are not enough to close the divide (Morgan and VanLengen, 2005). Appendix

A: Factors of the Digital Divide, reveals that socio-economic status plays an important role on how students use educational technology in the classroom. Students in lower socio-economic schools spend more time on computers than those students in higher socio-economic areas yet much of that time is spent performing drills whereas the students in higher socio-economic schools spend less time but use the technology in more challenging, higher thinking exercises (Becker, 2000).

In summary, the literature presented in Appendix A suggests that providing computer access alone will not close the divide or have an impact on student grades (Bryant et al., 2001). Instead, data suggest that teacher technology skills and the manner in which students use technology have a great impact on all aspects of student academic success (Becker, 2000). Teacher's technology skills are perhaps the most important factor in determining student success as related to educational technology. Studies suggest that children in schools of higher socio-economic status are advantaged by access to a teaching approach that emphasizes use of technology for developing higher-order skills and not by greater access to computers (Becker, 2000).

Teachers can use two primary strategies to mitigate this factor of the Digital Divide (see Appendix B: Mitigating Teaching Strategies). First, teachers need to integrate technology use into their core curriculum in ways that supports education standards (Foss, 2003). Second, teachers need to apply the use of technology in ways that develop higher order thinking skills (Bryant et al., 2001). Research shows that students who use computers to apply knowledge, in addition to repetitive drill, can have as much as a one third grade level increase (Bryant et al., 2001). These strategies must be employed regardless of the socio-economic status of the students the teacher serves.

In summary, the literature presented in Appendix B suggests that it is vital to ensure that all teachers are adequately trained in the use of computers so that they are comfortable with a wide range of computer oriented tasks (Morgan and VanLengen, 2005). As shown in Appendix B: Mitigating Teaching Strategies, integrating technology into core curriculum (Bryant et al., 2001) and utilizing technology to enhance critical thinking skills (Foss, 2003) is essential to improving student grades. Additionally, it is important to provide adequate resources in the form of non-obsolete computers and Internet access (Morgan and VanLengen, 2005) to teachers and students.

Below, Table 2: Socio-Economic Risk Factors and Mitigating Teaching Strategies, summarizes the final outcome of the study. Table 2 is developed by combining the results of the analysis gained in phases one and two of the content analysis. The key factors found in the literature to be the primary factors inhibiting education in K-8 students are placed under the concept Socio-Economic Risk Factor and key strategies identified as the best strategies in overcoming the Digital Divide among K-8 students are placed under the concept of mitigating teaching strategies.

The column on the left of Table 2, Socio-economic Risk Factors and Mitigating Teaching Strategies, represents the key factors as suggested by the literature. Selection of these factors is based upon their relevance and the fact that multiple sources within the literature support these factors. The right column, Mitigating Teaching Strategies, shows those key strategies as identified by the literature that are relevant to the identified risk factor listed under Socio-economic Risk Factor. The phrases within Mitigating Teaching Strategies that are highlighted in bold, point out the key areas within the strategies that the literature suggests are most relevant to overcoming the Digital Divide within K-8

education.  A discussion of each risk factor is presented below in terms of ways that

teachers can mitigate these risks in the classroom.

**Table 2: Socio-economic Risk Factors and Mitigating Teaching Strategies**

| Socio-Economic Risk Factor | Mitigating Teaching Strategies |
|---|---|
| **Income Level** | |
| Affluent students dominate classroom computer use and predominately use software that requires the use of critical thinking skills (Becker, 2000 and Chen and Wellman, 2003) | Use technology to **apply higher-order thinking concepts** in all income levels in order to gained a one-third grade level increase in eighth graders (Bryant et al., 2001) |
| | Integrate computer use with the curriculum. **Design curriculum [based on] the standards** and make sure [computer use] is supporting the same goals. Provide computers (Foss, 2003) |
| **Access** | |
| White [and Asian] students are almost twice as likely to use a home computer for school assignments as compared to black and Hispanic students (Chen and Wellman, 2003) | **Have technology available in the classroom** because it directly contributes to student achievement, both by making students more effective in their learning and teachers more efficient in their teaching (Morgan and VanLengen, 2005) |
| | Give all students must have **"opportunities for knowledge construction** in authentic learning activities and situations (Morgan and VanLengen, 2005) where does this quote close? |
| | Have an **adequate number of computers and Internet access** in the classroom in order to accomplish efficient and effective use of computers it is necessary (Morgan and VanLengen, 2005) |
| **Grades** | |
| Studies have demonstrate that not only does education technology improve student achievement but it also improves student's self-concept and motivation (Bryant et al., 2001) | Schools should undertake **program evaluation on the impact of education technology** itself as part of an overall accountability and continuous improvement (Bryant et al., 2001) |
| | Use computers for **problem-solving and critical thinking** in order for computers to be most effective (Bryant et al., 2001) |
| | Students in the primary grades should **use software to reinforce math and spelling skills** (Foss, 2003) |
| | 62 percent of teachers surveyed indicated **computer use increased standardized test performance** (Morgan and VanLengen, 2005) |
| **Teacher Skills** | |
| Teachers' expertise with computers ranged from 75% who said they could display a disk's directory to only 18% who said they could develop a multimedia document (Becker, 2000) | **Teachers must direct and encourage students** to take advantage of the editing and reformulating capabilities that word processing provides (Becker, 2000) |
| | Education technology experts agree that **training teachers is the most important factor** in increasing student performance (Foss, 2003) |
| | Teacher education should not focus on technology alone, but also on its **alignment with curriculum** (Morgan and VanLengen, 2005) |

*Income Level:*  The selected literature indicates that teachers in schools with a high percentage of students on free or reduced lunch tend to use computers and the Internet for a skills and drills approach to learning and teachers in schools with a low percentage of students on free or reduced lunch programs are more likely to use these technologies to engage students in creative and critical thinking activities (Becker, 2000; Chen and Wellman, 2003 and Gorski, 2001).  Mitigating this risk is dependant upon teacher skill (Becker, 2000) and integrating technology into core curriculum standards (Foss, 2003).  Ultimately, mitigating this risk falls to the individual teacher to assign tasks that involve higher level critical thinking skills for students from all socio-economic circumstances (Bryant et al., 2001).

*Access:*  Research on the racial digital divide in the U.S. supports the view that providing access to IT will not be enough to eliminate the digital divide (Barbatsis et al., 2003).  As shown in Table 2: Socio-economic Risk Factors and Mitigating Teaching Strategies, all students must have an adequate number of computers with Internet access as well as opportunities for knowledge construction in authentic learning activities (Morgan and VanLengen, 2005).  This mitigating strategy is dependant, not so much on the teacher but the district and community in which he or she serves (Gorski, 2001).

*Grades:*  According to Bryant et al. (2001), studies have demonstrated that, not only does education technology improve student achievement, but it also improves student's self-concept and motivation.  Furthermore, teachers assigned to high-achieving classes are more likely to use the Internet and to find it essential in their teaching than teachers with average classes. Teachers of average classes are more likely than were teachers with low classes to use it (Stoicheva, 2004).  This correlation between

educational technology and student achievement demonstrates the need for computer technology in the classroom. However, the previously mentioned mitigating strategies i.e. (1) provide up-to-date computers (Morgan and VanLengen, 2005) and (2) apply those computers in higher order thinking skills, are a perquisite in order for student achievement to be impacted by educational technology (Bryant et al., 2001). Furthermore, in order to make the most of technology to have an impact on student grades, schools should undertake program evaluation on the impact of education technology itself (Bryant et al., 2001). This is a process that must be continually updated in order to be effective.

*Teacher Skills:* As Table 2, Socio-economic Risk Factors and Mitigating Teaching Strategies shows, one of the most critical strategies in mitigating the Digital Divide in K-8 education is teacher training in technology. Education technology experts agree that training teachers is the most important factor in increasing student performance (Foss, 2003). Yet, as of 2000, as few as 18% of teachers reported that they could develop a multimedia document (Becker, 2000). Studies have shown that computers have the most impact on children "when the computer provides concrete experiences, children have free access and control the learning experience, children and teachers learn together, teachers encourage peer tutoring, and teachers use computers to teach powerful ideas" (Haugland, 2000 p.1).

In summary, the literature suggests that the Digital Divide still exists and that several concepts of the divide have an impact on student achievement (Bryant et al., 2001). Although factors associated with the socio-economic status of students is outside the control of teachers and school administrators, the other factors associated with the

concepts of access, student grades and teacher skills can be controlled by school administrators and teachers. Additionally, all of the primary risk factors are more likely be mitigated by employing the strategies outlined in Table 2: Socio-economic Risk Factors and Mitigating Teaching Strategies, if a few basic guidelines are followed:

- Students must have access to an adequate number of up-to date computers regardless of the socio-economic status of the students (Morgan and VanLengen, 2005);
- Students must use computers for problem-solving and critical thinking skills (Bryant et al., 2001);
- Educational technology use must be aligned with core curriculum standards (Morgan and VanLengen, 2005); and
- Teachers and administrators must be trained in the proper educational use of technology (Foss, 2003).

## Appendix A

## Factors of the Digital Divide

| Digital Divide Key Concepts | Digital Divide Key Factors |
|---|---|
| **Race – White** | |
| Income Level $0-$25000 | Affluent mostly white students dominate classroom computer use and predominately use software that requires the use of critical thinking skills (Becker, 2000) |
| Grades | No Race Specific Data |
| Internet Access | Whites spend significant more time online (Barbatsis et al., 2003) |
| | White students are almost twice as likely to use a home computer for school assignments as compared to black and Hispanic students (Morgan and VanLengen, 2005) |
| | 1997 – Almost 40 percent of white students used a computer in school (Bryant et al., 2001) |
| | 1997 - 21 percent of white students accessed the Internet in school (Bryant et al., 2001) |
| | 55 percent of white Americans were online in 2000 (Chen and Wellman, 2003) |
| Teacher Skills | No Race Specific Data |
| **Race – Asian** | |
| Income Level $0-$25000 | No Race Specific Data |
| Grades | No Race Specific Data |
| Internet Access | 63 percent of Asian-Americans online in 2000 (Chen and Wellman, 2003) |
| | Asian-Americans have been the heaviest Internet users of any racial/ethnic group and have the longest experience (Chen and Wellman, 2003) |
| Teacher Skills | No Race Specific Data |
| **Race – Hispanic** | |
| Income Level $0-$25000 | Less affluent black and other minority students predominately use drill and practice software (Becker, 2000) |
| Grades | No Race Specific Data |
| Internet Access | Hispanic students were significantly less likely than their white counterparts to use computers for the more sophisticated simulation and application but were more likely to employ computers for drill and practice (Bryant et al., 2001) |
| | White students are almost twice as likely to use a home computer for school assignments as compared to black and Hispanic students |
| | 1997 – Only 20 percent of Hispanic students used a computer in school (Bryant et al., 2001) |
| | 1997 - Only 12 percent of Hispanic students accessed the Internet in school (Bryant et al., 2001) |
| | 28 percent of Hispanic-Americans were online in 2000 (Bryant et al., 2001) |
| | In 2003, only 8 percent of African-Americans were online despite being 11 percent of the population (Hargittai, 2002) |
| | In 2003, only 9 percent of Hispanic-Americans were online, despite being 10 percent of the American population (Hargittai, 2002) |
| Teacher Skills | No Race Specific Data |
| **Race – Black** | |

| Income Level $0-$25000 | Less affluent black and other minority students predominately use drill and practice software (Becker, 2000) |
|---|---|
| Grades | No Race Specific Data |
| Internet Access | African Americans at all levels of education, use the Internet less than do comparable European Americans (Barbatsis et al., 2003 and Hoffman and Novak, 1998) |
| | White students are almost twice as likely to use a home computer for school assignments as compared to black and Hispanic students (Barbatsis et al., 2003) |
| | Spent Less time online (Barbatsis et al., 2003) |
| | African American are significantly less likely than their white counterparts to use computers for the more sophisticated simulation and application but were more likely to employ computers for drill and practice (Barbatsis et al., 2003) |
| | 1997 - Only 17 percent of black used a computer in school (Barbatsis et al., 2003) |
| | 1997 – Only 15 percent of black students accessed the Internet in school (Barbatsis et al., 2003) |
| | 30 percent of blacks were online in 2000 (Chen and Wellman, 2003) |
| Teacher Skills | No Race Specific Data |
| **Non-Racial** | |
| Income Level $0-$25000 | Feared "messing up" or breaking the machine (Barbatsis et al., 2003) |
| | Explanation for race differences in Web use may lie in cultural differences in aesthetic preferences (Barbatsis et al., 2003) |
| | Survey data indicate that only about 22% of children in families with annual incomes of less than $20,000 had access to a home computer, compared to 91% of those in families with annual incomes of more than $75,000 (Becker, 2000) |
| | Younger, well-to-do, white, well-educated, urban and suburban Americans are still more likely to be on the Internet than older, less well-off, black and Hispanic, less educated, and rural Americans (Chen and Wellman, 2003) |
| | More than 60 percent of Americans with a household income of $35,000 or higher were online in 20 (Chen and Wellman, 2003) |
| | Only 42 percent of those with a household income of less than $15,000 were online (Chen and Wellman, 2003) |
| | Children [in low-income communities] "In many of [their] schools, drill is all the kids do." (Foss, 2003) |
| | Teachers in schools with a high percentage of White students and a low percentage of students on free or reduced lunch programs are more likely to use these technologies to engage students in creative and critical thinking activities, teachers in schools with a high percentage of Students of Color and a high percentage of students on free or reduced lunch tend to use computers and the Internet for a skills and drills approach to learning (Gorski, 2001) |
| | Households with an income level greater than $50,000 were three times more likely to be connected to the Internet than households with incomes less than $15,000 (Morgan and VanLengen, 2005) |
| | Students with higher family social and economic status were more likely to use a home computer for educational purposes (Morgan and VanLengen, 2005) |

| | Students from families with lower social and economic status and those who did not have home computer access were more likely to attend schools that did not have Internet access (Morgan and VanLengen, 2005) |
| --- | --- |
| | At higher levels of income and education, there are minimal ethnic or racial differences in Internet access or computer ownership (Morgan and VanLengen, 2005) |
| Grades | West Virginia experienced across the-board increases in statewide assessment scores in basic skill areas (Bryant et al., 2001) |
| | Studies have also demonstrated that not only does education technology improve student achievement but it also improves student's self-concept and motivation (Bryant et al., 2001) |
| | Teachers assigned to "high-achieving" classes were more likely to use the Internet and to find it essential in their teaching than teachers with "average" classes. Teachers of "average" classes were more likely than were teachers with "low" classes to use it (Stoicheva, 2004) |
| | GPA has increased with increased computer usage (Pugmire, 2004) |
| Internet Access | Research on the racial digital divide in the U.S. supports the view that providing access to IT will not be enough to eliminate the digital divide (Barbatsis et al., 2003) |
| | Those teaching lower-income students reported weekly use of computers more often than those teaching higher-income students (Becker, 2000 and Pearson and Swain, 2003) |
| | A shortage of individual computer stations in the classroom has long restricted more frequent, systematic, and well-integrated use of technology (Becker, 2000) |
| | Although much of children's use of home computers may be for entertainment rather than educational purposes, such experiences nevertheless may have academic value (Becker, 2000) |
| | The two most predictive factors of children's use of home computers were the child's age and the computer's capabilities (Becker, 2000) |
| Teacher Skills | Only about 1 in 10 secondary teachers of core academic classes could be considered an active user of analytic or product-oriented software in their teaching (Becker, 2000) |
| | Teachers' expertise with computers ranged from 75% who said they could display a disk's directory to only 18% who said they could develop a multimedia document (Becker, 2000) |
| | Children in higher-SES schools are advantaged not so much by greater access to computers, but by access to a teaching approach that emphasizes use of technology for developing higher-order skills (Becker, 2000) |

**Appendix B**

**Mitigating Teaching Strategies**

- Teaching Strategies
  - Have students use their Web access in computer classes for research related to assignments in academic classes (Becker, 2000)
  - Teachers must direct and encourage students to take advantage of the editing and reformulating capabilities that word processing provides (Becker, 2000)
  - Apply computers to use higher-order thinking concepts in math, in order to gained a one-third grade level increase for eighth grade students (Bryant et al., 2001)
  - Children using computers for drill and practice can initially improve basic skills—particularly in math and science—but computers are most effective when children use them for problem-solving and critical thinking (Foss, 2003)
  - Students in the primary grades must be able to use software to reinforce math and spelling skills (Morgan and VanLengen, 2005)
  - Ensure all students must have "opportunities for knowledge construction in authentic learning activities and situations" to remove the Digital Divide (Morgan and VanLengen, 2005)
- Tools
  - As part of accountability and continuous improvement, schools should undertake program evaluation on the impact of education technology itself (Bryant et al., 2001)
  - Train teachers
    - Education technology experts agree that this is the most important factor. "Teachers across the board don't feel competent to use technology as part of instruction." (Foss, 2003)
    - The most advanced technology is useless without properly trained teachers (Morgan and VanLengen, 2005)
    - Teacher education should not focus on technology alone, but on its alignment with curriculum (Morgan and VanLengen, 2005)
  - Use technology to its greatest advantage.
    - 62 percent of teachers surveyed indicated computer use increased standardized test performance (Morgan and VanLengen, 2005)
    - Use drill and practice exercises to work into more critical thinking exercises (Foss, 2003)
  - The increase in Internet connections alone has had no measurable impact on any measure of student achievement. The tool must be utilized as a prerequisite for the educational technology model to work (Goolsbee and Guryan, 2003)
  - Technology in the classroom directly contributes to student achievement, both by making students more effective in their learning and teachers more efficient in their teaching (Morgan and VanLengen, 2005)
- Resources
  - Align Technology with Curriculum
    - Ensure curriculum, technology use and assessment support standards and objectives (Bryant et al., 2001)
    - It is necessary to have an adequate number of computers and Internet access in the classroom (Morgan and VanLengen, 2005)

## Appendix C

## Definitions

*Academic Success*:  Academic grades and scores as measured by individual class grades

and test scores (Finn and Rock, 1997).

*Age-Related Factors:*  Defined as those factors that inhibits or enhance ones ability to

access and use technology solely on the basis of age (Hargittai, 2002).

*Conceptual Analysis*:  Form of content analysis that looks at the occurrence of selected

terms within a text or texts, although the terms may be implicit as well as explicit

(Palmquist et al., 2005).

*Digital Divide*: 1. "The gap between those who have access to the Internet from those

who do not" (Birdsall, 2000, p.1).  2. "The gap between those who have access to

and can effectively use information technologies and those who cannot" (Lynch,

2002 p.2). 3. Inequities of Internet access (Castells, 2001)

*Educational Advocates*:  Those entities, including parents or other community members

who are involved in schools in order to affect children's experiences and

achievement.  (Booth and Dunn, 1996)

*Educational Technology*:  Computer technology utilized in such a manner as to enhance

key building blocks of student achievement (Bryant et al., 2001).

*Information Technology:*  Refers to the effective use of the Internet (Castells, 2002)

*K-8 Students*:  6 to 12 year old children who are public or private school students within

the United States (Gorski, 2001).

*Literature Review:*  Process of looking again at what others have done in areas that are

similar, though not necessarily identical, to one's own area of investigation

(Leedy & Ormrod, 2005).

*Mitigating Strategies*:  Defined as those tools or resource used to connect K-8 students

and technology in a way that will increase school performance (Pugmire, 2001).

*Race-Related Factors:*  Defined as those factors that inhibits or enhance ones ability to

access and use technology solely on the basis of race (Chen and Wellman, 2003).

*Socio-economic Status:*  Refers primarily to income level (Chen and Wellman, 2003) but

may also incorporate income level with race and age (Hargittai, 2002).

*Student Achievement:*  Measured by grades and test scores of students (Finn and Rock,

1997).

## References

Branigan, Cara (2002) ED: *Tech is Key to Implementing New NCLB Rules.*
eSchool News Online
Retrieved August 15, 2003 from
http://www.eschoolnews.com/news/showStory.cfm?ArticleID=3922

Cooper, Mark N (2002) *Does the Digital Divide Still Exist? Bush Administration Shrugs,*
*But Evidence Says "Yes"*
Retrieved September 28, 2005 from
http://www.slis.indiana.edu/faculty/hrosenba/www/l574/pdf/cooper_dig-
divide.pdf

Fico, Maria and Zardoya, Irma (2001) *Urban Students Cross the Digital Divide Through*
*Laptop Leasing Program.*
Education Winter 2001, Volume 122, Number 2

Finn, Seth and Inman, John G. (2004) *Digital Unity and Digital Divide: Surveying*
*Alumni to Study Effects of a Campus Laptop Initiative*
Journal of Research on Technology in Education, Spring 2004: Volume 36
Number 3

Garson, G. David and Pavlichev, (2004) *Alexei Digital Government Principles and Best*
*Practices* (Chapter 19)
Idea Group Publishing

Gaujean-La Mar, Natasha (2001) *New Jersey's Solution to the Digital Divide*
The Journal Sep2001, Volume 29 Issue 2, p66, 4p, 2c

Kennedy, Tracy, Klement, Krisitne and Wellman, Barry (2003) *Gendering the Digital*
*Divide,* IT and Society, Volume 1, Issue 5 2003 pp72-96

Koss, Fabian A (2001) *Children Falling into the Digital Divide* Journal of International
Affairs Volume 55 Issue 1, p75, 16p

Krippendorff, K. (2004) *Content Analysis: An Introduction to its Methodology*
Sage Publications, Thousand Oaks, CA.

Looker, Dianne and Thiessen, Victor (2003) *The Digital Divide in Canadian Schools: Factors Affecting Student Access to and Use of Information Technology*
Retrieved October 3, 2005 from
http://www.statcan.ca/english/research/81-597-XIE/81-597-XIE.pdf

MacDonald, Geoffrey and Valletta, Rob (2003) *Is there a Digital Divide?*
Retrieved September 18, 2005 from
http://www.frbsf.org/publications/economics/letter/2003/el2003-38.html

Martin, Stephen P (2003) *Is the Digital Divide Really Closing? A Critique of Inequity Measurement in a Nation*
Retrieved September 18, 2005 from
http://www.stanford.edu/group/siqss/itandsociety/v01i04/v01i04a01.pdf

Reisman, Sorel (2003) *Electronic Learning Communities: Current Issues and Best Practices* (Chapter 5)
Information Age Publishing, Greenwich, CT

Robinson, John P et al., (2003) *Digital Divide: Past Present and Future*
IT and Society, Volume 1, Issue 5 2003
Retrieved September 12, 2005 from
http://www.stanford.edu/group/siqss/itandsociety/v01i05.html

Sponner, Andrew S (2004) *Preschoolers, Computers, and School Readiness: Are We On to Something?* Pediatrics, Volume 114 Number 3

Steinfield, Charles (2003) *New Directions in Research on E-Commerce* (Chapter 12)
Purdue University Press Ashland, OH

US Department of Education (2002) *No Child Left Behind Act of 2001*.
Retrieved August 16, 2003 from
http://www.ed.gov/legislation/ESEA02/pg34.html

US Department of Education (2003) *Tool Kit for Bridging the Digital Divide in Your Community*
Retrieved August 14, 2003 from
http://www.ed.gov/Technology/tool_kit.html

Warschauer, Mark (2002) *Re-Conceptualizing the Digital Divide*

First Monday, volume 7, number 7

Retrieved September 8, 2005 from

http://firstmonday.org/issues/issue7_7/warschauer/index.html

Wilhelm, Anthony G. (2004) *Digital Nation: Toward an Inclusive Information Society*

(Chapter 2)

MIT Press Cambridge, MA

Winnetka School District, (2003) *Revenue vs. Expenditure Breakdown.*

Retrieved August 16, 2003, 2005 from

http://www.winnetka.k12.il.us/District/budget/2002_2003/rev_vs_ex_brkdwn_02.
pdf

**Bibliography**

Anguin, Julia and Castaneda, Laura (1998) *Closing the Digital Divide Early*
> San Francisco Chronicle May 4, 1998
> Retrieved October 28, 2005 from
> http://www.sfgate.com/cgi-
> bin/article.cgi?file=/chronicle/archive/1998/05/04/MN2696.DTL

Barbatsis, Gretchen, Biocca Frank, Fitzgerald Hiram, Jackson, Linda A., von Eye,
> Alexander, and Zhao,Yong (2003) *Internet Use in Low-Income Families:*
> *Implications for the Digital Divide*
> Retrieved September 28, 2005 from
> http://www.stanford.edu/group/siqss/itandsociety/v01i05/v01i05a07.pdf

Becker, Henry J (2000) *Who is Using Technology and Who is Not*
> Retrieved October 6, 2005 from
> http://www.teacherlib.org/articles/becker.pdf

Birdsall, William F. (2000) *The Digital Divide in the Liberal State: A Canadian*
> *Perspective*
> Retrieved September 18, 2005 from
> http://www.firstmonday.org/issues/issue5_12/birdsall/.

Booth, Alan and Dunn, Judith F (1996*) Family-School Links: How Do They Affect*
> *Educational Outcomes?*
> Laurence Earlbaum Associates, Inc. Publishing, Mahwah, New Jersey

Bridges.org [Author Unknown] (2004) *Spanning the Digital Divide: Understanding and*
> *Tackling the Issues*
> Retrieved October 8, 2005 from
> http://www.bridges.org/spanning/annex2.html

Bryant, Anne L, Nivens, Michael T, and Rodrigues, William (2001) *School Technology*
> *and Readiness Report*
> Retrieved September 6, 2005 from
> http://www.ceoforum.org/downloads/report4.pdf

Castells, Manuel (2002) *The Internet Galaxy: Reflections on the Internet, Business, and Society* – Oxford Press, Oxford NY.

Chen, Wenhong and Wellman, Barry (2003) *Charting and Bridging Digital Divides: Comparing Socio-economic, Gender, Life Stage, and Rural-Urban Internet Access and Use in Eight Countries*
Retrieved September 10, 2005 from
http://www.chass.utoronto.ca/~wellman/publications/index.html

Cooper, Kathleen B., et al (2004) *A Nation Online: Entering the Broadband Age*
Retrieved September 10, 2005 from
http://www.ntia.doc.gov/reports/anol/

eSchool News (1998) *Spending for School Technology to Top $5.2 Billion*
Retrieved October 17th, 2005 from
http://www.eschoolnews.com/news/showstory.cfm?ArticleID=64

Finn, JD and Rock, DA (1997) *Academic Success Among Students at Risk for School Failure*
Journal of Applied Psychology 1997 Apr Vol 82(2) 221-234

Foss, Jessine (2003) *The Schoolhouse "Digital Divide"*
Retrieved October 6, 2005 from
http://www.connectforkids.org/node/433?tn=lc/ra

Goolsbee, Austan D. and Guryan, Jonathan (2003) *Closing the Digital Divide: Internet Subsidies in Public Schools*
Retrieved September 8, 2005 from
http://ideas.repec.org/p/nbr/nberwo/9090.html

Gorski, Paul (2001) *Understanding the Digital Divide from a Multicultural Education Framework*
Retrieved September 12, 2005 from
http://www.edchange.org/multicultural/net/digdiv.html

Hargittai, Eszter (2002) *Second-Level Digital Divide: Differences in People's Online Skills* First Monday, volume 7, number 4
Retrieved September 8, 2005 from
http://firstmonday.org/issues/issue7_4/hargittai/index.html

Haugland, Susan (2000) *Computers and Young Children*

    Retrieved October 15th, 2005 from

    http://ceep.crc.uiuc.edu/eecearchive/digests/2000/haugland00.pdf

Hoffman, Donna L and Novak, Thomas P (1998) *Bridging the Digital Divide: The*

    *Impact of Race on Computer Access and Internet Use*

    Retrieved September 8, 2005 from

    http://elab.vanderbilt.edu/research_papers.htm

Irving, Larry, et al (1999) *Falling Through the Net: Defining the Digital Divide*

    Retrieved September 28, 2005 from

    http://www.ntia.doc.gov/ntiahome/fttn99/contents.html

Leedy, P. D. & Ormrod, J. E. (2005) *Practical Research: Planning & Design 8th Edition*

    NJ: Merrill Prentice Hall Upper Saddle River, New Jersey

Lynch, Beverly P (2002) *The Digital Divide or the Digital Connection: A US Perspective*

    Retrieved September 8, 2005 from

    http://www.firstmonday.org/issues/issue7_10/lynch/

Montgomery, S.M. (1995) *Addressing Diverse Learning Styles Through the use of*

    *Multimedia*

    Retrieved October 15th, 2005 from

    http://ieeexplore.ieee.org/xpl/abs_free.jsp?arNumber=483093

Morgan, James N. and VanLengen, Craig A. (2005) *The Digital Divide and*

    *K-12 Student Computer Use*

    Retrieved October 8, 2005 from

    http://proceedings.informingscience.org/InSITE2005/I56f86Morg.pdf

Palmquist, M., et al., (2005) *Conducting Content Analysis: Writing Guides*

    Retrieved September 28, 2005 from

    http://writing.colostate.edu/guides/research/content/index.cfm

Pearson Education (2004) *Title Unknown*

    Retrieved October 15th, 2005 from

    http://www.pearsoned.com/about/index.htm

Pearson, Tamara and Swain, Colleen (2003) *Educators and Technology Standards:*
   *Influencing the Digital Divide,* Journal of Research on Technology in Education
   Spring 2003 Volume 34 Number 3

Price, Betsy (2003) *Detecting and closing the Digital Divide*
   Retrieved September 14, 2005 from
   http://www.findarticles.com/p/articles/mi_qa4002/is_200310/ai_n9334832

Pugmire, Tim (2004) *Closing the Digital Divide in Schools*
   Retrieved September 8, 2005 from
   http://news.minnesota.publicradio.org/features/200106/04_pugmiret_computers/

Sandham, Jessica L (2001) *States Slowing Spending for Public Schools*.  Education Week
   9/5/2001.
   Retrieved August 16, 2003 from
   http://www.edweek.org/ew/newstory.cfm?slug=01downturn.h21

Stoicheva, Mila (2004) *The Digital Divide and Its Implications for the Language Arts*
   Retrieved September 28th, 2005 from
   http://www.ericdigests.org/2001-1/divide.html

University of Wisconsin Madison (2004) Writing Center – Review of Literature
   Retrieved October 08, 2005 from
   http://www.wisc.edu/writing/Handbook/ReviewofLiterature.html

Unknown Author (2000) *Education Schools Join in Commitment to Technology*
   The Journal June 2000, Vol. 27 Issue 11, p22

Warschauer, Mark (2003) *Technology and Social Exclusion: Rethinking the Digital*
   *Divide*, London: MIT Press

Wolfe, et al. (2004) *Computer History Timeline*
   Computer History Museum Retrieved October 16th, 2005 from
   http://www.computerhistory.org/timeline/timeline.php?timeline_category=cmptr