

Executive Summary

THE DAVID and LUCILE PACKARD FOUNDATION

The Future of Children

VOLUME 10 • NUMBER 2 - FALL/WINTER 2000

CHILDREN
AND
COMPUTER
TECHNOLOGY

A decorative graphic consisting of a series of horizontal bars of varying lengths and shades of blue and purple, arranged in a stepped, descending pattern from left to right.

Children and Computer Technology



ANALYSIS

Virtually all of our nation's children have access to computers at school, and over two-thirds have access at home. Although a wide consensus prevails among parents, teachers, and policymakers that children need to become competent computer users to be prepared for life and work in the twenty-first century, questions are being raised about the effects of the expanding role of computers in children's lives. This journal issue examines the available research on how computer use affects children's development, whether it increases or decreases the disparities between rich and poor, and whether it can be used effectively to enhance learning.

Effects on Children's Development

The amount of time and the types of activities that children engage in while using computers are key factors influencing whether computer technology has positive or negative effects on their development. Studies on computer use, on children's development, on learning, and on the effects of other media, suggest that excessive, unmonitored use of computers can be harmful.

- ◆ Obesity in children is linked to excessive time in front of a television screen—defined as five or more hours a day. The sedentary time spent in front of a computer screen could pose a similar risk.
- ◆ Reports warn that repetitive-strain injuries may result when children use computers at workstations not designed for them, and that children's vision may be harmed from staring too long at a computer screen.
- ◆ Teens who spend more time online, communicating with strangers in multiuser domains and chat rooms, have been found to experience greater declines in social involvement and increases in their feelings of loneliness and depression.
- ◆ Playing violent computer games—a popular activity, especially among boys—has been linked with increased aggression.

Other studies show, however, that computer use can have positive effects on children when used appropriately.

- ◆ Interesting and engaging educational software and nonprofit Web sites offer children opportunities to explore the world and to create original works of art and literature.
- ◆ Communicating through the Internet can enable children to keep in touch with friends and family, and to form online communities with others who share their interests.
- ◆ Children's use of home computers is linked to slightly better academic performance.
- ◆ Through training in media literacy and "computer fluency," children can learn to recognize and seek out higher-quality software and Web sites, and learn to use computers in more active ways to create, design, and invent.

More systematic studies are needed to understand how computer use affects children's development, and to help parents, teachers, and policymakers refine and adopt guidelines that maximize the positive effects and minimize the negative effects of computers in children's lives.

Disparities Between Rich and Poor

Whether technology serves to increase or decrease disparities between rich and poor depends not only on equalizing access to computers, but also on equalizing access to opportunities to use computers in creative and enriching ways.

- ◆ Only about 22% of children in families with annual incomes under \$20,000 had a home computer in 1998, compared with 91% of children in families with incomes over \$75,000.
- ◆ Fewer than 3% of low-income children reported using computers in libraries or community centers in 1998.
- ◆ Schools serving predominantly low-income children generally have computers connected to the Internet, but they tend to have older, less functional computers; to have fewer computers in each classroom; and to offer fewer experiences using computers to create presentations and analyze information, compared with schools serving higher-income children.

For computer technology to help create a more egalitarian society, such disparities in the quality of home and school access across different socioeconomic groups must be addressed.

Use to Enhance Learning

Computer technology has been demonstrated to enhance classroom instruction by making learning more engaging, and by providing new ways of teaching complex concepts and critical thinking.

- ◆ Use of technology that incorporates visual and collaborative teaching practices has helped promote learning among students of all ability levels, but especially those with mild learning disorders.
- ◆ Math and science applications have improved middle-school students' understanding of graphs and concepts such as velocity and acceleration.
- ◆ In the first list released by the U.S. Department of Education's Expert Panel on Educational Technology in September 2000, nine technology programs were named as either exemplary or promising based on quality, significance, replicability, and evidence of success.

Computers may not be the panacea envisioned by some, but they can be used in ways that benefit students. Further experimentation and research will be required to identify additional opportunities to enhance student learning and the supports required to ensure such opportunities are integrated effectively into classroom instruction.

Computer technology is rapidly transforming society, and the task of influencing that transformation may seem daunting. But by the steps we take today to shape what children learn and experience through their use of computers, we can help ensure that all children are empowered to use computers effectively, responsibly, and creatively to shape the digital world of tomorrow.

RECOMMENDATIONS

RECOMMENDATION 1

More public and private research dollars should be allocated to assessing the effects of extended computer use and exposure to various types of computer content on children's physical, intellectual, social, and psychological development.

RECOMMENDATION 2

Parents, teachers, and other adults working with children should limit the extent of time children spend using computers and supervise the content children are exposed to, including games, software, and the Web.

RECOMMENDATION 3

Public, private, and nonprofit groups concerned with the role of computer technology in society should support and encourage the dialog that has been initiated among

researchers, software and Internet companies, and government agencies to create new incentives for developing high-quality content for children.

RECOMMENDATION 4

Schools and community organizations should provide media literacy training for teachers, parents, other adults who work with children, and children themselves, to strengthen their critical understanding of the motives underlying much of the software and content found on the Web and to empower children to make good choices about their computer use.

RECOMMENDATION 5

State and local education agencies should refine and adopt age-appropriate guidelines for children's computer fluency. Such guidelines should be disseminated to all elementary and secondary teachers and incorporated into preservice and in-service technology training sessions.

RECOMMENDATION 6

The U.S. Department of Commerce should work with industry to expand opportunities for low-income families to acquire home computers and Internet access.

RECOMMENDATION 7

Public and private funders should support efforts by libraries and community centers to include technology programs focused specifically on children, and to provide their staff with training in the skills and types of exposure appropriate and enriching for children of different ages.

RECOMMENDATION 8

The U.S. Department of Education should assist the poorest schools in applying for E-rate discounts and encourage all schools to offer a broad range of technology-related experiences to their students, preferably connected to the curriculum in ways that have been shown to be appropriate and effective.

RECOMMENDATION 9

When acquiring new hardware and software, schools should consider options that incorporate universal design features to facilitate access to computers for all students, including those with special needs.

RECOMMENDATION 10

More public and private research dollars should be allocated to assessing the effectiveness of technology-supported practices in the classroom, across various subjects and grade levels and to disseminating the results widely to state and local education agencies and teachers.

ARTICLE SUMMARIES

Children and Computers: New Technology—Old Concerns

Ellen A. Wartella, Ph.D., and Nancy Jennings

Although we tend to see the issues surrounding the emergence of computer technology as new, in fact, similar promises and concerns have accompanied each new wave of media technology over the course of the past century: films in the early 1900s, radio in the 1920s, and television in the 1940s. Each of these earlier technologies gave rise to proponents who touted the educational benefits of the new technologies and to opponents who voiced fears concerning exposure to inappropriate commercial, sexual, and violent content. This article places current research on children and computers in a historical context, noting the recurrent themes and patterns in media research, and discussing how the increased level of interactivity now possible through the Internet heightens the potential for both educational enrichment and exposure to harm.

Who's Wired and Who's Not: Children's Access to and Use of Computer Technology

Henry Jay Becker, Ph.D.

Much debate has focused on the extent and significance of a "digital divide" between those children who are benefitting from access to computer technology and those who are being left behind. In this article, the author presents the results of new analyses of data from the national study, *Teaching, Learning and Computing: 1998*, and from the Census Bureau's Current Population Surveys in 1997 and 1998, to examine children's differential access to computers in school and at home. These data suggest that although low-income students have frequent exposure to computers at school, the nature of their experiences vary greatly from those of high-income students, and that they are far less likely to have access to a computer at home. To help bridge the digital divide, the author concludes that less-advantaged children need greater access to the benefits of sophisticated and powerful uses of computer technology in their classrooms.

Changing How and What Children Learn in School with Computer-Based Technologies

Jeremy M. Roschelle, Ph.D., Roy D. Pea, D. Phil., Oxon., Christopher M. Hoadley, Ph.D., Douglas N. Gordin, Ph.D., and Barbara M. Means, Ph.D.

As we enter the twenty-first century, schools are facing ever-increasing demands in their attempt to ensure that students are well-equipped to enter the workforce and navigate a complex world. This article provides several examples of computer technology applications that can improve how children learn by supporting four fundamental characteristics of learning: active engagement, group involvement, frequent interaction and feedback, and connections to real-world contexts. Additional examples illustrate computer applications that can expand what children learn by helping them understand core concepts in math, science, and reading. Findings from evaluations of these applications are included whenever possible. The article also includes a discussion of the structural and organizational changes that are needed to help ensure that computers are used as effective learning tools.

Use of Computer Technology to Help Students with Special Needs

Ted S. Hasselbring, Ed.D., and Candyce H. Williams Glaser, Ph.D.

Nearly five million students in this country cannot benefit fully from a mainstream education program because they have a disability that makes it difficult for them to participate in a traditional learning environment. This article provides an overview of the types of disabilities experienced by these students, and describes the various ways computer technology can help them become active learners in the classroom alongside their nondisabled peers. Students with mild learning and behavior disorders (numbering about three million) could benefit from word processing, communication, and hyperlink features of computers. Students with more severe disabilities (about two million) could benefit from the sophisticated computer devices that can help them overcome speech and hearing impairments, blindness and physical limitations. Barriers to more widespread use of promising computer-based technologies highlighted in the article include inadequate teacher training and cost.

The Impact of Home Computer Use on Children's Activities and Development

Kaveri Subrahmanyam, Ph.D., Robert E. Kraut, Ph.D., Patricia M. Greenfield, Ph.D., and Elisheva F. Gross

Many concerns have been raised about the impact of technology on children's lives as they spend more and more time on computers at home as well as in school. This article provides a summary of the limited research available on the effects of home computer use on children's physical, cognitive, and social development, focusing primarily on studies related to use of video games and the Internet. Some studies suggest, for example, that home computer use is linked to slightly better academic performance and has no negative impact on children's friendships and family relationships. Other studies suggest, however, that children's use of computers could lead to increased risk of obesity and other harmful physical effects, increased loneliness and depression, and, when used to play violent computer games, increased aggression. Across all these areas, more systematic research is needed to help parents and policymakers understand how best to guide and protect children in their use of home computers.

Children's Media Culture in the New Millennium: Mapping the Digital Landscape

Kathryn C. Montgomery, Ph.D.

A new "children's digital media culture" is swiftly moving into place on the Internet. In this article, the author describes the technological, demographic, and market forces shaping this new digital media culture, and the rich array of Web sites being created for young people by nonprofit organizations, media conglomerates, and toy companies. Efforts to create "safe zones" on the Web (sites that are protected from both marketers and predators) are discussed, as are efforts to create "quality zones" made up of sites that are designed to enhance children's learning and development, not merely to keep them free from harm.

Five Commentaries: Looking to the Future

The following experts, representing various disciplines and backgrounds, responded to the question: "How can we help ensure that computer technology is used equitably, effectively, and ethically to promote positive child development?"

- *Milton Chen, Ph.D., The George Lucas Educational Foundation*
- *Jane M. Healy, Ph.D., author*
- *Mitchel J. Resnick, Ph.D., The Media Laboratory, Massachusetts Institute of Technology*
- *Laurie A. Lipper and Wendy Lazarus, M.P.H., The Children's Partnership*
- *Chris J. Dede, Ed.D., Harvard University*

Appendix A: Federal Programs to Increase Children's Access to Educational Technology

Linda G. Roberts, Ed.D., director, Office of Educational Technology, U.S. Department of Education

Appendix B: What Children Think About Computers

ALSO IN THIS ISSUE:

Glossary

A Selected Bibliography

See back cover for information about ordering additional Executive Summaries or issues of the Journal.

The *Future of Children* (ISSN 1054-8289) © 2000 by The David and Lucile Packard Foundation, 300 Second Street, Suite 200, Los Altos, California 94022, all rights reserved. Printed in the United States of America. Cover photo © Owen Franken/Corbis. ♻️ Printed on recycled paper with soy ink. (The electronic edition of this issue can be found at <http://www.futureofchildren.org> on the World Wide Web.) Note: Opinions expressed in *The Future of Children* by the editors or the writers are their own and are not to be considered those of The Packard Foundation.

The Future of Children Journal and Executive Summary

BACK ISSUES

- U.S. Health Care for Children
(Winter 1992 • Vol. 2, No. 2)
- Adoption
(Spring 1993 • Vol. 3, No. 1)
- Health Care Reform
(Summer/Fall 1993 • Vol. 3, No. 2)
- Children and Divorce
(Spring 1994 • Vol. 4, No. 1)
- Sexual Abuse of Children
(Summer/Fall 1994 • Vol. 4, No. 2)
- Critical Health Issues for Children and Youths
(Winter 1994 • Vol. 4, No. 3)
- Low Birth Weight
(Spring 1995 • Vol. 5, No. 1)
- Critical Issues for Children and Youths
(Summer/Fall 1995 • Vol. 5, No. 2)
- Long-Term Outcomes of Early Childhood Programs
(Winter 1995 • Vol. 5, No. 3)
- Special Education for Students with Disabilities
(Spring 1996 • Vol. 6, No. 1)*
- Financing Child Care
(Summer/Fall 1996 • Vol. 6, No. 2)*
- The Juvenile Court
(Winter 1996 • Vol. 6, No. 3)*

- Welfare to Work
(Spring 1997 • Vol. 7, No. 1)*
- Children and Poverty
(Summer/Fall 1997 • Vol. 7, No. 2)*
- Financing Schools
(Winter 1997 • Vol. 7, No. 3)*
- Protecting Children from Abuse and Neglect
(Spring 1998 • Vol. 8, No. 1)*
- Children and Managed Health Care
(Summer/Fall 1998 • Vol. 8, No. 2)*
- Home Visiting: Recent Program Evaluations
(Spring/Summer 1999 • Vol. 9, No. 1)*
- When School Is Out
(Fall 1999 • Vol. 9, No. 2)*
- Domestic Violence and Children
(Winter 2000 • Vol. 9, No. 3)*
- Unintentional Injuries in Childhood
(Spring/Summer 2000 • Vol. 10, No. 1)*

CURRENT ISSUE

- Children and Computer Technology
(Fall/Winter 2000 • Vol. 10, No. 2)*

UPCOMING ISSUES

- All Upcoming Issues (see Web site)
 - Remove my name from mailing list
- * Executive Summaries available for these issues only.

Name _____
 Title _____/Affiliation _____
 Organization _____
 Dept./Floor/Suite/Room _____
 Street Address _____
 City _____ State _____ Zip _____
 Phone _____ E-mail _____

**To order free JOURNALS and/or EXECUTIVE SUMMARIES, please send requests to: Circulation Department,
 The David and Lucile Packard Foundation,
 300 Second Street, Suite 200, Los Altos, CA 94022
 E-mail circulation@futureofchildren.org or FAX (650) 941-2273. Please allow 4-6 weeks for delivery.**

JOURNAL and EXECUTIVE SUMMARY also available online:

<http://www.futureofchildren.org>

Note: We regret that, at this time, only Executive Summaries can be shipped internationally.