MARKLE FOUNDATION

Children and Interactive Media

A compendium of current research and directions for the future

A Report to the Markle Foundation
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Executive Summary

Why another study? Indeed, why a study ***about*** studies? And why now?

Today we are in the middle of a new revolution in both technology and culture; a revolution in which our children are often in the vanguard. For they are the first generation that is truly "growing up digital." Of course, interactive media for young people is not entirely new. But since the first video games were introduced more than two decades ago, the digital content industry has experienced enormous growth in size and technological sophistication. In recent years, the Internet, more affordable home computing and a host of other digital game and formats have helped make the use of such interactive media a dominant activity of modern childhood. In the years ahead, it's clear that digital media will have an even more central role in the educational and social experiences of young Americans.

Concerned parents, teachers, content producers, child advocates and policy-makers want to understand much more about how such a pervasive experience can contribute to, and certainly not detract from our children's intellectual, social and physical development. We sense that, because of their unique properties, well designed interactive media have an extraordinary potential to not only help young people learn, but also engender a true love of learning.

But are our assumptions borne out by the facts? What kind of evidence do we already have about the power of digital media to influence children's health and well being? What sort of new research do we need to better understand the role of these media in children's lives? And how can we as researchers, media producers, policy-makers and parents better shape that role from knowing the answers?

Because of questions like these, the Markle Foundation commissioned a review of all publicly available research to see how much is known about the role of interactive media in children's lives. And the startling answer from experts in the field is: very little. In fact, there are far more questions than there are answers about what computer and video games and Internet use mean to the social, intellectual and physical development of children today. As a result, we risk losing an extraordinary opportunity to help shape a robust environment that rewards editorial quality and educational value – an environment in which new media producers can thrive by understanding children as more than just a commercial market.

We all share a powerful interest in finding out more: Children's content developers who could learn more about how to create engaging, educational interactive experiences; parents who could learn more about what media products might be helpful or even harmful to their children; policymakers and advocates who could build future policies on a firm foundation of empirical knowledge; and finally, researchers themselves, who might learn a great deal more by bringing together across academic disciplines work that often goes forward on autonomous tracks.

This summary provides only a snapshot of the extensive detail that can be found in a more than 200 page report and annotated bibliography exploring the current body of research discussing the effect of interactive media on children. They provide interested readers not only with specific citations, but also a far more comprehensive discussion of existing research on children and interactive media. The goal is to provide a clear picture of just where we really are in our understanding of children and interactive media; a sense of direction of where we need to go in finding answers; and an invitation to others to join us on that important journey.

The report focuses on how children use emerging communications media—video games, CD-ROMs, the Internet and other computer software—outside the classroom, in their homes. It is organized into four sections: (1) interactive media use and access; and its impact on children's (2) cognitive development, (3) social development, and (4) health and safety. Finally, we have a series of questions and proposals rooted in the understanding that the medium alone is not the message; that creative ideas and human values will ultimately determine whether communications technologies fulfill their enormous potential to educate, inform and inspire.

1. Interactive Media Use and Access

The Kaiser Family Foundation's recent report *Kids & Media @ The New Millennium* found that children today are immersed in media. Their lives are increasingly devoted to video game playing, browsing the Internet and conversing in chat rooms. We know that children now spend as much time using media as they do in school, with family or friends. So we have a powerful incentive to understand how such a pervasive experience affects their development.

One challenge for researchers is that "new media" present a constantly moving target. During the course of the 1990s patterns of children's media use changed radically as their range of options kept growing. A decade that began with video games and CD-ROMs saw the explosion of the Internet and the World Wide Web. Today's developments in media convergence, wireless Internet and pervasive computing will certainly alter the terrain in new and unexpected ways in the years ahead. But the most important focus for researchers in the field is less on the technology platform, but on the kind of content that children experience.

FOR BOYS, GAMES RULE

Researchers have found that playing games is the most common way young people of all ages 2–18 use computers. They have found that boys reported significantly more time commitment than girls in playing computer and video games. Evidence from the few studies that have analyzed different categories of game content show that boys and girls prefer different types of games, with boys generally preferring sports, action adventure and violent action games; while girls generally prefer educational, puzzle, spatial relation and fantasy-adventure games.

While many assume that interactive games are frequently played in isolation, they are often the focus of vibrant social contact for boys, who compare notes about levels of game play and scores they made. One study found that boys age 11 – 17 who report frequent game playing were also those likely to see their friends more often outside school.

Another faulty assumption exists about girls' seeming disinterest in computer technology. A report released by the American Association of University Women Educational Foundation emphasized that girls are critical of the computer culture rather than computer phobic. They dislike both the violence in most interactive games, as well as the narrow, technical focus of computer programming classes. What's more a March 2000 survey by the National School Boards Foundation (NSBF) found that boys and girls are equally involved in using the Internet, albeit in different ways. It found that girls are not "phobic" or even disinterested when it comes to the Internet. They were more likely to use the Internet for education, schoolwork, e-mail, and chat rooms, while boys were more likely to use the Internet for entertainment and games.

THE YOUNGER THE BETTER

Regardless of gender, children's media choices and preferences change as they mature. Evidence suggests that patterns established at an early age tend to be highly predictive of later media-related

preferences. But surprisingly, there are very few current studies of children's interactive media use that include children of pre-school age.

The newest studies available reveal that younger children are more likely to prefer educational games than older children. This preference for educational games decreased as a function of age for both girls and boys alike.

But there are several gaps in our knowledge about age and new media use. For example, there is little research exploring variations in interactive media use among children of different ethnic groups and among children less than eight years old. We are especially limited in our understanding of how and why children use networked services from their homes.

ACROSS THE "DIGITAL DIVIDE"

Not every American family and child has access to computers, the Internet and interactive media. Persistent differences across socio-economic and ethnic lines have rightly generated an important public policy debate about possible implications and solutions to this inequality. But the most recent research suggests that access to computers and the Internet is rapidly spreading in the United States and that closing the "digital divide" will depend less on technology and more on providing the skills and content that are most beneficial.

For example, video game consoles and software, which are less expensive than computer systems, are widely spread across all socio-economic levels. In fact, ownership of video game equipment was more common in lower-income households than in higher-income households. Unfortunately, even though similar *entertainment* content is available for both computer and video gaming systems, the vast majority of *educational* software is available only for those who have access to a computer or perhaps a net appliance.

We need to know whether and how children may be affected by living on the wrong side of the "digital tracks." Evidence suggests that children who have access to home computers demonstrate more positive attitudes toward computers, show more enthusiasm, and report more self-confidence and ease when using computers than those who do not. Our specific concern regarding the issue of the digital divide is in providing not only access to hardware but training and software that makes computers useful and meaningful.

Much of the research on children's use of media has focused on the uses of *particular* media (e.g., books, television, computers, Internet) and not on the whole media environment. The literature on print literacy has virtually no overlap with the literature on children and television, and these in turn have little connection with literature on children and computers. While this may have been a useful simplifying strategy in the past, it appears increasingly less useful in an age of media convergence, when children are surrounded by an increasingly seamless web of multiple media experiences.

Future research needs to study not just the level of media use, but specific media content. For instance, rather than just studying children's use of the Internet, we should consider the genre of the content involved, the kind of interaction it provides; whether it uses audio, text, or audiovisual messages; and whether the user is involved in networked activities and how children use these experiences in their social lives.

2. Cognitive Development

WHAT TECHNOLOGY TEACHES…AND WHAT IT DOESN'T

We have long understood that children learn and grow, socially, intellectually and even physically from playing games. They also learn skills, information and behavior from their parents, siblings and peers; from television, music, movies and comic books. But how much do we understand about whether the introduction of interactive media into the equation affects how and what children are learning? Is the very interactivity of newer technology a distinction that makes a real difference in what children learn? In simple terms, does playing collaborative learning games make children more likely to act collaboratively? Or playing violent video games make children more likely to act violently?

And as prior media research has shown, it is not the medium itself that affects children's perceptions, attitudes, or awareness. It all depends on the specific kinds of *content* with which they carry out specific kinds of *activities*, under specific kinds of external or internal *conditions* for specific kinds of *goals*. In order to understand the impact of interactive media, researchers will have to focus on the details of that interactivity, on whether and how it allows children to engage the content in a truly responsive way.

COLLABORATION BEATS THE COMPETITION

We know that in a traditional "analog" environment, interactivity in the form of collaboration is a proven learning strategy. Studies have shown, for example, that children's communication with peers about how to solve a science problem can improve science learning. Others demonstrate that stimulating collaboration in young children's story-telling play lead to improved writing skills.

In another study examining collaborative learning in 4th grade children using an educational software program showed that pairs of children who could play together got more right answers than the pairs who had to play against one another. Other findings provide encouraging evidence that informal, collaborative experiences with quality educational software can help develop skills that are not only content-specific, but that can also be transferred to new situations.

IS HOME PLAY LIKE HOMEWORK?

What about the impact of interactive media experiences outside the classroom on academic performance? Does using a computer or playing video games help or hurt?

In general, research suggests that where interactive video games have been designed to teach certain skills, they can be highly effective learning tools. But there has not been enough research on games that are already in the marketplace to determine what their effect is on other cognitive skills. And until there is more research, we simply don't know enough to say whether children's access to and use of computers at home significantly influences their achievement in school. While early studies have suggested that home computer access may be associated with higher test scores, a variety of other factors in the home and family environment could also be relevant. Given the fact that the primary reason cited by parents for purchasing a home computer and connecting to the Internet is education, we have very little research to document whether using interactive media at home actually contributes to achievement at school.

GETTING DOWN TO SPECIFICS

It's impossible to give any single answer about the influence of new interactive technologies on children's cognitive development. There appear to be many different answers depending on the type of technology, the genre of the content and the children. For example, interactive toys probably engage children differently than interactive computer games. Within the same technology, there are significant differences in both content and presentation style.

Clearly, we have to be much more specific about what we mean by "interactivity." Developing a more detailed road map would allow researchers, as well as parents, teachers and policy-makers to evaluate specific elements of these media – such as audio, video, text, depth, style and structure of interaction -- and their impact on children of different ages and situations. In short, the actual content is more important than the technology.

We have already learned some important things about effective, educational "interactivity" from studies of how parents teach children to read. As adults read bedtime stories, product labels, advertisements and signs, instructions for games and toys, they give children a framework of prompts, hints, pointers and dialogues that can support the first tentative steps toward reading and writing. This sort of support is a cornerstone of good interactive design because it allows even very unskilled users to navigate an interface with visual pointers, dialogue boxes, hints and help systems. Further research could only help refine such effective tools for media producers, as well as useful ways to help parents judge quality content for their children.

3. Social Development

DIGITAL FRIENDS AND FAMILY

Children don't experience media in a vacuum. Past research on the impact of television tells us that immediate family, such as parents and siblings, heavily influence what children take away from the viewing experience. Family environment also provides a key context for how young people experience computers. Recent studies have found that students' perceptions of their parents' desire for them to learn about and use computers was a significant predictor of heavy computer use.

Specifically, the degree to which parents 1) are available to their children and involved in their children's learning activities, 2) are attracted to and use the computer themselves, and 3) are knowledgeable about the value and quality of academic software influenced whether children embraced the computer and Internet for creative, educational purposes, rather than primarily game play.

Recent findings are not nearly as encouraging when it comes to parental involvement with teens and interactive media. One researcher recently concluded that "the image of the solitary youngster seated in

front of a computer is accurate for over 60% of adolescents." One reason for this is that so many young people often know more than their parents about computers and Internet use, often serving as the technical "gurus" of the family.

But the use of interactive technologies is not necessarily an isolating event for young people. For many, it has become an important social activity. Social researchers may have found that more American adults are "bowling alone," but there's little evidence that children and teens are using computers completely alone. Recent research with children and families suggests that rather than being isolating, the Internet helps connect children (and parents) to others.

Interactive environments, particularly networked technologies can have a positive influence on social behaviors and intellectual development. There has, for example, been a popular – but still understudied – boom in communities of young media users who create their own web pages. Such personal online publishing offers a sophisticated way for young people to connect with their peers and others interested in the same topics. And many are seizing that opportunity with enthusiasm and creativity.

MORE THAN A GAME?

A decade before the first digital computer was conceived, Margaret Mead pointed out that playing games provides a critical opportunity for children to acquire the distinctive perspectives of social identities and voices. And more recent research has shown that children's fantasy play – like having an "imaginary friend" – can be a productive strategy in their own social development.

Some researchers suggest that online interaction through chat rooms and game-playing can have a similar function, allowing young people to take on identities they wish to explore and even helping them deal with difficult issues in their "real" lives. Conversely, some young people may use these media to "act out" in hostile or unhelpful ways both online and off. While a few studies have examined the formation of online personal relationships and their ability to satisfy social needs of adults, we know much less about the nature of those relationships, particularly for children and teenagers.

Online communications lack many of the characteristics of traditional relationships such as geographic proximity and physical appearance, cues about group membership and the broader social context. But

the very absence of some of these qualities in online communication may have great advantages, especially for children and teens. The emphasis on shared interests rather than social or physical characteristics can be empowering for all people, and especially for members of disadvantaged social groups, those who may be geographically isolated, or physically disabled.

Can the Internet enable awkward teens to find social niches that might otherwise elude them in their real world? Or may it lead them to withdraw and become isolated? (Certainly, parents also have legitimate safety concerns about child predators who seek to have socially inappropriate interactions with children both online and off.) In short, we have much more to learn about consequences – both positive and negative -- of networked relationships and communities for children's healthy social development.

VIOLENCE AND AGGRESSION

One of the most often expressed concerns about the old and new media is the impact of violent content on children and teenagers. The problem researchers have long identified with much popular media is that they present a combustible formula in which violence has no context, causes no bad consequences and results in no remorse. Today's generation of computer and video games are indeed more graphic, violent, and realistic than ever before.. But does the interactive, repetitive nature of these games increase the likelihood of subsequent aggressive behavior?

There are certain characteristics of violent computer and video games that make them powerful media experiences for children: First, identification with aggressive characters, particularly in games that allow children to not only choose their character but also select particular traits. Second, game players are active participants whose own behaviors lead to success or failure. Third, children receive constant reinforcement of aggressive choices by acting them out, and then being rewarded (with points, sound effects and access to new game levels) for doing so.

Theoretically, these qualities should increase the power of interactive games to teach and reinforce aggressive behavior. But there is only recent and very limited empirical evidence to substantiate this claim. Researchers have found some relationship between video game play and aggressive behavior by teenagers.

Several researchers have examined the short-term impact of violent video game play of children from 4 – 10 years old. Their results suggest that playing violent video games encourages relatively immediate increases in aggressive behavior, attitudes and thoughts – but only in the short-term. There has been little systematic research on the long-term influences of interactive game play, and especially limited attention given to young children.

One recent study examined the effect on 3rd and 4th grader's after playing a violent video game (*Mortal Kombat II*) or non-violent one (*NBA Jam:TE*). Steps were taken to "rig" the *Mortal Kombat II* game so that the young subjects would not experience its graphic violence in full; for example, no mutilation moves or spurting blood. That even relatively brief exposure to this "tamed-down" version of the game elicited aggressive responses by the children raises concerns about the long-term impact of the most violent games that are available daily on home computers, video gaming systems and arcades throughout the nation.

With limited long-term studies to date – and scholars themselves using different definitions of violence -- more research is needed to fully understand the potential impact on children of the current generation of interactive games.

VAGUE WARNING SIGNS AND CONFUSING ROAD MAPS

In 1994, the U.S. Congress required the computer and video game industries to develop some type of parental advisory label to be placed on game packaging. By far the dominant system is provided by the ESRB [Entertainment Software Rating Board], a ratings board created by the interactive game industry, labels game content based on five age-based categories: Early Childhood (EC), Everyone (E or K-A), Teen (T), Mature (M), and Adults Only (AO). There may also be specific content descriptors (edutainment, mild animated violence, comic mischief, realistic violence, mild language, suggestive themes and others) with the rating symbols.

The RSAC [Recreational Software Advisory Committee, now reconceived as the Internet Content Rating Association], an independent and nonprofit organization, developed content-based ratings derived from manufacturers' responses to a series of questions about violence, nudity, sex, and offensive language. Classification icons on game packaging or in advertisements appear as thermometers with four "temperature" readings. The temperature readings represent the level of intensity for these four behavioral categories and may also be accompanied by content descriptors.

Do ratings really provide useful information? Do parents even pay attention to them?

Of the thousands of products rated by the ESRB, 71% of those products are rated "E" for everyone. That one category can include everything from games that provide challenging, skill-building adventures to those that include violence or other undesirable content raises serious questions about the usefulness of such ratings. At the same time, researchers, parents, children, and commercial game raters have very different definitions of violent content, especially cartoon-type or fantasy violence.

In any event, there is little evidence that parents even use these rating systems when making purchases. Surveys indicate that after the first two years of being in effect, consumer awareness and use of the ratings was extremely low.

4. Health and Safety

Health Education. Interactive media, both online and off, has demonstrated an extraordinary potential to help children live healthier, safer lives. Interactive programs such as the *Life Adventure Series: Diabetes CD-ROM* or *Starbright Explorer Series: Exploring your Incredible Blood* are extraordinarily effective tools for helping children understand and manage their health conditions.

Click Health's action-adventure computer and video games -- like *Bronkie the Bronchiasaurus* for asthma or *Packy & Marlon* for diabetes -- demonstrably improve children's self-care for chronic illness. A clinical trial of *Packy & Marlon* found that diabetic children and adolescents who had access to the game at home for six months experienced a 77-percent decrease in diabetes-related emergency and urgent care clinical visits, compared to a control group of youngsters who had an entertainment game at home.

Physical Effects. Many adults who work constantly with computers have experienced a range of physical and ergonomic problems, from eyestrain to Carpal Tunnel Syndrome. But could the mouse and joystick prove to be as dangerous to young wrists as the curve ball proved to be on young Little Leaguers or repetitive workouts for young gymnasts? There is little existing research on how interactive media can affect children's physical health and development.

Addiction. A 1995 survey of 868 adolescents found that 50%, the majority of whom were boys, reported behaviors that would score high on an addiction scale. They reported playing on six or more days per week, playing for more than one hour at a time, feeling they play longer than intended, and neglecting homework to play. Other researchers, using criteria similar to those for pathological gambling, found that of 387 teens between 12 and 16 years-old, 20% were currently dependent on game playing and 25% had been so at some point in their lives.

Weight and Lifestyle. American children are more over-weight, slower and weaker than their counterparts in other developed nations and seem to be developing sedentary lifestyles at an earlier age. It may be that interactive game use and television viewing are displacing involvement in sport and other physical activity. While amount of television watching seems to predict whether children may be overweight, viewing behavior has not been shown to cause decreases in physical activity. Surprisingly, we found no published research exploring causal relationships between interactive media use and obesity. Only future research can tell us whether there is a connection between how much children watch TV or play interactive games and other sedentary behaviors that can affect their long-term health.

THE PRIVATE LIFE OF CHILDREN AND FAMILIES

Online privacy is developing into a major public policy issue as more and more Americans spend their time and money on the Internet. From advertisers whose "cookies" silently track surfing behavior to the potential for disabling viruses and credit card fraud, computer privacy and security presents a range of sensitive new issues. Questions of privacy and deceptive online advertising are especially significant with respect to children.

Web sites often ask children and adults alike to provide personal information such as name, age, gender and e-mail address. Researchers have found that children and teenagers are much more likely than parents to say it is OK to give sensitive information to commercial Web sites in exchange for a free gift.

We don't know much about how children perceive advertisements on the Internet, although past research on television suggests that a great deal depends on age. But unlike television and print media, online advertising is often subtly integrated within the content itself. Entire web sites provide an opportunity for children to interact with product brands and characters. A small exploratory study

suggests that even children 9 – 11 years may not be aware of the commercial intentions of many web sites.

In 1998, Congress recognized the need to regulate online marketing to children and passed the Children's Online Privacy Protection Act (COPPA), which provides safeguards against the collection of personal information from children under age 13. COPPA authorizes the Federal Trade Commission to develop and enforce data collection rules for commercial Web sites targeted at children, and requires advertisers to disclose how they collect and use such data.

A Research Agenda for Quality Interactive Media

We believe that the content industry, academic and market researchers, producers and parents, advocates and policy-makers all share an interest in doing the kind of research that can result in high-quality interactive media that provides not only successful, engaging entertainment, but also promotes healthy, happy and better educated children. To that end, we propose a potential national research agenda that includes:

Building Common Ground Among Researchers. All too often, groundbreaking theory-based research on children and interactive media languishes unnoticed in academic journals across different disciplines -- such as education, communication, psychology and sociology – which largely exist in isolation of one another. There is also a gulf between academia and the industry-based market researchers who play a key role in designing interactive media products for children. Clearly, we – and our children -- could all benefit from a more robust collaboration among scholars in different fields and between academic and market researchers. Scholars can gain critical insights into the market realities that drive what media experiences children have. While product-driven market researchers might gain broader insights into the role of media in children's social, intellectual and physical development.

Research that is Useful to Content Producers. As the success of products like *Sesame Street* and *The Magic School Bus* prove, a developmental approach to interactive media design can thrive in the marketplace. It will help parents make more knowledgeable purchasing decisions. It will help educators teach media literacy skills and instructional designers integrate interactive media into

children's learning environments. And it will help advocates and policy-makers set realistic priorities about how and when to bring public rule-making to bear on the private marketplace.

To support such research and collaboration we believe it's essential to:

- Provide funding to support developmentally based research on the uses, design, and effects of interactive media;
- Create a multidisciplinary research infrastructure that will provide a diverse pool of scholars the opportunity to study new media and children's issues systematically;
- Facilitate the exchange of ideas among a community of scholars, educators, and producers so they can translate current knowledge into entertaining and educational interactive media products for children;

A Community of Scholars. We should build a multidisciplinary community of scholars from both industry and academia fields devoted to studying children and media, a forum that brings together the best thinking and research not only across different academic disciplines, but also among those in the content industry and those in academia.

National Media Lab. We need a "road map" that classifies different types of interactive experiences children might have and the kinds of content they might encounter. We should establish a national media laboratory or consortium of media laboratories to examine, review, and evaluate new computer games. The national lab would not be a government ratings board, but an independent repository – both online and off -- for the huge variety of interactive media products and research findings about their design, usability and content.

Such a research consortium would be a natural point of organization for the community of scholars, by sponsoring such activities as:

- Regular multi-disciplinary and multi-industry conferences generating high profile, peer-reviewed publications of academic and industry-based research.
- Publishing an annual review of top research in the field.

- Disseminating research findings and, in clear, understandable language, interpreting the practical implications for parents, educators, children's media producers, policy-makers and the press.
- Speakers' Directory and a Consultants' Directory of affiliated researchers, so that other organizations could find trusted experts in the field.

We know can we can help foster an enlightened and successful generation of interactive producers and products through research on children that is developmentally based, multidisciplinary, cumulative, useful to content developers and responsive to the concerns of the public and policy-makers. But we cannot do so without first understanding much more than we do today about how these new media affect children – their thoughts, emotions, social relationships, and even their health. By generating an ongoing flow of credible, useful, systematic research, we can profoundly affect the lives and futures of next generation of Americans who are "growing up digital."

1.0 Introduction

Computer, video game, and Internet use have become a ubiquitous part of child and adolescent culture, and are popular sources of entertainment, information, and preferred leisure activities. Accompanying the escalating use and popularity of these interactive media are increasing questions about how these media can facilitate children's and adolescents' cognitive, social, and health-related development. Moreover, the promise of the networked world of the Internet and World Wide Web is that we have the potential to profoundly shape children's education by developing educational materials that can more easily traverse the home to school environment. Convergence of media in the home can shape the quality of children's healthy development by providing them with access to information, people and entertainment of unprecedented scope and influence.

How will these new media affect children's lives? What kind of evidence do we have about their power to influence cognitive, social, emotional and even physical development? What sort of research do we need to better understand the role of these new media? And can we suggest research that will inform media producers, public policymakers and parents?

We acknowledge that few studies have actually been conducted on these important questions and hence, in the review we cover only the available published studies. This, then, is a review of the extant work on the role of interactive media in children's development. Our focus is on emerging communications media—video games, CD-ROMs, the Internet and other computer software—and how children use such media in the home and in other out-of-school settings. Where it will be relevant and useful, however, we will refer also to research on children's use of older media, such as television and film. The purpose of the review is to identify critical research questions that might aid parents, policy and media design. We especially hope to strengthen the dialogue between those who study children and their media environments and the media creators, media managers, and policy makers who build those environments while providing useful information to parents on both the promise and potential perils of new media for children.

This report will (1) review what we do and do not know about children's and adolescents' use of interactive media in out-of-school environments, (2) describe the effects of that use on cognitive, social, and health-related development, and (3) propose directions for future research. The goal is to

highlight the foundation literature, as well as the most recent publications in the area of children and new technologies. We have included a comprehensive listing of citations to complement the literature review in the form of an annotated bibliography.

In this review, we offer a view of child development as shaped by processes of media socialization. Within that framework, we discuss the special role of interactive media. We draw from varied theoretical backgrounds to examine both the potential and actual evidence of how interactive media influence children. In particular, we have noticed that the literature on the role of interactive media in children's learning (and thus interactive media's impact on cognitive development) is rooted in a literature on media socialization that is quite distinct from the uses and effects model, which dominates the literature on the impact of media on children's social development and behavior.

The concept of media socialization, which examines specifically how different kinds of media influence children's cognitive growth, is a perspective which has emerged over the last fifteen years as a key framework for understanding how and what children take from their experiences with communication. It is grounded in classic thinking about the nature of language socialization (Shieffelin & Ochs, 1986), the nature of education and learning (Hickman, 1990; McDermott, 1981; Pea, 1994), mind, self, and society (Mead, 1934), cognitive development (Piaget, 1964), social cognitive development (Vygotsky, 1962) and dialogue (Bahktin, 1990). Following Scribner and Cole (1981) we believe that such a framework can be generalized to understand the role of any communications medium in learning.

The core idea within such a perspective is that learning is social, i.e., grounded in performances in specific socio-cultural situations. To learn one must interact with the world, and to interact with the world one must take an interactional role. We go through the world as acting selves, and our stance toward each situation is created by our sense of identity—who we are, what we are expected to do, what we are trying to achieve, what tools and other resources we can command to accomplish our ends. Thus, out-of-school environments and experiences (including media experiences) can be influential in children's learning. Children will take from these various interactions with media, knowledge and generalizable skills. The job for research is to examine how children use media to construct cognitive representations of their interactions. Within this perspective is the work of Seymour Papert and his colleagues at the MIT Media Lab who have proposed "constructionism" as both a theory of learning with media and a strategy for education (Harel & Papert, 1991; Kafai &

Resnick, 1996). Children formulate ideas and are most likely to learn when they are actively engaged with external artifacts such as toys, computer programs, videogames or programmable bricks.

A slightly different theoretical approach to examine the role of interactive media in children's social development is derived from and modeled on the study of children's social learning from television and other "old" media. Here, questions of how the content of media—including violent, sexual, or commercial content—may influence children's own attitudes and behaviors are posed. Furthermore, formulations of social learning theory (e.g. Bandura, 1977), arousal theory or cultivation theory (National Television Violence Study [NTVS], 1996) all suggest ways in which children's own behavior may be modeled after images in the media. In short, media present models of social interaction which are thought to influence children's knowledge, attitudes and behaviors. This "effects" paradigm has been especially influential in identifying a "problem" oriented approach to studying children and media. How does viewing violence affect children's aggressive behavior? Can collaborative software programs teach children such pro-social behaviors as cooperation? How do advertising and the new forms of marketing in the networked environment influence children's consumer behavior?

The substantial literature on television's influence on social behavior (Comstock, Rubinstein & Murray, 1972; Comstock, 1991; Huston et al., 1992; Pearl, Bouthilet, & Lazar, 1982) is the model for studying how interactive media may influence the social development of children. Numerous studies affirm that entertainment programs, as well as specifically designed educational programs and software influence children's social learning. Further, media effects researchers argue that entertainment media offer children an "informal curriculum" regarding social behavior that is taught through the social content of entertainment in media, and that children are as likely to learn this content as they are to learn the formal curricula in the schools. Of course, children's learning about the social world portrayed in media is influenced by what media messages children are exposed to, the nature of media portrayals of social behavior and children's cognitive abilities to understand and interpret media messages. Thus, the effects tradition provides a number of strategies for assessing the role of media in children's development: survey studies of how children use media; content analyses of media portrayals; and experimental and field studies of the "effects" of media portrayals on children's knowledge, attitudes and social behaviors.

The recent publication of the first comprehensive national survey in nearly thirty years to examine

media use demonstrated that children are immersed in media. *Kids & Media @ The New Millennium*, is based on a nationally representative sample of more than 3,000 children ages 2–18 (Roberts, Foehr, Rideout, & Brodie, 1999). For a complete report on a variety of media-use activities, including television, videotapes, movies, print media, video and computer games, and music, visit the Kaiser Family Foundation Web site at http://www.kff.org for further details.

This report is organized into four sections: (1) media use and access,

(2) cognitive development, (3) social development, and (4) health and safety issues. These areas were derived in part after initial literature searches yielded research articles that could be categorized into these general topic areas. The primary source for the citations was a review of on-line databases, particularly PsycINFO, MEDLINE, Social Sciences Abstracts, Sociological Abstracts, and ERIC. Abstracts were searched using combinations of the following key words: advertising, children, computers, computer games, interactive, Internet, media, video games, and violence. Searches were also conducted on specific names of research scientists working in the area of interactive media and children.

A second source of guidance in determining topic areas came from experts themselves. A conference of researchers, educators and policymakers was convened to discuss the topic areas selected for the literature review, as well as areas of interest and concern to the research and policy communities. Appendix A includes the list of experts who attended the Austin conference held in November, 1999. Those attending were consulted about locating specific references within their expertise and were asked to review drafts of the report. Finally, the literature selected for the review and the annotated bibliography was primarily limited to published articles in academic journals, well-publicized research from Web sites, studies focusing on children and adolescents, and research emphasizing out-of-school environments.

Environments outside of the classroom have become contexts for the use of a wide range of entertainment and information technologies. Evidence suggests that children who own or have access to home computers, for example, demonstrate more positive attitudes toward computers, show more enthusiasm, and report more self-confidence and ease when using computers than those who do not have a computer in the home (e.g., Anderson, Lundmark, Harris, & Magnan, 1994; Bannert & Arbinger, 1996; Colley, Gale, & Harris, 1994; Comber, Colley, Hargreaves, & Dorn, 1997; Kirkman,

1993; Levine & Gordon, 1989; Siann, Durndell, Macleod, & Glissov, 1988). Furthermore, unstructured environments such as the home, recreational settings, after-school programs, children's museums, and the like may offer more varied learning opportunities than those provided in the structured classroom setting. Meaningful, extended, and uninterrupted time on the computer, for example, is more readily provided in the home than in the computer-sharing classroom (Kirkman, 1993; Schall & Skeele, 1995). Risk-taking and experimentation are more comfortable at home, a context which facilitates creativity and other forms of higher-order thinking (Krendl & Lieberman, 1988). The use of technology in curriculum-based educational settings is an area of research beyond the scope of this review. Interested readers, however, are encouraged to access a recent review in this area via the Web site of the *Center for Children & Technology* at http://www.edc.org\CCT\cctweb.

With this introduction, we now turn our attention to the review of children's access to and use of interactive media. This topic has spawned a number of recent national studies as we become more aware of the technological revolution affecting our lives.

2.0 Media Use & Access

An examination of the amount of time children spend with a particular medium is among the most basic steps in understanding the potential effects of new media technologies (Kubey & Larson, 1990). While the media-use patterns of children and families have been studied extensively in research on television, national sample research on the use of interactive media is only recently entering the literature. Of course, there is anecdotal evidence that children's lives are increasingly taken up with video game playing, browsing the Internet and conversing in chat rooms; yet, there is relatively little systematic examination of the sorts of social content children are exposed to through interactive media. Moreover, any review of children's use of "new media" should caution readers to note that these are studies of a constantly moving target. Over the course of the 1990s, patterns of children's media use changed radically just as the decade saw the explosion of the Internet and the World Wide Web. Consequently, the "time bound" nature of the evidence regarding children's media use is important to remember. For instance, early in the 1990s, girls were thought to have little interest in computers. Yet, as software marketed for girls diffused (e.g., *Barbie Fashion Designer*, *Purple Moon*, *The American Girls Premiere*), the gender gap in children's use of computers is now thought to be solely a function of the differences in amount of time boys and girls spend with video games and not their use of computers for activities such as Internet use, chat rooms, and e-mail (National School Boards Foundation [NSBF], 2000).

In the next section, we present the most recent data on interactive media use focusing on four demographic variables: sex, age, socio-economic status, and ethnicity of child users. The primary domain of use is the home environment.

2.1 Sex Differences

Over the past two decades researchers have examined sex differences in relation to children's use of interactive media in different locations (e.g., home, school, and arcade), in relation to numerous psychological outcomes (e.g., interests, attitudes, anxiety, self-confidence, and competency), and by specific domains of use (e.g., computer or video games, homework, e-mail use, and Internet use.) Since 1999, several studies have examined children's use of the Internet, however, this area of research is still in its infancy. The genre or domain of interactive media use that has received substantial

research attention is computer and video game play, and accordingly, our primary focus is on that literature.

As documented by Roberts et al. (1999), gaming is the most common way in which youth of all age groups (2–18 years) use computers. Sex differences in preference for and in total time playing computer and video games in home and arcade settings have been consistently reported, with boys reporting significantly more time commitment than girls (e.g., Bamossy & Jansen, 1994; Barnett et al., 1997; Colwell, Grady, & Rhaiti, 1995; Comber et al., 1997; Funk, 1993; Funk, Germann, & Buchman, 1997; Greenfield, 1994; Griffiths, 1991; Griffiths, 1997b; Griffiths & Hunt, 1995; Harrell, Gansky, Bradley, & McMurray, 1997; Huston, Wright, Marquis, & Green, 1999; Kubey & Larson, 1990; Lin & Lepper, 1987; Phillips, Rolls, Rouse, & Griffiths, 1995; Provenzo, 1991; Roberts et al., 1999; van Schie & Wiegman, 1997; Wiegman & van Schie, 1998; Wright et al., in press). These findings come primarily from questionnaires asking children and adolescents to report estimates of the amount of time spent playing games. The recent findings of Huston et al. (1999), Roberts et al. (1999), Wiegman and van Schie, (1998), and Wright et al. (in press) come from an analysis of time-use diary data and information on daily activities, which is usually provided by primary caregivers and children. Time-use diaries have the advantage of (1) increasing accuracy as systematic reporting of daily activities is easier for participants than recollection of general time estimates, (2) capturing all of the child's activities, permitting examination of a diverse range of activities, and (3) being less subject to distortions of social desirability than are survey questions about frequency of use.

To understand the role of interactive media in the lives of children, it is perhaps more important to gather detailed information about time spent using *particular types* of content, not just an index of total use. Interactive games vary widely in their content and effects are partially dependent on that content. Concern about preference for and play of *particular types* of game content has motivated researchers to develop systems of categorizing game content, often with some similarities to television coding systems. Researchers have used codes modeled after television and film motifs including genres such as crime and violence, military adventures, sports, and cartoon/fantasy (Gailey, 1996). Categories have also been created based on the primary action or main goal of the game: general entertainment, educational, fantasy (cartoon) violence, human violence, and sports violence (Funk, 1993; Funk & Buchman, 1995). Funk and colleagues are particularly interested in the effects of playing violent interactive games on health and social behaviors, and as such have incorporated various types of violence into their categorical coding system. Wright et al. (in press) designed their game coding

system to reflect cognitive demands of the game as well as some content features; the categories indicate the types of mental and sensorimotor activities required by the player. The categories include education, sports, sensorimotor (with sub-categories of action/arcade, fighting/shooting, driving/racing, and other vehicular simulations), strategy (with sub-categories of adventure/role playing, war, strategic simulations, and puzzles/games), and other content.

Evidence from the few studies that have analyzed categorical data show that boys and girls prefer different types of game content. Gailey (1996) interviewed and observed game playing of 21 urban children ranging in age from six to twelve, and found boys preferred violent action games and sports games and girls preferred puzzle or spatial relation games, such as *Tetris*, and fantasy-adventure genres. Barnett et al. (1997) and Griffiths (1997b) found similar patterns of content preferences reported by adolescents, as did Wiegman and van Schie (1998). In a larger survey of 900 children in grades four through eight, Funk et al. (1997) found that girls were more likely to list educational games as favorites, while boys more often preferred sports games. Girls expressed a stronger preference for games containing cartoon fantasy violence, while boys preferred games categorized as realistic human violence (Buchman & Funk, 1996; Funk et al., 1997). In analyses of nationally representative samples, Wright et al. (in press) found boys spent significantly more time per week playing sports games than girls (boys=62.43 min; girls=7.54 min). Similarly, Roberts et al. (1999) reported that boys have a much stronger preference for media content related to action/adventure and sports.

Sex differences in interactive media use are of theoretical interest since young children are thought to develop sex-typed attitudes, preferences, and behaviors through observations of the world around them, including the media they are exposed to (for a comprehensive treatment of this topic see Serbin, Powlishta, & Gulko, 1993). There has been growing consensus among researchers that no single theoretical framework can adequately account for all aspects of sex typing (Huston, 1983; Katz, 1986; Serbin et al., 1993).

Cognitive developmental theorists focus on children's developing knowledge of gender stereotypes, which is thought to precede and facilitate sex differences in behavior. Those working from the perspective of gender schema theory suggest that gender schemas (our thoughts about characteristics of males and females) help individuals choose behaviors that are "appropriate" for their own sex. Social learning theorists emphasize behaviors and preferences over cognitions. Children are thought to acquire sex-typed behaviors gradually, through observation of sex-typed patterns in others, as well as

by being reinforced for their own sex-typed behaviors (Serbin et al., 1993). It is likely that all of the above contribute to some degree to sex differences in interactive game play, although there is very little systematic, theoretically-driven research investigating those possibilities. For example, Williams and Ogletree (1992) examined preschool children's sex-typed beliefs concerning computer attitudes, interest, and competence. Little evidence was found to support any gender differences in the areas of computer interest or competence. These findings contrast with the gender differences that dominate the computer literature for elementary, high school, and college populations (Williams & Ogletree, 1992). If in fact computers are stereotyped as "masculine" in later elementary years, girls have not yet acquired such perceptions in the preschool years. The strong implication is that engaging interest in computers should be undertaken early in the educational experience of all children.

We know significantly less about how boys and girls use other types of interactive activities. A glimpse into the role of the Internet in children's lives, however, can be obtained from a March 2000 national survey conducted by the National School Boards Foundation (NSBF) and Grunwald Associates (http://www.nsbf.org/safe-smart/br-overview.htm). In this survey of Internet use by children ages 2–17 from 1,735 households, we find that boys and girls are equally involved in using the Internet, albeit they use it in different ways. Girls were more likely to use the Internet for education, school work, e-mail, and chat rooms, whereas boys were more likely to use the Internet for entertainment and games (NSBF, 2000). The study clearly shows that girls are not phobic or even disinterested when it comes to the Internet, in contrast to interactive gaming.

No single source creates the apparent differences between boys' and girls' use of interactive media, particularly games and other software. The interactive game "culture" is a prominent part of boys' socialization experiences. Gaming has become a collective leisure activity for boys, and boys' tendency to incorporate computing or gaming into friendship networks may influence use at home and at school (Chen, 1986; Haddon, 1993; Lindlof, 1991). Paradoxically, even though many assume that interactive games are frequently played in isolation, they are often the focus of social contact for many boys (Barnett et al., 1997; Gailey, 1996; Goldstein, 1994; Orleans & Laney, 2000). Gailey (1996) observed that Nintendo games were frequent and intense topics of conversation among siblings and peers at home, school, day care, and other locations. No documentation of the amount of time spent conversing was provided, however. The children shared information about dangers and rewards, and generally gave each other advice and encouragement. Subrahmanyam and Greenfield (1998) noted similar behaviors. They found that boys compared notes about levels of game play and scores they had

obtained. It is probable that such social interaction and camaraderie serve as reinforcing behavior, which encourage future game play. Colwell et al. (1995) found that males ages 11–17 years who did report frequent game playing were also those likely to see their friends more often outside school.

The content of game software has generally been more appealing to boys than girls. An illustration of this phenomenon (with the early genre of games) can be seen in the work of Johnson and Swoope (1987) with 330 children in grades 1, 3, 5, 7, 9, and 11. Children's interest in computers and video games was measured using a 46-item interest inventory composed of stereotypically masculine, feminine, and neutral items. The following three target items were embedded within the questionnaire: Star Trek video game, Ms. Pac Man video game, and computer. Three forms of the questionnaire were administered: 1) How interested would girls be in using the item? 2) How interested would boys be in using the item? 3) How interested would you be in using the item? Interest in playing video games was strongly influenced by the content. When the video game had a masculine theme (i.e. Star Trek), both genders rated boys' interest significantly higher than girls' interest. When the video game had a feminine theme, (i.e. Ms. Pac Man), both genders rated boys' and girls' interests about equal. Both genders perceived boys to be more interested in computers, but male and female ratings of their own degree of interest showed no significant differences (Johnson & Swoope, 1987).

Numerous observers and researchers have suggested that the predominant masculine content of fighting, war, or other violent themes is likely to account for the differential appeal of video game and computer technologies to boys and girls (e.g., Armitage, 1993; Dorr & Kunkel, 1990; Johnson & Swoope, 1987; Kafai, 1996; Kinder, 1996; Kubey & Larson, 1990; Linn, 1985; Murray & Kliman, 1999; Skeele, 1993; Subrahmanyam & Greenfield 1998; van Schie & Wiegman, 1997; Wiegman & van Schie, 1998). Moreover, one might also consider the behaviors required to win numerous interactive games. In many cases, playing video and computer games encourages players to repeat cycles of competitive, aggressive behaviors (Dill & Dill, 1998; Funk & Buchman, 1996; Griffiths, 1999a), behaviors not generally considered desirable for females (Serbin et al., 1993).

Classroom observers and teachers indicate that boys tend to monopolize computer-use time in the classroom, particularly in periods of uncontrolled access (Bhargava, Kirova-Petrova, & McNair, 1999; Cassell & Jenkins, 1998; Kinnear, 1995). Teachers may unintentionally create a self-fulfilling prophecy for girls by allowing boys to spend greater amounts of time working on the computer in the classroom. The findings of Kinnear (1995) suggest that teachers may actually perceive girls to be less interested in

and competent with computer activities due their lack of assertiveness in requesting time on the machines.

It has been suggested that interactive game play has the potential to significantly influence experience with and attitudes toward technology (Emes, 1997; Greenfield, 1984; Greenfield & Cocking, 1996; Murray & Kliman, 1999; Subrahmanyam and Greenfield, 1998). If such play is an "introduction" to later computer use and computer literacy, boys have an advantage of early experience and comfort with interactive media. Such perceptions or schemas may have detrimental effects on female interest in and use of computer technology in the worlds of work and play to which they provide access.

Researchers, educators, and parents have expressed concern about girls' seeming disinterest in computer technology and the dearth of appealing interactive games available for girls (Cassell & Jenkins, 1998; Murray & Kliman, 1999). The realization that girls are an interested target audience led to increased efforts to design interactive content for girls as well as boys. The growth of specific software developers targeting girls such as *Girl Games* "Let's Talk About Me" and Mattell's *Barbie Fashion Designer* demonstrate that girl-oriented content may be successful; nonetheless, several highly publicized girl video game companies, such as *Purple Moon* from the mid 1990s, did not succeed in the marketplace. While it is likely that games and activities which encourage social interaction will attract girls' participation (Corston & Colman, 1996; Vail, 1997), it is clear that ongoing efforts are needed to develop engaging, interactive content and environments for all children. In the report released by the American Association of University Women Educational Foundation (http://www.aauw.org/2000/techsexecsum.html), the AAUW commission emphasized that girls are critical of the computer culture rather than computer phobic. They dislike both the violence present in interactive games and the narrow, technical focus of computer programming classes. The commission members believe that girls' legitimate concerns should focus our attention on changing software content, the way computer science is taught, and the goals we have for using computer technology (AAUW, 2000). Rather than thinking in terms of 'boys' or 'girls,' we need to focus on creating interesting content that will engage the minds of *all* children.

2.2 Age Differences

Children's media choices and preferences do change as they mature. As with television, changes in media-use habits as children grow older appear to result from changes in use opportunities and from cognitive and social developmental changes (Huston et al., 1992). Evidence suggests that patterns established at an early age tend to be highly predictive of later media-related preferences and achievement (Neuman, 1991). Surprisingly, however, there are very few current studies of children's interactive media use that include children of preschool age.

The work of Huston et al. (1999) focused on these young media users and found sex and age differences for many types of activities, including video game use. Time-use diaries were collected over a three-year period for two cohorts of children ages 2–5 and ages 4–7. Analyses of longitudinal time-use data of these children showed that video game play increased with age and that boys spent more time than girls playing video games; furthermore, the magnitude of this difference between boys and girls increased with age (Huston et al., 1999). In the final year of the study, younger children played 14.67 minutes on a weekend day and older children played 26.92 minutes on a weekend day (Huston et al., 1999). Downes (1994) also reported a widening with age of this "use gap" in a survey of 460 Australian elementary children (ages 5–7 and 8–12). Unfortunately, these data sets did not permit exploration of specific game content.

This limitation was addressed by Wright et al. (in press) with the analyses of 730 children ages 0–12 years of age. The youngest children (0–5 years) spent significantly more time per week playing educational content games than the older children (83.77 minutes and 22.44 minutes, respectively). In contrast, the 9–12 year-old children spent much more time playing sports games than any of the younger age groups (60.56 min and 26.82 min, respectively). Roberts et al. (1999) reported similar patterns of content use.

Buchman and Funk (1996) surveyed children 9–12 years and found that the total time spent playing interactive games steadily decreased as a function of age (from 5.6 hours per week to 2.5 hours per week from fourth to eighth-grade for girls, and from 9.4 hours per week to 5 hours per week for boys at the same grade levels). Preference for educational games also decreased as a function of age for both girls and boys. Younger children were more likely to prefer educational games than older

children. Although the data provide important insight into preferences of game categories for children of different ages, the age range is limited to 9–12 year old children. Roberts et al. (1999) present similar findings. It is clear that we found few studies placed within a developmental framework, a step that is necessary for future research.

2.3 Socio-economic Status & Ethnicity

The "digital divide" or unequal access to digital media across socioeconomic and/or ethnic groups continues to persist, as does the debate in public policy circles about possible implications and solutions.

The U.S. Bureau of the Census in collaboration with the National Telecommunications and Information Administration (NTIA) provides one source of information about computer ownership and individual use. The NTIA reported that significant growth in computer ownership and usage overall from 1994 – 1997 had occurred to a greater extent in some income levels, demographic groups, and geographic areas, than in others (McConnaughey, & Lader, 1998, http://www.ntia.doc.gov). Households earning below $35,000 had ownership rates of 36.6% and online access rates of 26.3% (below the national average). In contrast, households earning more than $75,000 in urban areas had the highest computer ownership rates (76%) and online access rates (50.3%) (McConnaughey, & Lader, 1998). White households were twice as likely (40.8%) to own a computer as Black (19.3%) or Hispanic (19.4%) households (McConnaughey, & Lader, 1998).

Hoffman and Novak (1999) reported similar results from analyses of three surveys (Spring 1997, Fall 1997, and Spring 1998) of the CommerceNet/Nielsen Internet Demographic Study (http://www2000.ogsm.vanderbilt.edu). An important focus of the project is the collection of Internet and Web-use data from persons 16 years or older of different racial and ethnic groups. Highlighted findings include Whites were more likely to have access to the Internet and to Web use than Blacks and these gaps seem to be increasing over time (Hoffman & Novak, 1999). Moreover, gaps in computer ownership and Internet access persisted even after controlling for educational differences.

In addition to these studies of household uses of interactive technology, research by the Annenberg Public Policy Center and the Kaiser Family Foundation has focused primarily on children's at home

media environments. The Annenberg Public Policy Center 1998 national survey of media use among families with children (http://www.appcpenn.org) provides further evidence of a digital divide. Stanger and Jamieson (1998) reported 32.5% of families with annual household incomes below $30,000 reported owning a home computer, while 61% of those between $30,000 and $50,000, 73.8% between $50,000 and $75,000, and 88.1% above $75,000 reported home computer ownership. Online access for families in each income level was 12.9%, 24.6%, 39.9%, and 61.1%, respectively (Stanger & Jamieson, 1998).

Roberts et al. (1999) of the Kaiser Family Foundation found similar evidence using federal estimates of median household income in the zip code area of each school or household. Forty-nine percent (49%) of youth who went to school or lived in zip codes with a median household income of $25,000 or less per year reported having a computer in the home; 66% of youth from zip codes between $25,000 and $40,000 reported owning computers; and 81% of youth from zip codes greater than $40,000 reported having a computer in the home (Roberts et al., 1999). Seventy-eight percent (78%) of White youth came from homes with at least one computer, which is considerably more than Blacks (55%) or Hispanic (48%) youth (Roberts et al., 1999).

Clearly, the underlying policy concern is whether children without access to computers at home will be disadvantaged in the increasingly "wired" schools and in the workplace. Evidence suggests that children who own or have access to home computers demonstrate more positive attitudes toward computers, show more enthusiasm, and report more self-confidence and ease when using computers than those who do not have a computer in the home (e.g., Anderson et al., 1994; Bannert & Arbinger, 1996; Colley et al., 1994; Comber et al., 1997; Harvey & Wilson, 1985; Kirkman, 1993; Levine & Gordon, 1989; Siann et al., 1988). Furthermore, Hoffman and Novak (1999) report that individuals with home computers are much more likely to use the Web. Some individuals, however, lack access to computers or Internet connections in their homes, thereby limiting their ability to make full use of the vast information resources provided by such access.

Acquisition of hardware or software, however, is not synonymous with effective use (Steinfield, Dutton, & Kovaric, 1989; Treitler, 1996). It is clear that the mere availability of computer hardware and software is not sufficient for effective integration of the varied applications and benefits technology can provide. Without the necessary knowledge and skills, the full potential will not be realized. The Internet delivers social and economic value to those individuals who can use it skillfully,

and opportunities will increasingly go to those with access to networked information services and possession of the skills necessary to use them (Batteau, 1996; Bikson & Panis, 1997; Civille, 1995; Hoffman & Novak, 1999; Michaelson, 1996; Vitalari & Venkatesh, 1987).

It may be the case that lack of knowledge and experience are perceived as barriers to using computers (Clark, 1996). A striking illustration of such cognitions comes from a description of the personal perceptions of residents participating in a project providing a Chicago inner-city community with Internet access. Inner-city residents often face other problems that limit their access to computers even if the hardware and software are available (Clark, 1996):

"In a community that is suffering from problems such as violence, substance abuse, unemployment, and lack of day care, many residents value computers but find that other needs take priority or limit their ability to take advantage of resources such as computers…Although children of all socio-economic statuses may be attracted to computer games and educational software, adults may be intimidated by computers because they may believe that their own lack of education or experience prevents them from learning how to use them" (Clark, 1996, p. 55).

Computers may be perceived as complicated devices requiring a certain degree of "expertise." Consequently, beyond the underlying issue of physical access to computer hardware and software is the development of computer literacy. The findings of two recent research programs lend support to the importance of computer experience and developing these technological skills. In the *Annenberg National Survey on the Internet and the Family* (http://www.appcpenn.org/internet), Turow (1999) discovered that formal education and income were not the major determinants of online connections in the home; rather, parents' experiences with the Internet and Web outside the home were more important predictors.

Second, *HomeNet* is an ongoing project developed at Carnegie Mellon University with the purpose of understanding the use of the Internet in the home environment and assessing its social impact (http://homenet.hcii.cs.cmu.edu). Similarly, in an analysis of the *HomeNet* project, neither household income nor education predicted Internet use (Kraut, Scherlis, Mukhopadhyay, Manning, & Kiesler, 1996). Rather, generation – or the difference between adolescents and their parents – was the strong predictor of use. Teenagers, particularly teen males, were the most frequent users of the Internet; in turn, they often provided motivation for their parents to learn to use the Internet (Kraut et al., 1996).

Both the Annenberg and Carnegie projects, highlight the importance of knowledge, familiarity, and comfort with the Internet, which subsequently influence frequency (and likely diversity) of future use.

SES also seems to influence access to particular types of interactive media content. While similar *entertainment* content is available for both computer and video gaming systems, the vast majority of *educational* software is available only for those who have access to a computer or perhaps a net appliance. To date, the producers of video games have designed very few educational games. Video game consoles are less expensive than computer systems, and it is possible that video game content (as opposed to educational content designed for computer systems) is more common in the households of lower-income families, who have purchased video game consoles rather than computers.

Some support for this proposition can be attained from the Roberts et al. (1999) study. Video game play was twice as common as playing games on computers; correspondingly, ownership of video game equipment was more common in lower-income households than higher-income households. It is likely that income level and parent education contribute to the differences in access to these two platforms. For example, younger children who live in zip codes where the median household income is less than $25,000 were three times more likely to have played a video game the previous day than to have played a computer game (Roberts et al., 1999). Additional research is needed to further describe the differences in equipment ownership, rationale for ownership decisions, and use of particular content across ethnic groups.

Published empirical research focusing on the interactive media-use experiences of ethnic minorities is limited. Ethnicity is often associated with income and education levels (i.e., ethnic minority groups with disproportionately lower incomes and less education); however, Civille (1995) suggests that income, education, and location are stronger driving forces in creating information haves and have-nots than is ethnicity or race.

Reports of demographic data such as those discussed above indicate that computer ownership is lower in minority households than in white households. Furthermore, computer and Internet inequity has persisted in the nation's public school systems (Becker & Sterling, 1987; Carver, 1995; Educational Testing Service, 1997; Metzendorf, 1988; Sax, Astin, Korn, & Mahoney, 1998; Sutton, 1991). While efforts are being made to bridge gaps in the school systems, the nature of the computer instruction students receive may differ from one environment to another. For example, past research has shown

there is a measurable tendency for the curriculum of Black children attending urban inner-city schools to contain more isolated skill development, remedial instruction, and drill-and-practice than the more complex problem-solving applications found in predominantly white schools (McAdoo, 1994). The informative ethnic comparison between racial groups in the *same* income and educational context has, unfortunately, not been reported.

It will be difficult for children to reap the full benefits of computer technology and networked information services (1) without access to quality hardware and software, and (2) without the instruction or training necessary to engage in more complex, discovery-oriented, or problem-solving applications, all of which lead to more diverse uses of the medium. Carver (1995), particularly interested in the development of Black adolescents, suggests that more effort be given to transforming the home and school environments into settings which can provide Black youth with knowledge about computers and which stress the role and importance of computers in society. This creation of a "home-school partnership" for learning and acquiring computer literacy is a recurring theme in the literature (e.g., Carver, 1995; Deringer, 1986; Downes, 1994; Giacquinta & Lane, 1990; NSBF, 2000; Schall & Skeele, 1995).

Finally, it might also be pointed out that the new generation of video game platforms (such as Playstation II) allow for Internet access. New, cheaper net appliances are expected in the marketplace soon. Might these platforms, as opposed to more traditional PCs and desktop computers, enable lower SES and ethnic minority families to gain access to the networked world of the Internet bypassing PC ownership completely? It seems possible, if not likely.

2.4 Use in Other Interactive Domains

While much of the discussion of sex and age differences has focused on interactive game use, computer use (specifically use of the Internet) in the home environment can offer families a powerful tool economically, socially, and politically (Bikson & Panis, 1997; Civille, 1995; Hoffman & Novak, 1999; Hood, 1998; Lazarus & Mora, 2000; Montgomery, 1998; Wakefield, 1985). Such empowerment means that family members can take control over daily decision-making and exercise options related to education, work, health care, and the like. For instance, results of a consumer survey conducted in the early 1990s indicated that those in households earning less than $15,000 a year were the most

interested in acquiring independent consumer product information on automobile and health insurance, eyeglasses, and prescription medication (Civille, 1995); other needs included access to information about employment opportunities and child care (Clark, 1996; NTIA, 1995). With less income available, families wanted to make more informed decisions regarding these important purchases. In the most recent analysis of online content for low-income and underserved Americans, Lazarus and Mora (2000) found that these individuals wanted (1) practical community-related information (e.g., local job and home listings), (2) information at a basic literacy level, (3) content for non-English speakers, and (4) cultural information (e.g., ethnic interests, health information targeted toward specific ethnic groups.) The Internet and World Wide Web are rapidly becoming vital links to the world's commerce, communication, and culture (Montgomery, 1998).

Researchers focusing on ethnic differences found that White Web users were more likely to report searching for product or service-related information than Blacks (Hoffman & Novak, 1999). The authors suggest we may gain insight into the underlying contributors to these ethnic differences by considering the extent of multicultural content available on the Web. The authors suggest that there may be insufficient content of interest to Blacks, thereby diminishing their use of the Web (Hoffman & Novak, 1999). Lazarus and Mora (2000) also found few notable examples of multicultural information available on the local community Web sites they surveyed; in contrast, general cultural sites (e.g., *BET*, *Black World Today*, *StarMedia Networks*, *Click2Asia*) are growing in number for Blacks, Hispanics, and Asians.

A computer in the home influences family functioning in varied ways. Learning and education, leisure and entertainment, household routines, work from home, personal development, extended family communication, and civic involvement are possibly affected domains (Dutton, Kovaric & Steinfield, 1985; Hood, 1998; Hunt, 1985; Montgomery, 1998; Rosenberg, 1997; Steinfield et al., 1989; Wakefield, 1985). Most recently, we can add e-commerce to the list. The potential and actual uses of computers in the home are evident, and becoming more varied and complex with the advances in the processing capacity of new hardware and technical features of associated software. Further information is needed, however, exploring the determinants and consequences of using networked information services, notably e-mail communication and the Internet, within the home. How do uses differ for individuals of different backgrounds, including gender, SES, and ethnicity? Roberts et al. (1999) and Henke (1999) provide glimpses of children's and adolescents' use of and preference for

various Web sites, and it is clear that entertainment and commercial sites are very popular with children.

The review of the media use literature reveals significant differences in patterns of interactive media use, specifically due to game play, between boys and girls and among children of various age groups. A close examination, however, also reveals several gaps in the literature. Striking examples include the absence of research exploring variations in interactive media use among children of different ethnic groups and among children younger than eight years of age. While Roberts et al. (1999) presented differences among ethnic groups for 8–18 year olds by type of interactive game (e.g., action, adventure, education), they were not able to analyze the use patterns of the younger children due to small sample sizes. This report does not explore children's use of interactive toys or hand held networking devices, such as Palm Pilots and digital phones. Systematic research on these interactive technologies is lacking, yet they appear to be diffusing quickly into homes, schools, and the workplace.

We continue to learn more about what individuals and communities need and want from online environments (e.g., Civille, 1995; Hoffman & Novak, 1999; Kraut et al., 1996; Lazarus & Mora, 2000). Ongoing research is necessary to understand what motivates individual level adoption of home computers and Internet use, both within and outside the home environment (Hoffman & Novak, 1999). In contrast, we are particularly limited in our understanding of how children use networked services from their homes. Accordingly, it is essential for researchers to adopt a developmental, even lifespan, perspective when studying the technological experiences of individuals and families.

2.5 The Evolving Media Environment

Much of the pertinent research on children's use of media has focused on the uses of *particular* media (e.g., books, television, computers, Internet) and not on the whole media environment. The literature on print literacy has virtually no overlap with the literature on children and television, and these in turn have little connection with literature on children and computers. While this may have been a useful simplifying strategy in the past, it appears increasingly less viable in an age of media convergence.

Media convergence refers to a process in which formerly distinct methods of communication merge to create new media. We can understand this process at a technical level, in terms of the hardware,

software, and standards that make such convergence possible. We can understand it at a social and cognitive level, in terms of the ways in which previously distinct information sources and new capabilities such as interactivity or telepresence alter the flow of information and influence. Or we can understand it at an institutional level, in terms of the ways in which communications policies and industries are realigned in response to new social challenges and business opportunities. But however we choose to look at these processes of convergence, it is clear that they are going to change the media environment into a more seamless presentation system, in which discourses—packages of communication content—interact with audiences across multiple media.

Moreover, the impact of such convergence will be felt even more strongly in light of the increasing pervasiveness of digital media. "Pervasive computing" refers to the incorporation of computational and representational capabilities into the spaces, objects, and tools with which we surround ourselves. To the extent that such pervasive computing is networked, as everyone now expects it to be, we will see the emergence of a highly interconnected, constantly available digital media environment. Of course, we should not forget that the prospect of pervasive and convergent media is not equally available to all. To the extent that educational or socioeconomic barriers limit access, the ideal of pervasive communication will not be a reality, as was noted in the previous section.

Nonetheless, media products increasingly involve coordinated presentation of content in multiple media. As an example, consider the phenomenon of "Pokémania." *Pokémon*, released originally as a Nintendo game in 1996, was instantly popular with elementary school students, first in Japan and then in the U.S. as well. The game was followed by a cartoon series on television, trading cards, toys, and comic books. A very successful *Pokémon* motion picture was released in late 1999, coordinated with a community-building program sponsored by Burger King in which children met on a specific night at their restaurants to trade *Pokémon* cards. *Pokémon* moved across multiple media, evolved, and was incorporated into children's culture via its repeated manifestation in their lives. Understanding the impact and influence of *Pokémon* requires understanding its presence in an increasingly more seamless communications environment and its integration into children's culture and relationships.

Technology convergence and movement of discourses across different communication media are by no means a new phenomenon. Children have always taken content from their media experiences, understood it in their own terms, and used it in the other activities in their lives. It is increasingly clear, however, that these sorts of phenomena cannot be easily studied within a conventional analytic

media-use framework. Future research needs to study not just media use, but also media content and its various media manifestations. Methodologically, this suggests the following: focusing on communities, descriptive research on their adoption of new technologies, and study of their evolving communication networks; conducting design experiments, which permit the development of hypotheses about the future direction of media evolution; and focusing on content genres, and the ways in which content are presented and used through multiple media. In short, "content" and not just "media use" needs to be the subject of future research.

2.6 Summary & Recommendations

If we are to relate interactive media use to other cognitive and social behavioral outcomes for children, then a richer theoretical and conceptual description of "media use" is necessary. In particular, interactive media (video games, CD-ROMs, computer educational/entertainment software, the Internet, the World Wide Web, interactive toys, messaging devices, etc.) vary considerably in their content along dimensions that might be particularly relevant for cognitive or social outcomes. For instance, rather than just studying children's use of the Internet, it would be useful to know whether children are using collaborative technologies (either multi-user games or chat rooms) in order to assess the influence of that content on cooperative behavior. Indeed, interactive media vary along several dimensions, which should be considered: (1) genre of the content (e.g., violent, educational, informational); (2) whether the interaction is synchronous or asynchronous; (3) the modality of the messaging (audio, text-based or audiovisual messages); and (4) whether the user is involved in networked or non-networked interactive activities. These are just several characteristics that vary across interactive media, and accordingly, may influence the impact of such media on children's development. It seems clear that before we begin to speculate on the range of effects interactive media use may lead to, we need research which provides a richer conceptual understanding of the *nature* of interactive media use. These dimensions are a place to start.

Ongoing national studies of how children of different genders, ages, ethnicities, and socio-economic backgrounds are using interactive media for different purposes (e.g., chat rooms, MUDs, gaming, collaborative activities, email, and exposure to various kinds of content such as violence and sexual content) are necessary. The goal of these studies should be to track changes in children's access to new media and the diversity of communication activities such exposure entails. Conceptualization of

media activities along dimensions which may relate to cognitive and social outcomes (e.g., children's use of collaborative gaming and its relationship to the acquisition of cooperative skills and knowledge) is currently sparse in the literature. Furthermore, we need to study those children who may have access to computers and other interactive media in the home, but who choose not to use them. Roberts et al. (1999) found that 69 percent of the children they studied lived in homes containing computers, but only about 40 percent of those reported using them on a typical day. What characteristics of children, families, other social dynamics, and aspects of the usability of the technology itself might account for both use and non-use? How do families incorporate rules regarding interactive media use into child rearing practices and at what ages? How do families use the various technological aids such as blocking devices and ratings systems to guide their children's use of interactive media? We need descriptions of the way children of different ages use new media in the context of their relationships with others and social institutions such as schools, museums and libraries. How do children of different ages use digital technologies in general across these locations? Further, better specification of any developmental differences in interactive media use is warranted, particularly research on pre-school age children.

Technological change combined with the economic, social, and personal attributes of family members will likely continue to create inequities of opportunity across families. Many believe that the digital divide will continue to widen, while others suggest that declining prices in computer equipment and Internet services will allow all individuals and families to enter onto the information superhighway. It is conceivable, however, that even if the digital divide were bridged (i.e., all individuals had access to hardware and Internet connections), the information gap would remain. For instance, individuals of lower education or SES levels may not possess the same abilities, interests, or recognized value of technology as those with relatively more educational attainment or higher SES. Access without a certain level of literacy in the use of these networked information services would be of limited benefit (Civille, 1995; Michaelson, 1996; Pavlik, 1998). Social and economic policies likely influence the opportunities of different children to use these new interactive media. Correspondingly, what are the long-term ramifications for children who do not have adequate access or the necessary skills required to experience the full potential of new technologies? Furthermore, how do children's early experiences with interactive media influence later interests, technological literacy, and career opportunities? These are some of the questions, which can be fruitfully examined in future research on children's media use and access. Finally, because of the quickly changing nature of interactive technology, regular tracking

studies of children's access and use are necessary to fully understand how such media use is part of children's development.

We now move to the effects of using interactive media. There have been three major areas in which effects studies have been conducted: (1) Cognitive development, (2) social development, and (3) health-related development. Reviews of these areas follow.

3.0 Interactive Media, Cognitive Development, & Learning

This section reviews research on children's development and learning from the standpoint of media socialization. The core idea within such a perspective is that learning is social, i.e., grounded in performances in specific socio-cultural situations. To learn one must interact with the world, and to interact with the world one must take an interactional role. We go through the world as acting selves, and our stance toward each situation is created by our sense of identity—who we are, what we are expected to do, what we are trying to achieve, what resources we can command to accomplish our ends. In any situation, our first task is always to learn to perform the role we will take in that situation. The other things we will take from the event—the skills we acquire, the cognitive representations we build—are generated from the process of playing a role in the event. They are by-products of the enactment of self and the pursuit of goals through social activities.

Socialization is the process of acquiring roles and the knowledge and skills needed to enact them. We all encounter situations first as novices, unpracticed and untutored. We meet the challenges of a new situation with the resources we bring (situated knowledge), the assistance of our fellow actors (scaffolding), the process of discovery through which we acquire new resources (inquiry), the process of communication through which we involve others in our learning (dialogue), and a point of view within which to make sense of new activities and determine how to use what we are learning (framing).

3.1 Situated Knowledge

Within one influential theory of human development, cognitive growth is simply the acquisition of situated knowledge and skills. This view, commonly identified with Vygotsky (Vygotsky, 1962; for an overview and commentary, see Wertsch, 1991) but also reflected in the work of contemporary activity theorists (Cole, 1985; Engstrom, 1992; Lave, 1988), treats cognitive structures and skills as the outcomes of learning how to enact roles in particular activities. That is, learning and development are not so much processes of generating abstract, cross-situational principles; rather they reflect the accumulation of learned performances, each specific to a particular activity. From this standpoint, one would expect learning to be highly situation-specific, and indeed, there is a strong case that cognitive skills are situated and not easily generalized from one setting to the next (for an overview, see Lave,

1988). For example, tool use is not generalizable from one tool (sewing machine) to another (drill). Powerful and widely-cited examples of this principle have been offered in studies of navigation in Puluwat (Hutchins, 1995), weaving in Zinacanteco (Childs & Greenfield, 1980), reading and writing among the Vai (Scribner & Cole, 1981), and tailoring in Liberia (Lave, 1977; Reed & Lave, 1979).

As a consequence of the situated character of knowledge and skills, it is often difficult to demonstrate the impact of media experiences on general cognitive growth. However, where researchers have conducted assessments of learning or impact that are closely tied to the kinds of media activities children have participated in, they have been able to show significant effects, at least in the short term. For example, in research on what children learn from playing video games, skill gained in learning to play a video game generalized to very closely related visual and spatial reasoning tasks (Subrahmanyam & Greenfield, 1996; Okagaki & Frensch, 1996) but not to less closely related tasks (Greenfield, Brannon, & Lohr, 1996). Indeed, Greenfield (1996) has argued that different media, which rely on different representational systems, promote the acquisition of distinctive types of cognitive skills. Moreover, as we have learned from prior media research, the medium itself is not the single entity that facilitates change in our perceptions, affect, or cognition. As Salomon wisely noted, "Children's cognitions are not affected by 'Television' or by 'the Computer;' they are affected by specific kinds of *programs* with which they carry out specific kinds of *activities*, under specific kinds of external or internal *conditions* for specific kinds of *goals"* (Salomon, 1990).

The primary vehicles through which we acquire situated knowledge are performance and dialogue, which in turn are produced and understood in relationship to specific social activities. Communication plays a key role in the acquisition of situated knowledge. It is through communication that socializing agents such as parents, teachers, siblings, or peers teach children about new activities, and in particular, how they should enact their roles (including those involving communication) in those activities.

At the same time, communication itself depends on shared, situated knowledge. It is a well-established fact within contemporary language and communication theory that understanding involves not only decoding messages but also making additional inferences about meaning based on knowledge of the context (e.g., Bateson, 1972; Bransford & McCarrell, 1974; Schank & Abelson, 1977). Contextual knowledge includes knowledge of roles, purposes, objects, behaviors, and other elements of an event. So there is a reflexive relationship between messages and activities—messages teach us about

activities, and knowledge of activities helps us understand messages (Greeno, 1989; Brown, Collins, & Duguid, 1989).

3.2 Scaffolding

The foregoing arguments point to two seemingly contradictory conclusions: First, participation in activities requires substantial situated knowledge and skill; and second, the only way to gain situated knowledge and skills is through participation. This apparent contradiction is resolved in practice, where novices seldom encounter situations alone, but rather are supported by more experienced partners and social structures that are tailored to help the learner. Using these supports and their ability to engage in practical reasoning, learners are able to participate in activities and thereby learn their structure and content. This is an "apprenticeship" model of learning, in which knowledge is acquired in the process of performing.

We already know a great deal about the ways in which parents and other partners support children in learning about how to use verbal communication. It has been observed consistently, across cultures, that parents provide explicit instruction in what to say and how to say it. Parents prompt children to speak, including modeling utterances for children to repeat. They also label current activities by name, ask leading questions, simplify messages to make them easier to understand, repeat utterances or actions with the child as a direct participant or observer, or expand the child's utterance to make it an appropriate contribution (Ochs, 1986).

For example, in her groundbreaking study of the role of family dialogue in children's literacy activities, Shirley Brice Heath (1983) examined children's literacy events both in and out of schools. "Literacy events" are activities that involve reading and writing. Common literacy events for preschoolers include bedtime stories, reading labels, advertisements and signs, and interpreting instructions for games and toys. Heath studied preschoolers and their families to learn how they used reading—when they read, how they read, and most importantly, what they took from their reading. She observed that as parents and teachers read to children and discuss books with them, they provide a framework for understanding the material and abstracting it for use in other settings.

Similarly, prompts, hints, pointers, and dialogues can be built into the social environment and used to support unskilled performance. This sort of support is a cornerstone of good human-computer interface design, in which even very unskilled users can often be successful when navigating an interface because their behavior is guided by visual pointers, dialogue boxes, hints, and help systems. Such assistance for the learner is also pervasive in the designed environments in which we live and work, where it enables easier movement into unfamiliar situations (Brown, Collins, & Duguid, 1989).

With visual materials (e.g., film and television), formal features of the presentation provide analogous guidance to the viewer. Formal features are the result of production and editing. They include visual techniques (e.g. zooms, pans, and special effects), auditory features (e.g. sound effects and music), and more global dimensions of program pace, action, and variability of scenes (Huston & Wright, 1994). Formal features attract a child's attention, provide information about program content, and help children process the information presented.

Perceptually salient features are important in drawing young children's attention to a television program when they are not looking at the set (Wright et al., 1984). As children grow older, their developing cognitive skills and increased experience with television enable them to use the formal features to select programs that will be meaningful and interesting to them (Anderson & Lorch, 1983; Huston & Wright, 1994). Animation, children's voices, and visual special effects signal that the content is intended for a child audience, and such formal features are associated with increased attention to the screen for older children.

Children use formal features of media presentations to guide their sense of relevance and aid in information processing. Formal features can highlight particularly important aspects of a message (Huston & Wright, 1994). Rice (1984) found that "Sesame Street" and "Mister Roger's Neighborhood" contained single words, repetitions, literal meanings, and pictures of words being referred to in the program. Such formal features have been called the "syntax of television", and are important in understanding how children learn from television (Neuman, 1991). Media literacy depends in part on a child's understanding of the production conventions that make such formal features informative. Calvert (1994) examined the impact of computer presentational features (i.e., action and verbal labels) on children's production and recall of objects presented in a "list versus story" format. Kindergarteners relied more upon both types of features for production and recall of objects than did second graders. The research suggests that features including action and labels play an important role

in information processing activities for very young children; furthermore, educational software designed for young children should use these features to target important informative content (Calvert, 1994), thereby facilitating learning of that content.

Bruner (1977) called these and other supports for children's performance "scaffolding." Structures such as these make it possible for children to participate in activities well before they are capable of doing so independently, and in that sense provide a scaffold or platform to support or enable performance. Scaffolding is what allows novices to enter a situation sufficiently to learn not only how to reproduce the activity but also the content that is embedded in the activity.

To summarize, the core model for situated learning is apprenticeship (Collins, Brown & Newman, 1989). The young child, as with any novice, enters a situation unable to perform competently, but performances are organized in a way to include him/her nonetheless--perhaps first through observation, then by performing increasingly more complex and responsible tasks, with less and less support from others. The setting and the tools it contains also provide scaffolding for the learner. Even when a novice participates "peripherally" in an activity (i.e., when a pre-linguistic child is included as a participant in a mock dialogue, see Stern, 1987), he or she gains knowledge and skill. With increasing knowledge and skill, the learner is able to take on a greater scope of activity, participate more "centrally" in the activity, and function as a more independent learner (Lave & Wenger, 1991). Hence, where learning is viewed as apprenticeship, the primary dimension of growth is dependence-autonomy.

3.3 Inquiry

The key process in apprentice learning is inquiry. Concepts of learning as inquiry are traced back to classic theories in education and child development, particularly the pragmatist philosophy of John Dewey (Hickman, 1990; McDermott, 1981; Pea, 1994), and the cognitive developmental theories of Piaget and Vygotsky. All contemporary learning theories recognize that children are active learners, and an emphasis on the "active child" dates back to Jean Piaget's theory of intellectual development. Piaget's *constructivist* view asserted that children develop an understanding of the world through active engagement, not passive observation (Ginsburg & Opper, 1988). A related view, known as *constructionism*, asserts that knowledge is not simply transmitted from teacher to student, but is

actively constructed by the mind of the learner; furthermore, children are more likely to create ideas when they are engaged in a particular project or making of an artifact – a computer program, a robot, a poem (Kafai & Resnick, 1996). Finally, *social constructivist* views of learning emphasize the role of dialogue in structuring and supporting apprenticeship.

This understanding of children's learning underlies a broad array of current efforts at designing computer-based tools to help children learn. This includes work at the MIT Media Lab, from the early work of Seymour Papert and colleagues with the creation of the programming language *Logo* (Papert, 1980) to recent work with the *Programmable Brick* (Sargent, Resnick, Martin & Silverman, 1996); work being done in the context of large-scale projects in schools (for example, those conducted by TERC, the Center for Innovative Learning Technologies at SRI, and the Center for Learning Technology in Urban Schools at Northwestern University); and a host of interesting projects that use collaborative inquiry environments to promote learning (e.g., Lajoie & Derry, 1993; O'Neill & Gomez, 1994; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989). These and other projects have documented the many benefits to children of learning in an inquiry framework, which include motivation to learn, authentic learning, and active engagement in learning.

3.4 Dialogue

Increasingly, researchers have focused on the role of dialogue in guiding the process of inquiry. Dialogue--interchange with a human or mediated interlocutor--creates not only a structure through which scaffolding can be provided but also an opportunity for child learners to articulate and organize their emerging understandings. Dialogue refers to the ways in which attention and mental activity are engaged and structured by the presence and presentations of others. Theories of dialogue (Bahktin, 1990; Goffman, 1981; Wertsch, 1991) provide a framework within which to understand the role of interpersonal communication and social interaction in learning. There are three critical topics for a theory of dialogue: Identity, interaction, and collaboration.

Identity refers to the social self—the person one is perceived to be in a social situation. It is the performance of one's character in context. Communicating and negotiating identities is an implicit process in every activity, since the identity one attempts to enact might or might not be supported by

others with whom one interacts (Goffman, 1967). When one's identity is not supported, then it must be revised. Therefore, identity is always understood to be socially situated and fluid or changing.

Mead (1934) was early to point out that games provide a critical opportunity for children to acquire the distinctive perspectives associated with social identities and voices. As Denzin (1973) has shown, an important function of children's fantasy play is to provide opportunities to practice enacting an identity. In research on children's use of online interaction—chat rooms, role-playing games, and the like—a key focus has been their use of such opportunities to take on and rehearse identities that are unfamiliar to them but which they wish to explore. Sherry Turkle's (1995) work on the way adolescents and young adults "try on" identities in multi-player game environments (MUDs and MOOs) and Bruckman's (1997) related work on social interaction in collaborative learning environments have documented the critical role of identity-related play in online communication systems.

Interestingly, it appears that many of the most critical communication processes related to identity management are evoked equally well by computers and humans. Reeves and Nass (1996) have shown in a series of experiments that people respond to computers as though they are human, including showing politeness, deference to feelings, and other identity related message behaviors.

The second key topic for a theory of dialogue is interaction. Media, including interactive media, and genres of content within them are characterized by different types and degrees of interactivity. Media differ along a number of dimensions, but one key differentiator is the type of participation structure it provides for interaction. Participation structures (Levinson, 1993) govern what can occur on the message space or "floor" in a communicative event. This shared message space is the place in which the contributions of the various parties can be encountered and responded to. A medium is not interactive if there is no floor, and interactive media differ quite substantially from each other in terms of what can be placed on the floor and how contributions on the floor can be taken up. So, for example, broadcast television is in general not an interactive medium: while messages are offered in a public space, there is no opportunity for viewers to contribute to that space. Computer-based communication, whether it involves interaction with a program or with other humans via a network, almost always involves a shared message space to which multiple communicating agents contribute. This quality of interactivity, distributed and shared participation, is very important for learning, since active engagement in interaction is a determinant of learning outcomes (for example, people learn more from participating in a conversation than overhearing the same conversation, Clark, 1992).

While in some media the floor is relatively simple, in most interactive media this shared message space is quite complex. Many different kinds of displays can be put on the floor in computer-mediated communication: text, sound/voice, still pictures/video, animations and visualizations, or representations of the interaction setting (both realistic and imaginative). Telepresence refers to the degree to which these different types of displays contribute to a sense of sharing a setting or world with another. In general, the more fully the floor or shared message space supports displays for the human senses—by introducing sound, motion, three-dimensional visualization, touch, smell—the greater the sense of telepresence, of shared reality, embodied in the floor and the more complex the interactivity.

Additionally, media differ in the way they link together the contributions of different participants. A critical issue is whether a particular medium uses temporal placement to link contributions ("synchronous" communication) versus some other mechanism ("asynchronous" communication). In synchronous media, adjacent temporal spaces ("turns") are used to link contributions. By contrast, asynchronous media use other mechanisms to link displays and responses. One common mechanism is spatial proximity: responses are placed in a space near the display. A good example of this is asynchronous text conferencing, which is now generally organized as a set of themes called "threads." The original message is shown, and messages that respond to it are tagged as responses and displayed near the original message in a message list.

Finally, media differ in the degree to which they can sustain participation. Can the response provided by a participant be responded to, in turn, by other agents? Many interactive software programs and Web sites provide the opportunity to respond to a display, but do not in turn respond to the response. The ability to sustain a dialogue, and moreover to sustain a chain of relevant contributions to a common activity, varies dramatically across media. Sustained participation is a quality of human-human dialogue (whether computer-mediated or not) that is quite difficult to emulate in human-computer interactions, and currently can only be achieved in cases where the contributions of the human are restricted to a predictable range of responses.

A medium is interactive when it creates the possibility of display and response dialogue. But the quality of interactivity is a function of the richness of the display possibilities, the nature of the response options (in particular, the degree to which synchronous responding is possible), and the ability to sustain a chain of interaction. This is important because a key hypothesis for children's

development is that interactivity itself may be a critical determinant of cognitive outcomes. For instance, it might be noted that some of the best children's programming on television (such as *Sesame Street* or *Blue's Clues*) has found ways to use dialogue to elicit active processing and problem solving by child viewers. In this way, television, a passive medium, can elicit active responses.

The final key topic for a theory of dialogue is collaboration. Dialogue takes place in the context of shared effort—people cooperate to achieve some goal, whether it is as simple as having a pleasant conversation or as complex as designing a new airplane. Collaboration provides not only scaffolding, in Bruner's sense, but also a context that evokes more mature performance. Therefore, children communicating with peers about how to solve a science problem can improve science learning (Roschelle, 1991). Cassell and Ryokai (in press) illustrate the potential of collaboration in an interesting project called *StoryMat*, a type of interactive toy. They observed that storytelling, particularly in collaboration with peers, is a critical arena for children's cognitive development. Based on this observation, they designed *StoryMat*, a system that supports and records children's story-telling play. *StoryMat* is a quilt-like play mat that is appliquéd with familiar objects. It was designed to provide a play space that would stimulate children to tell stories, and it incorporates recording technology to capture and play back the stories. When a child tells a story, it is compared to similar stories recorded by the mat, and those similar stories are played back. Past stories then become a stimulus for further telling by the child. Cassell and Ryokai (in press) found that use of *StoryMat* promoted developmentally advanced forms of performance in children, of the kind that provides a bridge to written literacy.

In another study examining collaborative learning effects, Strommen (1993) observed 28 pairs of 4th grade children using an educational software program under two conditions: 1) a cooperative condition in which two children played against the computer, and 2) a competitive condition in which two children played against one another. Results indicated that the cooperative condition elicited more correct answers from the children than did the competitive condition. The findings suggest that with little or no encouragement, children spontaneously develop cooperative strategies, which can increase their learning (Strommen, 1993).

The findings of Mayer, Schustack, and Blanton (1999) provide encouraging evidence that informal, collaborative experiences with quality educational software can facilitate the development of content-specific cognitive skills. The authors studied children's computer experiences in informal settings

(e.g., boys and girls clubs and after-school programs) over a one-year period. The children often worked with peers or adult mentors on computer activities. The children demonstrated improvement in 1) content knowledge about computing (computer literacy), 2) comprehension of written instructions,

3) strategies for problem solving, and 4) basic academic skills. Mayer, Quilici, and Moreno (1999) and Mayer, Schustack, et al. (1999) suggest that part of what is achieved by playing an educational interactive game is the ability to more easily learn features and strategies of playing novel educational games and activities. This suggests that skills developed in a particular activity may transfer to new situations. Educational researchers are particularly interested in the use of cooperative learning strategies and methods in the classroom environment. Studies such as the above illustrate the potential of interactive technologies to facilitate cooperative behaviors and facilitate learning.

3.5 Framing

The frame for a message includes knowledge of its point, topic, and relevant background information; it provides the context for interpreting communication. As Goffman (1974) and others have pointed out, the impact of experience is a function of how that experience is interpreted, or framed. A classic demonstration of this phenomenon was provided by Bransford and McCarrell (1974), who showed that what people learned from narratives depended on the frame they were given. The general rule for communication theory, then, is that the effects of communication content are mediated by the frames people use in processing that content.

Oddly, while there has been great concern about the content of children's interactive media (particularly violent "first person shooter" video games), there has been relatively little attention paid to the ways that children frame the material they encounter (Gailey, 1996). Kinder (1996) provides an interesting counterpoint to this reaction. She looked at the way episodes of violent action in computer games can be understood in relationship to broader cultural conventions and practices relating to the use of violence in entertainment media, and specifically to gender depictions. Kafai (1996) allowed 16 boys and girls to build their own games, and found that the narratives and types of action used in the games were framed differently as a function of gender, with boys building games that more fully reflected that conventions of commercial video games. She attributed this to the boys' greater

experience with video games. As Greenfield (1996) has argued, many of the gender differences observed in this area may be accountable in terms of the ways that culture frames both the activity of game playing for boys and girls and the specific kinds of content (such as violence) children encounter in interactive games.

3.6 Effects on Children's Cognitive Development

The final issue, then, is the question of whether media experiences and media socialization play a significant role in determining the cognitive developmental outcomes of greatest significance to parents and others who care about children. In this final section, we draw some overall conclusions about critical cognitive outcomes.

3.6.1 Representational Skills

Communications media rely on different kinds of symbol systems and so provide children with different kinds of situated learning opportunities. Media can be described by their technology, symbol systems, and processing capabilities (Kozma, 1991; Salomon, 1979). Knowledge of the unique characteristics and symbol systems of media determine how each medium can best be used by children and how the information presented is differentially processed. For example, books are characterized by the symbol systems of text and static pictures. The stability of text allows the reader to slow down, pause, or re-read in order to comprehend difficult passages; reflect on the meanings of unfamiliar words, expressions, or ideas; or read selectively in search of particular categories of information. By contrast, television delivers content via the symbol systems of verbal language and visual images, particularly images in motion. Computers are distinguished by what they can do with information: their capability to process symbols. For example, print, equations, and numbers can be transformed into visually depicted graphs. Combinations of information technology often called "multimedia" present the prospect that the various advantages of the individual medium (i.e. print or television) can be brought together in a single instructional environment and used strategically to facilitate learning (Kozma, 1991).

Increasingly, research on children’s learning shows that (as would be expected within media socialization theory), the skills children acquire from using media reflect the specific kind of symbolic

experience a particular medium offers. For example, in the research cited earlier by Greenfield and others (Greenfield, 1996), experience with interactive video games has effects on children's growth, but the effects tend to be specific to the kind of spatial-visual representational medium that is used for such games. In general, experience with these games does not have effects on other cognitive skills.

3.6.2 Academic Achievement

There is an assumption that children's access to and use of computers at home does influence their experiences with computers in the school setting, and vise versa. The influence of home computer use on academic achievement or performance in various contexts, however, is not clear. This relationship appears to be influenced by several complex factors. In an early study of ethnic differences in home computer use and its effects on in-school achievement, Attewell & Battle (1999) found that forms of social inequality beyond access (gender, SES, and ethnicity) may modify the frequency of home computer use, the ways in which computers are used, and subsequently influence the educational benefits derived from home computing. The authors examined the relationship between home computing and school performance using the data from the National Educational Longitudinal Study (NELS) of 1988. They found that having a home computer was associated with higher test scores in math and reading for eighth graders, even after controlling for family income and social capital. It was also found, however, that children from higher SES homes achieved larger educational gains than did children from lower SES homes. One possible explanation for these findings is the level of parental involvement in the children's computing activities (Giacquinta, Bauer & Levin, 1993; Giaquinta & Lane, 1990; Rocheleau,1995). In general, children who engage in beneficial computing activities have parents who interact with them or communicate about those computing activities. Given the fact that the primary reason cited by parents for purchasing a home computer and connecting to the Internet is education (NSBF, 2000), it is surprising that we have very little research to document whether and what types of at-home interactive media use contributes to school achievement.

3.7 Summary & Recommendations

What can be said about the influence of new technologies on cognitive development? Do children benefit from using interactive media? It seems that educators also struggle to answer this urgent question, as significant financial resources are committed to integrating technologies in classrooms.

Asking general questions about this phenomenon we call "cognitive development" may not be a useful way of addressing the issue. "Effectiveness statements are of little use unless they elaborate the children's ages, the subject, the software used, the kinds of outcomes that were sought, and how the study was done" (Kirkpatrick & Cuban, 1998). Researchers need to consider matching software claims with assessment of those particular cognitive outcomes. Interactive media have the potential to benefit children in many important and life-altering ways. To determine the "effectiveness" of using various technologies, researchers will need to (1) adopt a developmental perspective, (2) consider diverse populations, (3) use varied methodologies to address similar questions, and (4) target specific outcomes of interest.

Research on the influence of interactive media on children's cognitive development should first provide conceptual descriptions and analyses of these media and their content. All too often, people see one example of a violent video game or disturbing chat room conversation and assume that is what all games or chats are like. But are they? What is needed is a "road map" to these interactive media: a classification of the different types of interactive experiences children might have and the kinds of content they might encounter. For example, we might establish a consortium of media laboratories to examine, review, and evaluate each new computer game. Parents, teachers, and others could use this information to find great online experiences for youth and protect them from doubtful ones.

Furthermore this road map should consider elements of these media which may influence both their usability for children of different ages and their learning with them. Critical elements of interactive media such as interactivity and its influence on cognitive engagement and learning outcomes should be studied further. Similarly, how various modalities of messaging, such as the presentation of visualizations, data or agents using images and or sound, and their impact on learning outcomes should be studied.

One common assumption is the idea that "interactivity" itself, regardless of content, may have an effect on the way children create and process information. Does active involvement with a computer activity influence processing of the information, such as increased comprehension and retention, or does it influence perceptions of the task, such as increased motivation for sustained engagement? Can we assume that "interactivity" facilitates learning? What are the cognitive consequences of interactive materials which encourage children to build, design, and create narratives, objects, virtual worlds, and other things?

Before addressing questions regarding effects on cognitive, social, or health-related outcomes, the concept of interactivity itself needs to be further conceptualized and empirically demonstrated. It should be pointed out that different types of interactive experiences may be elicited by different types of interactive media. For instance, interactive pets probably engage children differently than interactive computer games. Research examining Salomon's four characteristics of successful educational software (i.e., interactivity, guidance and informative feedback, multiple symbol systems, and supplanting users' memories allowing them to engage in higher order thinking) would be a useful first step in thinking about interactive media (Salomon, 1990; Salomon & Almog, 1998). Much richer conceptual development of this concept of "interactivity" or a cognitive psychological experience is clearly needed. In spite of broad claims about the likely positive impact of interactive media on children's cognitive development and educational achievement, the research evidence is less compelling than the theoretical arguments. Much more systematic, developmental research evidence is needed to bolster the popular claims that interactive media will change the way children think.

The public discourse around the promise of interactive technologies to improve children's learning is often juxtaposed to the public discourse around the perils of interactive media content for children's social development. Healthy social relationships, violence, safety, and privacy are all issues raised in the next section as we consider the roles of interactive technologies in children's social lives.

4.0 Social Development

Socialization refers to the process through which children acquire the behaviors, skills, motives, values, beliefs, and standards that are characteristic, appropriate, and desirable in their culture (Newcombe, 1996). Media are important sources of socialization, as demonstrated in the literature of the past 50 years on the role of television in children's development. With the exception of the family, television reaches children at a younger age and for more time than any other socializing institution (Huston & Wright, 1996). Television programming can provide children with a window into African jungle life and explorations in the Amazon rainforest, infrequent experiences in real life. Moreover, television may provide children with their first exposure to people of different ethnicities, religions, or cultures. Experimental studies demonstrate that children acquire beliefs about the activities and attributes of particular occupations from fictional and factual television programs (Huston, Wright, Fitch, Wroblewski, & Piemyat, 1997). Moreover, television families depicted in weekly series can serve as models for children, portraying family members managing their relationships and conflicts quite effectively (Douglas, 1996).

As with television, interactive media influence the socialization process.

Children live in a technological age and the Internet may be one of the largest, most rapidly growing socio-cultural phenomena in history (Anderson, 1997). Youth have immediate access to immense amounts of information in a variety of domains including education, entertainment, and health. E-mail and chat rooms have changed the nature of social communication. Virtual reality environments, such as Multi-User Domains or MUDs, challenge our traditional thoughts about identity formation and building of community (Turkle, 1995). Computer and video games, as well as interactive toys, serve as sources of entertainment providing challenging, skill-building scenarios. In contrast, interactive games often provide children with models illustrating (as well as requiring) aggressive and violent problem-solving behaviors.

In this section, we focus on three areas of social development that have received recent interest and attention from both the general public and academic researchers. The first is a general discussion of the larger social context influencing interactive media use, such as the home environment and presence of family members and peers. The second is the effect of interactive media use on the development of

children's and adolescents' social relationships and their sense of identity. There is a very limited literature related to children on the second of the two topics; hence, we examine those studies on adults and families, which do pose relevant issues for youth. Finally, we address a major topic of public concern: the effects of violent and aggressive content on children's and adolescents' social development. Researchers addressing violence and aggression have primarily used computer and video games as the genre of interest; accordingly, we will focus on that particular literature. We address both our optimism and apprehensions regarding the potential of interactive media to shape the social development of youth.

4.1 Social Context & Collaboration

Children do not use media in a social vacuum. The institutions of the social world (e.g., family, peers, school, workplace, church, community, and now virtual environments) seem to shape the actual content of media-related activities and their cultural meanings (Anderson et al., 1994; Lindlof, 1991). As was pointed out in the section on cognitive development, each context where interactive media are used provides a different constellation of family members, peers, co-workers, or others who influence, support, or teach the media user.

Researchers investigating the effects of television viewing on children indicate that children's viewing experiences need to be placed within a larger social context to understand viewing effects. Family members, for example, can play an important and influential role in children's television viewing. Parents affect children's viewing through their own viewing patterns, by co-viewing with their children, by discussing their values and attitudes about television, and by regulating or encouraging viewing of particular types of content (Austin, 1993; Messaris, 1986; Wright, St. Peters, & Huston, 1990). The presence of siblings also influences viewing choices. **Children with older siblings tend to watch more cartoons and situation comedies with their siblings without adults present, but those who have younger siblings continue to watch child-informative programs past the age of four (Wright et al., 1990).** Research on the processing of television messages tells us that immediate family, such as parents and siblings, heavily influence what children take away from the viewing experience. Co-viewing can give parents (or siblings) an opportunity to discuss content with children, possibly facilitating understanding of the material presented or reducing fearful reactions. The process of co-viewing does change with age. In one study of 326 children ages 3 – 7, the majority of

children's programs were watched without parents and co-viewing declined with age (St. Peters, Fitch, Huston, Wright, & Eakins, 1991). These studies of children and television suggest factors that should be examined regarding children's interactive media use.

4.1.1 Parental Influence

It is important for parents to communicate their values and expectations to their children regarding interactive media use. Parents often cited "education" as an initial reason to purchase a computer for the family (Center for Media Education, 1998; Deringer, 1986; Giacquinta & Lane, 1990; Lindlof, 1992; NSBF, 2000; Venkatesh & Vitalari, 1987) or to connect their children to the Internet (NSBF, 2000). Generally, parents expect that their children need and will use computers and the Internet on a regular basis (Green, 1996; NSBF, 2000). These beliefs and expectations, in turn, can influence behavior. There is some evidence for this proposition.

Rocheleau (1995) found that students' perceptions of their parents' desire for them to learn about and use computers was a significant predictor of heavy computer use. When parents communicate the importance of becoming computer literate to their children, they create a higher probability that their children will be frequent computer users. Conducting research in the late 1980s, Giacquinta & Lane (1990) and Giacquinta, Bauer, and Levin (1993) illustrated the influence of parental support and encouragement on children's use of particular types of software. Academic use or non-use of computers in the homes of 51 families was associated with the following factors: (1) the degree to which parents encouraged and assisted a child's academic computing activities, and (2) the degree to which a child's school emphasized academic computing. Specifically, the degree to which parents (1) were available to their children and involved in their children's learning activities, (2) were attracted to and used the computer themselves, and 3) were knowledgeable about the value and quality of academic software influenced whether children used the computer primarily for educational purposes, rather than game play (Giacquinta & Lane, 1990). In general, it seems that children who engaged in little or no academic computing, had parents who did not interact with their children about computing activities, and who assumed the schools would set the agenda for the children's computer-related activities.

In short, parental encouragement of interactive media use does not substitute for school or other encouragement and vice versa; rather, parental support seems necessary for young children to embrace

engaging, quality interactive materials and environments. In the *Safe & Smart* report (NSBF, 2000), parents reported positive attitudes regarding their children's Internet use, and specifically held beliefs that the Internet is a positive tool for learning and communicating with families. The NSBF (2000) suggests that schools have the opportunity to help narrow the digital divide. Furthermore, they suggest that the Internet is a useful tool to engage parents in their children's school-related activities, to facilitate communication among parents, teachers, and administrators, and to create a forum for community discussion.

Recent findings are not so encouraging regarding the topic of parental involvement with adolescents and interactive media. Roberts et al. (1999, p. 65) report that "the image of the solitary youngster seated in front of a computer is accurate for over 60% of adolescents" in this national survey. Of those 7^{th}–12^{th} graders who used media, 55–64% reported playing interactive games alone and 61% reported visiting chat rooms and Web sites alone. Parents played interactive games with adolescents 2–3% of the time and were involved 6–10% of the time when they were visiting chat rooms and Web sites (Roberts et al., 1999). Interestingly, non-interactive media (television, videos, movies) were generally social activities, while interactive media (computer and video games, chat rooms, Web sites) were generally solitary activities (Roberts et al., 1999). Clearly, information about the social context of younger children's media use experiences is needed. It is likely that parents will spend more time with younger children as they will necessarily require more assistance, at least until a basic level of computer literacy is acquired. Moreover, parents establish parameters for young children's use of computer-related activities.

While adult perceptions and presence can have significant implications for children's use of a particular medium and specific content, children and adolescents frequently know more than their parents about the technical aspects of computers and Internet use. Recent findings of the *HomeNet* project are beginning to inform us about the dynamics between family members when using interactive media. One of the most recent reports related to this project tells us that in 54% of the families surveyed, the teenagers were the technical "gurus" of the family; the teens were those requesting technical support for Internet use and subsequently passing the information along to other family members (Kiesler et al., 1999). Not only does another person's expressed values and needs influence media use behaviors, but working together in an interactive environment, or collaboration, can modify the media use experience.

The concept of collaboration was introduced and developed in the above discussion on cognitive development. Collaboration is a social phenomenon, and accordingly, a few examples of such social interaction are presented. Interactive media provide the opportunity for multi-user participation. Games specifically designed for multi-user play may enhance cooperation or competition with others depending on the program goals. Knowledge is limited concerning the frequency and effects of "co-playing" with others, particularly with the increasing availability of Internet multi-player game sites. There is public interest, however, in the effects of co-playing and how social context changes as a function of age of the players. Research shows that television viewing and interactive game use with family members, for example, occurs more frequently in childhood but becomes somewhat less common in adolescence, as a result of growing autonomy and separation from the family (Kubey & Larson, 1990). While Roberts et al. (1999) did not collect data from children about playing alone, with parents, or with siblings/peers, the results for adolescents support the findings of prior research showing they spend less time with adults than do younger children.

4.1.2 Peer & Sibling Influences

As children begin to spend more time outside of the home environment, interaction with peers plays an increasingly important role in social development. By the age of about seven, children will spend as much social time with friends and peers as they do with adults (Giffiths, 1997c). Peer interactions facilitate the development of interpersonal skills and social competence. The use of interactive technologies has become an important social activity for youth and is not solely an isolating event. Roberts et al. (1999) reported that 36% of the adolescents who played video games reported playing them with peers or siblings. Van Schie and Wiegman (1997) found no evidence linking frequent game playing behavior with social isolation, while Colwell et al. (1995) found that adolescent males who reported frequent game playing were also those likely to see their friends more often outside school. Orleans and Laney (2000) reported that computer use was an important social activity and was engaged in more frequently by boys than by girls. In a small observational study of 32 children (ages 8 – 17 years) boys more frequently participated in networked gaming, incorporated the activity in social conversations, and engaged in more general socialization around computer activities than did girls. In contrast, face-to-face social interactions were more salient for girls (Orleans & Laney, 2000). Interactional skills, verbal facility, social identity formation, and group adjustment (particularly for boys) were all positively associated with computer activity (Orleans & Laney, 2000). The authors suggest that orientations toward the computer and computer-related activities may be different for male

and female adolescents. While the study is an initial effort, it suggests fruitful avenues to be examined in the area of child socializing behaviors and computing.

Recent studies support the contention that girls and boys differ in their perceptions of technology and its related content. As discussed earlier in this report, girls are not attracted to the gaming culture, particularly the violent content present in many interactive games (AAUW, 2000). The NSBF (2000) reported that girls are using the Internet as much as boys, but in different ways. Specifically, girls are using the Internet for education, schoolwork, e-mail, and chat rooms, whereas boys are using it for entertainment and games. To reiterate, we must focus our energies in creating engaging interactive content of interest to all children.

It is evident that interactive environments, particularly networked technologies, have the potential to promote social interactions among youth; hence, rather than emphasizing competition, interactive environments can be designed to promote cooperative behavior among children. Can collaborative video game play influence endeavors such as pro-social behaviors, cooperation, "good" group work patterns, or educational outcomes? Research examining the effects of collaborative environments (e.g., Cassell & Ryokai, in press; Mayer, Quilici, et al., 1999; Mayer, Schustack, et al., 1999; Strommen, 1993) indicates that such collaborations can have a positive influence on behaviors and cognitive outcomes. Additional research efforts, however, are needed to further explore children's interactions in collaborative environments and the effects of these learning environments and technologies on cognitive and social development.

4.2 Social Relationships

Access to the Internet and World Wide Web has the potential to satisfy diverse informational and social needs of individuals. New social contexts and opportunities for personal relationships are being created by the global revolution in technology-mediated communication (Parks & Roberts, 1998). Some scholars argue that the Internet can promote social relationships by liberating people from the constraints of geography, stigma, illness, disability, or time schedules to create communities of individuals with similar interests (Civille, 1995; Katz & Aspden, 1997; Rheingold, 1993). Others suggest that use of the Internet can result in social isolation (Nie & Erbring, 2000; Stoll, 1995; Turkle, 1997) or even a decline in personal well being, such as loneliness and depression (Kraut, Patterson, et

al., 1998). There is potential for both positive and negative outcomes to occur depending on the particular use of the medium and differences in the users.

An additional point of contention related to children's use of the Internet and other interactive media activities is the assumption that there is only a limited amount of time and energy available to devote to social and non-social activities (Orleans & Laney, 2000). It is the often-mentioned idea of time displacement – time spent participating in one activity will displace time spent in another activity. One's intuition and even knowledge of child development may suggest that time spent in isolation with a computer is not as valuable, possibly even detrimental, as time spent socializing with peers or others. But is computer use really an isolating event? As illustrated in the above section, computer use can promote certain types of socialization, which contributes to skill development and self-efficacy. It is clear, however, that we know far too little about the socializing aspects of interactive media to draw strong conclusions at this time.

The research presented below focus primarily on adult computer users or families. While the research base does continue to grow, we currently have a limited understanding of how children and adolescents use these technologies. The issues and topics presented, however, are as relevant for youth as for adults. The discussion will hopefully generate thoughtful ideas and research questions related to children's use of the Internet and online communication.

4.2.1 The Development of Social Networks

When computer networks link people as well as machines, they become social networks (for review see Wellman, 1997; Wellman et al., 1996). Furthermore, research evidence demonstrates that using the computer network for e-mail, chat, or other interpersonal communication is the dominant use of the Internet at home, particularly for adults (Kraut, Mukhopadhyay, Szczypula, Kiesler, & Scherlis, 1998; Kraut et al., 1996). Young children, on the other hand, seem to be using the Internet for educational purposes as well as for communication with others (NSBF, 2000).

Electronic mail, instant messaging (or "buddy lists"), and other technological advances provide a means to easily and efficiently maintain current relationships or broaden networks of personal acquaintances beyond the boundaries of immediate family, close friends, school, work, and even community (Civille, 1995; Katz & Aspden, 1997; Pavlik, 1998; Wellman et al., 1996). Clearly, there

are time, convenience, and cost-saving factors, which partially explain the growing popularity and use of electronic mail and online communications.

Further, networked services bring individuals and communities with similar interests together across distance, time, and social class. For example, parents are attracted to parenting Web sites for the opportunity to engage in conversations with those having similar concerns, to get expert opinions, and for the convenience of quick answers (CME, 1997). Children have also converged online to communicate and develop new relationships with other children worldwide. An extraordinary example of the far-reaching implications of new communication technologies for creating communities among children can be seen in the *Junior Summit*. Children from 139 different countries were given the opportunity to communicate with one another online. They formed an online community, which has continued for over 16 months and is sustained by their members beyond the original intent of the project organizers (Cassell, Markle Experts Conference, 1999). Abbott (1998) describes a community of young media users who create their own Web pages. "The Web is clearly offering young people who use it for publication a sophisticated and complex means of speaking to their peers, to others interested in the same topics, and to those they seek to influence" (Abbott, 1998, p.103). This growing interest in Web page creation and authorship by adolescents and young adults is an understudied phenomenon.

The Internet can satisfy personal and social needs as illustrated by the work of Bier, Sherblom and Gallo (1996). Interested in how low-income families would make use of unlimited Internet access, Bier et al. (1996) conducted an intervention gathering qualitative and quantitative data about time spent online, sites visited, information sought, and obstacles encountered. Six families were provided a home computer and modem, Internet access, and ongoing training and support throughout the duration of the study. The families participating in the study experienced a number of profound positive personal changes as a result of this new-found information and communication resource. All participants reported a positive change in their self-perception as learners and knowledgeable individuals. Many discussed the usefulness of the Internet in acquiring medical information for their families and being able to share information with friends and neighbors. Participants also reported developing personal relationships with others on the Internet, which became a source of support and companionship.

Such changes within the families proved to be ethical dilemmas for the researchers involved, as this excerpt demonstrates:

"Participants integrated this technology into their lives to such a degree that they felt dependent on the resources we (researchers) provided, and which they could not afford to replace. They expressed deep concern over losing these provisions at the end of the study and questioned our role in their dependency…

They (participants) feared they would not be able to maintain the daily routines they had established based on this ideal Internet access. In addition to losing Internet access, they feared the loss of positive personal transformations they had undergone as a result of their Internet experiences. Specifically, participants feared losing their newly acquired sense of identity, education, and community" (Bier et al., 1996, p. 146-147).

Incidentally, the investigators were able to establish an Internet link at the children's schools, and were searching for practical and equitable solutions for the families to possess equipment and access independent of the study. It becomes apparent from reading the above that the uses individuals make of interactive media and the gratification received from such use are particularly appropriate factors for examining use of the Internet. The Internet may serve many functions and provide varied gratifications to different groups.

4.2.2 Characteristics of Personal Relationships

Scholars are currently examining the changing nature of personal relationships and communities that develop via the use of networked online services. For instance, relationships in the "real" and "virtual" worlds differ in their strength. Strong ties describe relationships associated with frequent contact, deep feelings of affection and obligation, and application to a broad content domain, while weak ties are relationships with superficial and easily broken bonds, infrequent contact, and narrow focus (Kraut, Patterson, et al., 1998). While relationships developed via the Internet may provide useful sources of information (e.g., newsgroups, professional list serve groups) and support (e.g., parental support groups), they may also be characteristic of weak social ties. In contrast, e-mail and online communications can supplement other forms of communication and interaction among those with whom we have formed strong relationships, such as close friends and family.

Relationships may be characterized as neither strong nor weak, but may exist on a continuum and vary from one particular setting to another. For example, two types of social venues on the Internet are MUDs (i.e., Multi-Use Domains or Dungeons) and MOOs (i.e., Multi-User Dimensions, Object Oriented). In both types of venues, individuals create characters and virtual worlds in which to interact. Interactions on MUDs tend to be oriented toward competitive role-playing games, while interactions on most MOOs are less competitive and more social (Parks & Roberts, 1998; also see Turkle, 1995). Parks and Roberts (1998) found that MOO relationships were more developed than newsgroup relationships, but less developed than off-line relationships. The authors suggest that MOOs provide an important context for the formation of personal relationships, many of which transfer to other settings (Parks & Roberts, 1998). One participant in another study described his relationship in a MUD as "much deeper and better quality" than his real-life friendships (Bruckman, 1997).

Interestingly, online communications generally lack many of the characteristics that are emphasized in traditional relationship development: physical proximity, frequent interaction, information about physical appearance, cues about group membership, and information about the broader social context (Lea & Spears, cited in Parks & Floyd, 1996; Parks & Roberts, 1998). Correspondingly, the absence of some of these qualities may be advantageous for a number of reasons. Technology-mediated communication can free individuals from limitations of face-to-face meetings, such as evaluations based on physical appearances (Parks & Floyd, 1996; Sproull & Kiesler, 1991). "On the Internet no one knows whether you are homeless, have a disability, are attractive, are young or old…if you communicate from your home, no one knows whether it is a mansion or a hovel" (Michaelson, 1996, p. 57). Although Michaelson is talking about adults, the sentiment applies to youth as well. The Internet provides youth and others with anonymity that can be beneficial as a way of "equaling the playing field" for persons of differing backgrounds. To status conscious individuals, this may be a benefit and a relief.

An emphasis on shared interests rather than on social characteristics can be empowering for all people, but particularly for members of disadvantaged social groups. The development of online social relationships may be particularly important for specific populations, including isolated, or disabled adults and children. The Internet can provide social opportunities for children unable to travel or attend school due to disabilities or medical illness (Bremer & Rauch, 1998). Computer and Internet

use can empower the learning disabled, allowing learning experiences to take place from the home environment and facilitating parental involvement in the child's education (Margalit, Rochberg, & Al-Yagon, 1995). While networked environments can beneficially extend the child's world and can remove physical and social barriers to others, optimal uses of networked environments for children's healthy social development are not well known. If it is reasonable to predict that physical accessibility and computer literacy become commonplace, might the Internet serve as a great equalizer, bridging the gap between the advantaged and the disadvantaged?

Members of virtual communities want to link with others for companionship, exchange of information, and social support from their home and workstations (Rheingold, 1993; Wellman et al., 1996). Individuals will likely find support networks within their local communities as well as in distant geographic locations. Will participation in networked virtual communities impede participation in real-life communities, or can these groups have a parallel existence with few, if any, detrimental effects? Researchers speculate that there is potential for both to occur. Recent work with longitudinal field data suggests decreases in "real world" social interactions are possible. To reiterate, the researchers of the *HomeNet* project provided 93 families with computer equipment and email accounts on the Internet in March of 1995 and March of 1996; their Internet use was then tracked over a period of one or two years and a number of measures of psychological and social well being were collected. Findings from *HomeNet* suggest greater use of the Internet was associated with slight declines in social involvement, increases in loneliness, and increases in depression (Kraut, Patterson, et al., 1998). Critiques of the project suggested inclusion of a comparison control group (receiving no free Internet access) would strengthen confidence in the findings (Shapiro, 1999). Kiesler and Kraut (1999) acknowledged the advantages of adding a control group, but in their attempt to do so found the costs to be beyond the scope of the project; a true experimental design, however, can be expected in future research.

Contrary to the above findings, recent research with children and families suggests Internet use does not isolate children from their families, peers, or communities, but rather it is a powerful communication tool that connects children (and parents) to others (NSBF, 2000). Children and parents reported using e-mail, chat rooms, and instant messaging to connect with others not avoid them.

While a few studies have examined the formation of online personal relationships and their ability to satisfy social and informational needs, we know much less about the nature of those relationships,

particularly for children and adolescents. The relative lack of social presence online may foster relationships with other users who have more diverse social characteristics than are normally encountered in person (Wellman et al., 1996). Is the temperament of online relationships shallow, impersonal, or even hostile? Are they similar to real-life interactions? The growth of technology-mediated relationships poses new challenges for those examining social relationships in all contexts, and indicates that existing theories guiding research on interpersonal relationships now require further consideration and elaboration to include contexts other than face-to-face interactions. This change in our way of thinking about social relationships is no more apparent than when examining participation in virtual environments. Virtual worlds not only influence how we communicate with others, but our reflection and construction of our own identities.

4.2.3 Identity Construction in Virtual Environments

Identity from the perspective of developmental psychology refers to those personality characteristics that define the self by the individual and others, as well as the internal sense of continuity in self-images over time (Grotevant, 1997). One's identity consists of stable characteristics (e.g., gender and race), distinctive personality traits, ideological values and beliefs, and interpersonal experiences to name a few.

Identity development is a lifelong process and is shaped by one's experiences during infancy, childhood, adolescence, and adulthood. In Erikson's view (1968), an individual's identity begins with the establishment of basic trust versus mistrust of the people and world surrounding the infant. The search for identity, however, is particularly relevant during adolescence, a time during which the young person is confronted with numerous psychological, physiological, sexual, and cognitive changes. Erikson (1968) described adolescence as a time for self-definition and for the formation of identity. He further described a process of identity formation in which an adolescent proceeded through a period of questioning and exploration (a period called moratorium), to a phase of identity achievement. Identity achievement was obtained after a search in which the adolescent explored different facets of his or her personality and examined various roles.

The Internet expands any conceptualization of identity, as it has now become a context for adolescents and others to explore and construct new identities. In an early conceptualization of the relationship between personal identity and computers, Turkle (1984) described an identity-transforming

relationship as a one-on-one phenomenon – one person with a machine. Turkle develops an argument for how a child's interaction with a computer influences his or her sense of "humanness" and "objectness." A child's unique sense of being as an individual is developed through contact with the machine's capabilities.

In online environments, interactions or communication may take place with people from all over the world, people with whom we converse with daily, or people with whom we have developed relationships with but whom we may never physically meet (Turkle, 1995). Virtual reality environments such as MUDs not only allow community building with other participants, but permit exploration of one's identity, role-playing with multiple facets of that identity, or creation of completely new character traits. MUDs "provide worlds for social interaction in a virtual space, worlds in which you can present yourself as a 'character,' in which you can be anonymous, in which you can play a role as close to or as far away from your 'real self' as you choose" (Turkle, 1997, p.144). Turkle (1997) characterizes the experiences of many individuals participating in MUDs as parallel lives.

The literature on identity formation in adolescence (Erikson, 1968; Turkle, 1995) would anticipate potential benefits of "virtual" role-playing experiences in the search for identity achievement. Turkle (1995; 1996; 1997) suggests that children and adolescents may actually use interactive media and Internet experiences to constructively "work through" life issues, while others may use these media to "act out" in unhelpful ways. In every case, she emphasizes the importance of examining personality traits and other developmental issues that may put children or adolescents at risk for deleterious experiences. One positive example of "working through" can be seen with one participant's (called Julee) role-playing experience in a MUD. Julee and her mother seemed to have a dysfunctional real-life relationship. Yet, Julee was able to take the role of "mother" in a role-playing game and have the conversation with her "daughter" (played by another individual in the MUD) that Julee's mother had not be willing to have with her. In this sense, Julee was able to re-experience a familiar situation in a setting where she could examine it, do something new with it, and revise her relationship toward it (Turkle, 1997, p. 146).

The Internet has elicited excitement in so many people partially because of the possibility of establishing contact, exchanging views, and presenting oneself in different ways to different people (Rosenberg, 1997). While we know adolescents experiment with their identities online, we do not

know how such experimentation may affect overall development and identity in childhood and adolescence. Can the Internet enable awkward teens to find social niches that might otherwise elude them in their real world? Or may it lead adolescents and others to withdraw and become social isolates within the real world they inhabit? Safety concerns about the kinds of people children and adolescents meet online have been emphasized in the popular press. We hear stories about pedophiles and child predators going online and "pretending" to be children and adolescents in order to later have socially inappropriate interactions with their online friends. We know this occurs, but to what extent? Orleans and Laney (2000) propose that to "pathologize" computer use without adequate warrant does a serious disservice to children and their future. They suggest that reasonable age-appropriate limits and wise selection of software will likely provide sufficient safeguards. It is clear, however, that we know far too little about the beneficial and detrimental consequences of networked relationships and communities for children's healthy social development.

4.3 Violence and Aggression

One of the most often expressed concerns about the old and new media is the impact of violent content on child and adolescent development. Violent themes are prevalent in today's generation of interactive games. Hence, one fundamental issue of concern is the relationship between playing violent games and engaging in aggressive real-life behavior. Such concerns are well deserved for a number of reasons. The interactive, repetitive nature of computer and video game play may magnify both positive and negative effects of game play. Furthermore, the content of many games of the 1990s is more graphic, violent, and realistic than that of their predecessors (e.g., Anderson & Dill, 2000; Dill & Dill, 1998; Funk & Buchman, 1995, 1996; Greenfield & Cocking, 1996; Griffiths, 1997a; Griffiths, 1999a; Phillips et al., 1995; van der Voort & Beentjes, 1997). These characteristics may make interactive games more powerful than television as sources of messages about violence and other social behaviors (Anderson & Dill, 2000; Calvert & Tan, 1994; Cocking & Greenfield, 1996; Greenfield, 1994; Griffiths, 1999a; Kinder, 1996; Scott, 1995). Does playing a violent video game increase the likelihood of subsequent aggressive behavior? Is there systematic empirical evidence to support such an assertion?

4.3.1 Theoretical Models

The theoretical bases for the existence of a relationship between playing violent interactive games and subsequent aggressive behavior draw upon the extensive literature on media violence effects. Researchers studying media violence have used a variety of experimental, observational, and longitudinal designs to support the hypothesis that exposure to media violence increases aggressive behavior, cognitions, and affect (for review see Huesmann & Miller, 1994; NTVS, 1996). Furthermore, Huesmann and colleagues propose that the relationship between aggression and television viewing habits are somewhat *bi-directional*. That is, watching violent programs clearly influences aggressive behavior, but aggressive behavior also has the weaker but detectable effect of encouraging children to seek out more violent programming. Thus, this positive feedback cycle increases the cumulative effects that violent programs have on aggressive behavior.

A number of theoretical orientations have been used to propose potential explanations for this relationship. These include social learning theory (and social-cognitive theory, which is based on social learning), arousal theory, cultivation theory, desensitization theory, script theory, and catharsis theory (for a comprehensive treatment of all theories see Calvert, 1999; Huston & Wright, 1997; NTVS, 1996). The social learning and social-cognitive paradigms are particularly useful when considering the potential influences of media on the social development of young children, and are frequently discussed in the academic literature.

From the perspective of social learning theorists (e.g., Bandura, 1977, 1986), the relationship between viewing violent television and subsequent aggressive behavior has been attributed to modeling. Children learn how to commit aggressive acts by watching others. More importantly, through observation of mass media models the child observer comes to learn which behaviors are effective and when they are "appropriate," that is, which behaviors will later be rewarded, and which behaviors will be punished (Kunkel et al., 1996). Social-cognitive theory is based on the concept of developmental *scripts*. The child is viewed as a processor of information who develops scripts to guide social behavior (Huesmann & Miller, 1994). These scripts contain information about 1) what events may occur in the environment and in what context, 2) how a person should behave in response to those events, and 3) what the plausible outcome of this behavior would be. Anderson and Dill (2000) propose a theoretical approach that combines many of the components of existing theories, called the General Affective Aggression Model (GAAM). In short, GAAM describes a multistage process by

which personological (e.g., aggressive personality) and situational (e.g., video game play and provocation) input variables lead to aggressive behavior (Anderson & Dill, 2000).

4.3.2 Unique Characteristics of Interactive Games

While the above theories provide insight into understanding why use of violent media may influence subsequent aggressive behavior (or vice versa), it is important to remember that interactive technologies possess unique characteristics. Fundamental differences exist among types of media, specifically regarding the characteristics that create an interactive environment: character identification, active engagement, sensorimotor practice, control over decisions and outcomes, and response determined feedback to name a few. Although these characteristics are used to create the most engaging interactive environments and can facilitate learning of educational and informational material, they are also the qualities that can facilitate learning of violent and other undesirable content.

There are compelling reasons to believe that there should be a strong link between playing violent interactive games and aggressive behavior. These reasons include: (1) identification with characters, or more specifically with the aggressor, (2) active participation and control over individual actions and behaviors, and (3) reinforcement of aggressive behavioral choices. First, character identification may be stronger for the interactive game player, as the child is not only allowed to choose their character but to select particular traits for that character. In games such as *Killer Instinct* and *Mortal Kombat*, the player can choose a character from a pool of several, each possessing specific characteristics including particular fighting strengths and weaknesses (Dill & Dill, 1998).

Second, game players are active participants and exert control over their actions. For instance, the child who plays the game directly experiences success or failure when his or her own behaviors lead to those outcomes (Calvert, 1999). Third, children are making aggressive behavioral choices, are acting them out, and are rewarded for those violent behaviors. The child player behaves aggressively and is rewarded (with points, sound effects, access to new levels of the game) for doing so (Dill & Dill, 1998; Funk, Flores, Buchman & Germann, 1999; Provenzo, 1991; Schutte, Malouff, Post-Gorden, & Rodasta, 1988; van der Voort & Beentjes, 1997).

The question becomes do the qualities of personalization and identification, active participation and control, and reward for antisocial behavior amplify the likelihood of subsequent aggressive thoughts

and behaviors, beyond what might occur with passive observation of aggression on television? Theoretically, these factors should increase the power of interactive games to teach and reinforce aggressive behavior; however, there is only recent empirical evidence (Anderson & Dill, 2000) to substantiate this claim. We now discuss what research can and cannot tell us, beginning with the difficulties of defining media violence.

4.3.3 Research Evidence

There is no single definition of violence that is accepted by all researchers (Kunkel et al., 1996). Researchers have different perspectives on what constitutes media violence, and hence they may assess violent content with a variety of conceptualizations and methods. Since the late 1960s, George Gerbner has provided one systematic method for analyzing television violence by focusing on the act or threat of physical violence (Liebert & Sprafkin, 1988). Potter and his colleagues (1995) have used broader definitions, such as: "any act that serves to diminish something in a physical, psychological, social, or emotional manner." Greenberg et al. (1980) included verbal acts of aggression and anti-social behaviors such as deceit. The National Television Violence Study, covered three years of television viewing and is the most extensive content analysis ever conducted. It utilized a definition of violence including "any overt depiction of a credible threat of physical force or actual use of force…or depictions of physically harmful consequences" (Kunkel et al., 1996; NTVS, 1996, 1997, 1998).

Similar issues exist when classifying interactive content, such as a variety of coding systems which were mentioned in the media use section of this report. It is common practice to code interactive game content from the perspective of the adult coder (i.e., the adult experimenter or researcher). Funk and her colleagues have taken a different approach to this process. They have developed content descriptions and categories based on children's perceptions (for descriptions see Funk, 1993; Funk & Buchman, 1995; Funk et al., 1997). Moreover, commercial rating systems (discussed below) have been developed to provide information about violent content (as well as sex and language) in games and Web sites. Griffiths (e.g., 1997a; 1997b) and others have acknowledged the need for a "taxonomy" of computer and video game content. Moreover, Durkin (1995) has suggested that expert players should be enlisted to chart content more fully. While we assume, based on findings from television research, that some genres will have positive effects and some genres will have negative

effects, systematic content analyses of interactive games are absent from the literature as suggested earlier in the report.

With the acknowledgment that conceptualizations of violent content do differ among individuals and organizations, a few studies have examined the effects of interactive media on aggressive behavior, albeit with mixed findings. Correlational work, observational studies, and experimental methods have been used to explore the uses and effects of violent interactive games (for reviews of this literature see Anderson & Dill, 2000; Dill & Dill, 1998; and Griffiths, 1999a). The following studies present correlational evidence linking video game play and aggressive behavior or affect on youth ranging in age from 9–17 years. Measures of aggression include self, teacher, and peer reports. Video game play has been positively related to adolescents' (and in some studies their teachers') perceptions of impulsivity (Lin & Lepper, 1987), and aggressive behaviors (Dominick, 1984; Fling et al., 1992; Griffiths & Hunt, 1995). In the Dominick (1984) study, however, the relationship became non-significant when controlling for other factors. Wiegman and van Schie (1998) found that adolescents (ages 10–14 years) who reported preferences for violent video games (significantly more boys than girls) also behaved more aggressively as rated by their peers. In contrast, youth reporting no preference for violent content demonstrated more pro-social behavior. One cannot confer causation with these data, nor can one dismiss the possible influence of unmeasured factors.

Several researchers have examined the short-term effects of violent video game play by observing the subsequent free play behaviors of children ranging in age from 4–10 years (Cooper & Mackie, 1986; Irwin & Gross, 1995; Schutte et al., 1988; Silvern & Williamson, 1987). The evidence from these observational studies suggests that playing violent video games engenders relatively immediate increases in aggressive behavior, affect, and cognitions and decreases in pro-social behaviors (Dill & Dill, 1998; Griffiths, 1999a). Interestingly, Schutte et al. (1988) noted that children's play behaviors were similar to the characters they controlled in the interactive game, lending support for an explanation based in social learning theory. Parents and educators often express similar anecdotes as they witness children pretending to be television characters during play, such as the *Power Rangers*. These, however, are short-term effects.

Conducting experimental laboratory research on the effects of playing violent interactive games is fraught with ethical considerations. Furthermore, there is no systematic program of research in this area, and limited attention is given to young children. Studies that have examined undergraduates'

experiences with recent genres of violent video games demonstrate increases in hostility (Ballard & Weist, 1996), more aggressive play style or higher "kill ratio" in a competitive condition (Anderson & Morrow, 1995), and increases in physiological arousal and aggressive thoughts after virtual reality game play (Calvert & Tan, 1994). Other experimental studies have reported no increases in aggression (e.g., Graybill, Strawniak, Hunter, & O'Leary, 1987; Winkel, Novak, & Hopson, 1987) or mixed results (Scott, 1995).

Kirsh (1998) recently examined 3rd and 4th grade children's interpretations of an ambiguous situation after playing a violent (*Mortal Kombat II*) or non-violent (*NBA Jam:TE*) video game. Children who played the violent game responded significantly more negatively to three of six questions asked about an ambiguous provocation story than children who played the relatively non-violent game. Interestingly, steps were taken to "rig" the *Mortal Kombat II* game so that its graphic nature would not be experienced in full; for example, mutilation moves were not allowed, blood did not spurt following a direct blow to the opponent, and children were required to choose same-sex, same-race opponents. Because evidence of short-term hostile attribution biases were found with a modified ("tamed down") version of this extremely violent game, one must consider the ramifications of long-term exposure to games displaying the most violent content – those that are available to children and adolescents daily on home computers, video gaming systems, and in arcades.

In the most recent work to date on video game violence, Anderson and Dill (2000) conducted two studies of video game violence effects on college students, one correlational (Study 1) and the other experimental (Study 2). While we present only a brief overview of the results of these studies, the full report may be accessed at http://www.apa.org/journals/psp/psp784772.html. The purpose of Study 1, was to assess the potentially negative consequences of long-term exposure to video game violence by measuring video game experience, aggressive personality, and delinquent behavior in real life. A questionnaire was administered to assess irritability, trait aggression, aggressive behavior, delinquency, and world view (or perceptions of the world as a safe place). A video game questionnaire measured exposure to video game violence and amount of time spent playing video games. Exposure to video game violence was positively related to both aggressive and non-aggressive delinquent behaviors; furthermore, exposure to video game violence was positively associated with aggressive personality (Anderson & Dill, 2000).

Study 2 focused on the short-term effects of video game violence on aggressive thought, affect, behavior, and world view. Participants were randomly assigned to play either *Myst* (non-violent game) or *Wolfenstein 3D* (violent game), which were carefully matched on several dimensions. The participants who played the violent video game behaved more aggressively toward their opponent than did those who played the non-violent video game (Anderson & Dill, 2000). Both studies indicate that concern about the potential deleterious consequences of playing violent interactive games is warranted. It seems that in the short term, playing violent games may prime aggressive thoughts, while long-term exposure may result in learning and practicing aggression-related scripts that can become more accessible when real-life conflict situations arise (Anderson & Dill, 2000).

At present little is known about the long-term effects of playing violent computer and video games. Anderson and Dill's (2000) measure of long-term exposure is based on retrospective self-reports, the accuracy of which is dependent on the participant's recollection of their past experiences. While studies tracking children's media-use habits and exposure to violent content throughout childhood, adolescence, and into young adulthood would be ideal, the financial and personal commitment required for this type of research is certainly acknowledged. Will consistent exposure over extended periods of time produce stable changes in one's personality? Longitudinal research designs are necessary to investigate this possibility. Moreover, we have limited evidence documenting the effects of the present generation of interactive game content. As with television, it is likely that the negative effects of play will be cumulative and dependent on the particular genre of games played.

The research base focusing on the relationship between playing violent interactive games and subsequent aggressive behavior, thoughts, and affect is still in its infancy. Anderson and Dill (2000) and Dill and Dill's (1998) reviews of the literature note that many studies in this area are laden with methodological difficulties, a problem that must receive thoughtful attention in future research. Characteristics of the child player as well as factors in the child's social environment (e.g., parenting attitudes and behaviors, peer interactions, television viewing diets) must also be considered. While questions about the causality of violence-aggression relationships cannot be answered with certainty, there are compelling theoretical and empirical reasons from the television literature and from recent video game studies to suggest that such relationships do exist.

4.3.4. Policy Initiatives: Rating Systems

Although we have only a few studies examining interactive game play and aggressive behavior, public policy has been established, premised on the idea that parents need to be informed about violence in interactive media content. Ratings systems have been developed to inform parents and youth about violent content in interactive games and on Web sites (for reviews of rating systems see Federman, 1996; Funk et al., 1999; Roberts, 1996).

In 1994, the U.S. Congress required the computer and video game industries to develop some type of parental advisory label to be placed on game packaging. Two rating systems were established in response. The ESRB (http://www.esrb.org) is an independent board that uses three randomly chosen raters (from a pool of over 100 trained raters) to review and evaluate the content of each product submitted to ESRB. The ratings given correspond to five age-based categories: Early Childhood (EC), Everyone (E or K-A), Teen (T), Mature (M), and Adults Only (AO). Specific content descriptors (edutainment, mild animated violence, comic mischief, realistic violence, mild language, suggestive themes, and others) may also be located with the rating symbols. ESRB ratings are by far the dominant system used in the gaming industry.

The RSAC (http://www.rsac.org), an independent and nonprofit organization, developed a content-based rating system. Ratings are derived from manufacturers' responses to a series of questions. Scores of 0 (lowest) and 4 (highest) are given to each product in the categories of violence, nudity, sex, and offensive language. Classification icons located on the game packaging or in product advertisements appear as thermometers with four "temperature" readings. The temperature readings represent the level of intensity for the four behavioral categories and may be accompanied by content descriptors.

There is ongoing debate among researchers, educators, parents, advocates, game developers, and policy makers about whether the current interactive product rating systems are effective. Do ratings provide useful and adequate information about media content? Of the thousands of products rated by the ESRB, for example, 71% of those products are rated "E" for everyone. A range of games that provide children and adolescents with challenging, skill-building adventures to those games that contain violence or other undesirable content may all be rated "E" with minimal descriptors.

Researchers, parents, children, and commercial game raters may all differ in their definitions of the nature and magnitude of violent content. An interesting comparison between the perceptions of consumers (children and parents) and commercial game ratings (ESRB), Funk et al. (1999) found that both "groups" agreed when the content was clearly non-violent or extremely violent; however, there was significant disagreement between the perceptions of consumers and the commercial ratings when the games contained cartoon-type or fantasy violence. Walsh (1999) reported similar types of disagreements when comparing industry ratings with parent evaluations of game content in the *1999 Video and Computer Game Report Card* (http:///www.mediafamily.org). There was virtually complete agreement when games were rated "EC" or "M"; however, for those games rated "E" or "T" parents were much less likely to concur with the ratings given by ESRB. In both studies, parents would have rated game content much more strictly than the industry.

Do parents and consumers attend to ratings when purchasing products? Surveys indicated that after the first 2 years of being in effect, consumer awareness of the rating systems was low (Fallas, 1996). There is little recent evidence indicating whether parents or others attend to the ratings when making purchases. When adolescents are purchasing the products, are parents or other caregivers aware of the specific content within the rated product? These are all issues in need of research attention.

4.4 Summary & Recommendations

Public questions about the role of interactive media in children's social development suggest that we need to know much more about whether and how networked online use influences children's isolation or social involvement, and participation with peers, family and other social groups. Access to and use of networked online services has immense potential to expand one's social network, thereby increasing sources of social support. Children and adolescents are increasingly using interactive technologies to communicate with others in their immediate environment and with those across geographic distances. Does the use of the Internet and e-mail service, as well as collaborative technologies, facilitate children's self-expression and communication skills? Virtual environments have become contexts for exploration of one's identity. How does role-playing online affect identity formation, or even detachment from reality, as children grow older? Do particular genres of content have particular learning effects on children's offline social behavior?

Research suggests that media provide children with powerful social models, which can influence their pro-social and aggressive behaviors. Interactive media, however, have specific qualities (e.g., identification with characters, active participation and control by the child, and reward for antisocial behavior), which may amplify the likelihood of subsequent aggressive thoughts and behaviors. Are interactive games more potent than other media in teaching aggressive behavior? How do other variables (e.g., home environment, parenting practices, peer relationships, sibling relationships) weaken or strengthen the impact of violent game use and other violent interactive content? These same questions can be posed regarding the effects of pro-social content (on which we have virtually no research) on the development of beneficial and constructive emotions and behaviors.

Children and adolescents are immersed in a technological world. As previous sections of this report have demonstrated, interactive media use has vast potential to influence cognitive and social development. We now turn our attention to issues of special concern related to the health and safety of youth.

5.0 Special Concerns: Health & Safety

The Internet and World Wide Web have immense positive potential to influence many facets of life, as elaborated in previous sections of this report. Correspondingly, there is parental and public concern over children's potential access to violence, pornography, and other undesirable content. Furthermore, there is concern about public access to private family information. Social scientists, parents, policy makers, and other child advocates are quick to identify both the benefits and potentially harmful aspects of using interactive media. Turow (1999) describes this quandary, particularly from the perspective of parents surveyed in the *Annenberg National Survey on the Internet and the Family*:

" American parents are conflicted about the Web. Across the nation, 70% of parents with computers in the home say the Internet is a place for children to discover 'fascinating and useful things' and nearly 60% say that children who don't have the Internet are disadvantaged compared to their peers who do. At the same time, over 75% of parents are concerned that their children might give out personal information and view sexually explicit images on the Internet."

What types of online information can benefit children most? What are the consequences of providing personal information on a commercial Web site? This section explores the positive potential of interactive environments to meet children's health-related needs and address concerns such as privacy issues.

5.1 Positive Potential

Interactive media have the potential to promote health and positive behaviors. Approximately 17 million consumers use the Internet to search for medical and health information (Vozenilek, 1998), and that number has likely increased. Due to the recent growth in Internet use to obtain this type of information in homes, libraries, and community centers, it is important for professionals to be aware of these sources and validate the accuracy of the information available to the public. Hertzler, Young, Baum, Lawson, and Penn-Marshall (1999) recently identified and evaluated Internet sites providing nutrition and exercise information for children. Sites were classified by their source (.gov, .org, .edu, and .com), which somewhat identified the authors' credentials and qualifications, and the "last revised" date on the site. The exercise demonstrated that there are a number of reputable sites providing

nutrition and exercise information relevant for children (e.g., *FDA Kids Home Page*, *The Kids Food Cyberclub*, and *The Pyramid Tracker*); however, keyword searches will often identify sites that are not useful or relevant. Commercial sites can contain useful information, but the purpose of advertising should not be overlooked when reviewing the content of such Web sites (Hertzler et al., 1999).

Organizations such as the *Starbright Foundation* (http://www.starbright.org) strive to help children cope with a myriad of psychosocial challenges when facing difficult and chronic health conditions. These psychosocial issues include isolation, decreased self-esteem, depression, boredom, and loss of peer interactions. Interactive environments are powerful tools contributing to the advancement of the Foundation's mission. Researchers collaborate with the Foundation to study the effectiveness of children's use of interactive programs, such as the *Life Adventure Series: Diabetes CD-ROM* or *Starbright Explorer Series: Exploring your Incredible Blood*. Healthcare teams have discovered that such programs are effective tools for helping children understand and manage their health conditions, and are developmentally appropriate tools for children to better understand their medical treatment (Bearison & Brown, 2000).

Interactive media can provide fun and effective environments for leisure-time learning and behavioral change (Clements, 1987; Kozma, 1991; Lepper & Gurtner, 1989; Lieberman & Linn, 1991; Papert, 1996; Salomon & Gardner, 1986). Games and simulations have the potential to help young people personalize information, assess risks and consequences, and make decisions in a hypothetical yet realistic situation (Dorman, 1997). These interactive media formats are appealing to children and adolescents and can expose them to content and experiences they might not seek from any other media format or from interaction with others (Lieberman, 2000).

Click Health (http://www.clickhealth.com) develops interactive software and video games to improve players' self-care behaviors and health outcomes. Players participate in action-adventure games while they make health decisions for the characters they control (Lieberman & Brown, 1995). For example, in the asthma self-management game *Bronkie the Bronchiasaurus,* players must make sure that dinosaurs Bronkie and Trakie, who have asthma, take their daily asthma medicine, avoid contact with environmental asthma triggers such as dust, pollen, smoke, furry animals, and sneezer characters who emit cold viruses, and use emergency medicine or sick-day medicine when their peak flow (breath strength) goes down. To win the game players must make sure their character carries out daily asthma selfcare and keeps peak flow high, throughout dozens of simulated days. Research has found that

players then transfer to their own daily lives the self-care skills and habits they learned in the game (Lieberman, 1997).

Another example of how interactive media can aid children's health care needs is the *Click Health* diabetes self-management game, called *Packy & Marlon*. The game uses the character's blood glucose level as one of the game goals. Players must balance the character's intake of food and insulin throughout several simulated days in order to keep blood glucose in the OK zone, neither too high nor too low. When blood glucose strays too far from the OK zone, the character must remedy the situation or else it will not be robust enough to meet other game challenges and will therefore be more likely to lose the game.

Lieberman (1997, 2000) demonstrates in several studies that well-designed health education video games can improve selfcare behaviors and health-related outcomes. For example, a randomized controlled clinical trial of the diabetes video game *Packy & Marlon* found that diabetic children and adolescents who had access to the game at home for six months experienced a 77-percent decrease in diabetes-related emergency and urgent care clinical visits, compared to a control group of diabetic youngsters who had an entertainment game at home with no health content and experienced no change in emergency and urgent care visits (Brown et al., 1997).

In addition to offering rehearsal in a simulated environment, *Click Health* games improve health behavior by providing (1) attractive role-model characters who demonstrate desirable selfcare behaviors and help de-stigmatize those behaviors for children who are afraid of being different from their peers (Lieberman, 1997); (2) customizable self-care regimens so that the character will be using a daily regimen that is most similar to the player's; (3) dynamic databases that allow players to look up essential health-related information to help them win the game; (4) supportive and informative performance feedback and unlimited opportunities for rehearsal of skills, to foster in players a stronger sense of self-efficacy (see Bandura, 1997) for health behaviors rehearsed in the game; (5) cumulative records of the characters' health status; and (6) two-player options that foster communication about the health topic with friends, family, and caregivers.

Click Health video games are designed to be highly appealing to children and adolescents, to provide compelling challenges that attract and involve players, to allow a great deal of control over the action, and to offer a high degree of interactivity in an action/adventure format. Research has shown that the

games are effective at improving health behaviors and outcomes related to chronic conditions, such as asthma and diabetes, and are also effective at encouraging prevention behaviors, such as those related to safety and smoking prevention (Tingen, Grimling, Bennett, Gibson, & Renew, 1997). In short, innovative uses of video game formats and principles demonstrate that depending on the content, video game technology can yield very positive learning outcomes for children. Yet, such interactive game play may have negative health consequences, a few of which will now be addressed.

5.2 Areas of Health Concern

Medical scientists and clinicians, in particular, are concerned about the detrimental effects of frequent interactive game play on health-related outcomes. Individuals may experience physiological responses as a result of playing interactive games (Emes, 1997; Funk & Buchman, 1995). For example, researchers have recently been exploring the mechanisms of video game-related seizures or video game epilepsy (e.g., Fylan, Harding, Edson & Webb, 1999; Graf, Chatrian, Glass, & Knauss, 1994; Kasteleijn-Nolst et al., 1999; Millett, Fish, Thompson, & Johnson, 1999; Ricci & Vigevano, 1999). These game-related seizures are likely triggered by particular temporal patterns of light stimuli (or display flicker) during game play or observation (Funk & Buchman, 1995; Fylan et al., 1999). Furthermore, specific video game content has specific effects. Ricci and Vigevano (1999) found variation between different game programs and activation of seizures. Although this is an uncommon condition, epilepsy warnings are found on some video game packaging today.

Another area of concern is the potential for interactive media use to become addictive (e.g., Griffiths,1993, 1995, 1996, 1999b; Griffiths & Hunt, 1998; Phillips et al., 1995). Griffiths (1999b) explores the concept of "technological addiction" defining it as a behavioral addiction (as opposed to chemical) containing core components of addiction: salience, mood modification, tolerance, withdrawal, conflict, and relapse. There seems to be subgroups of children and adolescents whose game-playing behavior would fit the DSM-III-R criteria for addiction. In a survey of 868 adolescents, Phillips et al. (1995) found that 50—the majority of whom were boys—reported behaviors that would score high on an addiction scale. For example, these individuals reported playing six or more days per week, playing for more than one hour at a time, feeling they played longer than they intended, and neglecting homework to play.

Griffiths and Hunt (1998) adapted the DSM-III-R criteria for pathological gambling so that it related to computer game playing and measured components of dependence in 387 adolescents between 12 and 16 years of age. Scores on the dependence scale indicated that 20% of the adolescents were currently dependent on game playing and 25% had been so at some point in their lives. The only other negative self-reported behavior associated with "dependence" was increased likelihood of aggression (Griffiths & Hunt, 1998). Accordingly, the authors suggest that they may be measuring preoccupation rather than dependence. The reported relationship with increased aggression deserves further research attention. Although playing interactive games may be an absorbing, benign activity for most children, the game-playing habits of some individuals may be a marker for existing or potential adjustment problems (Funk & Buchman, 1995; Griffiths, 1997b).

American children are more over-weight, slower, and weaker than their counterparts in other developed nations; correspondingly, children seem to be developing sedentary lifestyles at an earlier age (Dorman, 1997). Recently, the Surgeon General reported that 60% of Americans do not engage in any regular exercise (NBC nightly news reported on Jan. 26, 2000). Furthermore, rigorous physical education programs are increasingly being eliminated from K-12 curricula. These recent trends in Americans' behaviors constitute major health concerns. Although speculative, it may be that interactive game use and television viewing contribute to sedentary lifestyles by displacing involvement in sport and other physical activity (Dinubile, 1993). In a recent study with Black sixth graders, Trost, Pate, Ward, Saunders, and Riner (1999) found that the girls who were classified as low-active were significantly more likely to report watching television or playing video games for three or more hours per day than active girls; this finding was not significant for boys. While amount of television watching seems to be predictive of overweight status in children (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998), viewing behavior has not been shown to cause decreases in physical activity. Surprisingly, we found no published research exploring causal relationships between interactive media use and obesity. Future research is needed to examine relationships among times of day children watch TV and play interactive games, use of particular types of content, and prevalence of other sedentary behaviors (Trost et al., 1999). Investigations of these relationships are necessary to advance our understanding of the impact of media use on children's health-related development.

Evidence for both positive and negative health consequences of interactive game use is available in the literature. However, for most interactive media, we have no systematic research base from which to

draw conclusions. Moreover, there seems to be little consistent theoretical conceptualization of how and under what conditions we might expect health outcomes for children using interactive media.

5.3 Advertising & Privacy

Children are an important present and future audience for advertisers. They have personal buying power and influence purchasing decisions within the family (Guber & Berry, 1993; McNeal, 1992; Wartella, 1995). McNeal has studied children's spending patterns for over 30 years and estimates that children influence between 25 and 40 percent of household purchases (Reese, 1996).

As children's spending power and influence over their parents grow, marketers are casting their nets wider than ever before (Reese, 1996). The advertising deluge is no longer limited to Saturday morning and after-school television, but has now permeated the online environment. Children can now interact with their favorite commercial characters on the Internet. Advertising practices on the Internet, however, are much less apparent than those we have come to recognize on television. Montgomery and Pasnik (1996) point out two fundamental issues to consider with online advertising: (1) violating children's right to privacy, and (2) unfair and deceptive advertising practices.

First, family privacy can be invaded by using profiling tactics. It is often the case that children are asked to provide personal information, such as name, age, gender and e-mail address. Moreover, online advertisers collect information about individuals and specifically target each person based on his or her personal interests (Calvert, 1999). Companies are increasingly using "cookies" and intelligent agents that track and catalogue the interests and habits of the online visitors (Turow, in press). Soon, elaborate profiles exist about each individual user. In the most recent survey of *The Internet and the Family 2000* conducted at the Annenberg Public Policy Center (http://www.appcpenn.org), Turow and Nir (2000) found that almost half of American parents were not aware that Web sites gather information on users without their permission. Moreover, parents and children had very different ideas and opinions about giving out personal information to Web sites. The 10–17 year olds were much more likely to say it is OK to give sensitive personal and family information to commercial Web sites in exchange for a free gift (Turow & Nir, 2000).

Second, online ads are frequently integrated within the content in a branded environment. The required separation between television program and commercial are absent from the online environment. The entire Web site is an opportunity for children to interact with the product brands and brand characters, such as *Tony the Tiger* and *Chester the Cheetah*. In October of 1998, Congress recognized the need to regulate online marketing to children and passed the Children's Online Privacy Protection Act (COPPA), which went into effect April 21, 2000. COPPA provides safeguards to protect children's privacy on the Internet by regulating the collection of personal information from children under age 13 (CME, 2000; http://www.kidsprivacy.org). Specifically, COPPA authorizes the Federal Trade Commission to develop and enforce rules for regulating data collection procedures by commercial Web sites targeted at children; moreover, the act requires that advertisers disclose their privacy policy describing data collection techniques and how that information will be used.

We have limited information about how children perceive advertisements on the Internet. The television literature indicates that comprehension of persuasive intent is clearly related to age. As children grow older, they increasingly understand that the purpose of commercials is to persuade them to buy products (Comstock, 1991; Van Evra, 1998). For example, children typically begin to understand the persuasive intent of television advertising around the age of seven or eight (Robertson & Rossiter, 1974; Ward, Wackman, & Wartella, 1977). Does the knowledge we have acquired about children's understanding of television advertising apply to the Internet? In a small exploratory study of 23 children ages 9 to 11 years, Henke (1999) examined children's perceptions of the persuasive intent of favorite Web sites and preferences for web surfing and other activities. Children completed questionnaires that assessed favorite after-school activities and participated in an Internet search session. Several Web sites were bookmarked (*Toys R Us*, *Ben & Jerry's*, the Museum of Science, *Foster's Daily Democrat*, and *CNN*) and lists about other sites (e.g., *Batman Forever*, *ESPN*, and *MTV*) were provided to the children. Seventy-four percent of the children named commercial Web sites as their favorites, specifically *Toys R Us* and *Ben & Jerry's*, but only 13% said the purpose of their favorite site was to advertise (Henke, 1999). Interestingly, they thought the purpose of the site was for entertainment. The study suggests that even children 9 – 11 years may not be aware of the commercial intentions of many Web sites, and in particular, the branded environment phenomenon.

The amount of time children and adolescents spend exploring online commercial sites is limited only by their own interest and possibly parental regulation. Turow (in press) identifies three features of the Web that make auditing content and enforcing rules about it more difficult for parents than with

previous media: (1) the Web is virtually unlimited in nature; (2) there is an enormous presence of commercial sites; and (3) the complexity of the technology often results in adults knowing less about it than do their children. Internet filtering and monitoring devices are alleged to be solutions intended to provide mechanisms for parents to regulate undesirable Internet content. However, there is much debate about their use and their effectiveness. For example, parents who block sites containing the word "sex" may find that all educational biology sites are off limits (Turow, in press). In addition, parents may feel uncomfortable using such devices, and adolescents have been known to circumvent or disable the devices. Much more information regarding parental mediation of children's interactive media use is needed. Research on the health and safety issues addressed here would clearly advance current policy discussion.

5.4 Summary & Recommendations

What are the specific health issues that should be addressed in the design of interactive technologies? For example, are children at risk for the development of stress-related disabilities in the same way adults are at risk? How can we design ergonomically appropriate technologies for children that are usable and safe? Does industry research provide guidelines, which should be examined in a systematic research endeavor? We have reviewed only the most public concerns currently voiced about health and safety issues related to children's use of interactive technologies. Unfortunately, many health issues often arise only after highly publicized disasters or events that put children at risk. Additional work is needed to avoid such calamities – and indeed attention to the health consequences of children's interactive media use is clearly warranted.

6.0 Recommendations for Future Research

This literature review and the accompanying annotated bibliography present current research on children and interactive media in out-of-school settings. Using both the review and ideas generated during the Experts' Conference we convened in November 1999 as starting points, we have developed recommendations for future research, professional collaboration, and dissemination of research findings. These recommendations are in the form of both an overarching strategy for studying this area and a preliminary agenda of research questions that would best address the interests of parents, educators, media producers, and policymakers. All of these constituencies have an interest in knowing how to design and implement interactive media so that it will promote healthy child development and will provide high-quality entertainment and positive opportunities for learning.

We have observed that the current literature is spread across many different disciplinary journals (e.g., education, communication, psychology, sociology) and often is not integrated within research topics. That is, researchers in different disciplines often do not cite each other. Moreover, industry-based market-driven research, used for the purpose of designing interactive media products for children, is non-cumulative, is typically not integrated into an overall understanding of how children use or are influenced by interactive media, and is "adevelopmental" in that it is not conceptually connected to larger cognitive or social developmental dimensions of growth.

When research on children's use of interactive media is examined systematically and within a developmental framework, it affords a more comprehensive understanding of the role of media use in children's overall cognitive and social development. Knowing how interactive media affect children in these fundamental ways will help parents make effective decisions about their children's use of these media; will help educators teach media literacy skills; will help instructional designers integrate interactive media appropriately into children's learning environments; will help producers make wise choices about the design of interactive content and interfaces for young people; and will help policymakers set priorities. Children will be better served when those who design and implement young people's interactive media do so on the basis of sound research evidence.

To support research and outreach in this area we recommend several overarching strategies and goals:

- Provide funding to support developmentally based research on the uses, design, and impacts of interactive media;
- Integrate research on children and interactive media into a developmental framework;
- Create a multidisciplinary research infrastructure that will provide scholars the opportunity to study new media and children's issues systematically and efficiently;
- Encourage the exchange of ideas among a community of scholars, educators, and producers so they can translate current knowledge into entertaining and educationally effective interactive media products for children;
- Publish reports and provide online resources targeted to specific groups (parents, educators, instructional designers, children's media producers, policymakers) to address issues of concern to them and to provide clear recommendations that are solidly based on research findings;
- Put the use, design, and effects of children's interactive media on the public agenda, through publicity, press relations, conferences, and high-profile speeches and events.

By addressing these goals, we can help ensure that research on children and interactive media is developmentally based, multidisciplinary, cumulative, accessible to media content developers and producers, and responsive to social questions of interest to the public and policymakers.

6.1 Recommendations for Research Funding

Funding to support research in this field should be provided in several ways. It should supplement current ongoing national studies of children's health and development so that they include measures of young people's use of both old media (television, radio, print) and newer interactive media. For instance, the annual Panel Study of Income Dynamics (Hofferth, 1998) conducted through the University of Michigan currently tracks a national sample of families and conducts a variety of assessments of children's social and emotional well-being, family economics, and family structure. For the first time, in 1997, some media use measures were included. These should become routine in this and other annual, national tracking surveys of the state of America's children. Including media use measures would allow tracking the relationship between media use and other aspects of cognitive and social development.

Funding should also be available to support programmatic research devoted to the study of children and interactive media in out-of-school settings. There is no current federal agency that regularly funds such research; although the National Science Foundation did fund a research agenda setting project under the direction of Nancy Willard at the University of Oregon in late 1999 (personal communication, March 2000). A research initiative either located within a federal agency, such as the National Science Foundation or the National Institute of Health, or funded by private foundations through a national collaborative center devoted to this topic, should provide funding for pre-doctoral research training, post-doctoral research training, and specific programmatic studies of the influence of interactive media on children. The lack of an ongoing funding initiative has severely hampered the current state of knowledge about children and media (Wartella, 1999). The American Psychological Association recommends that the FY 2001 appropriation bill for the National Science Foundation include language that specifically recommends funding for research on children and technology as part of funding for the multi-agency Information Technology Research Initiative. Should this appropriations bill become law with such a recommendation, it would be a step in the right direction for encouraging federal funding of research on children and interactive technologies in out-of-school settings.

6.2 Recommendations for a National Research Agenda

The following are specific recommendations for a national research agenda of studies of children's use of these media and their role in cognitive and social development.

6.2.1 Media Use & Access

Ongoing national studies are needed to investigate how children of different genders, ages, ethnicities, and socio-economic backgrounds are using interactive media for different purposes (e.g., chat rooms, MUDs, gaming, collaborative activities, and exposure to various kinds of content such as violence and sexual content). The goal of these studies should be to track changes in children's access to new media and to identify the diversity of communication activities such exposure entails. Clear conceptualizations of media activities and analyses of their potential relationship to cognitive and

social outcomes (e.g., children's use of collaborative gaming and its relationship to the acquisition of cooperative skills and knowledge) are currently sparse in the literature.

Furthermore, we need to study those children who may have access to computers and other interactive media in the home, but who choose not to use them. Roberts et al. (1999) found that 69 percent of the children they studied lived in homes containing computers, but only about 40 percent of those children reported using them on a daily basis.

What characteristics of children, family relationships, other social dynamics, and aspects of the usability of the technology itself might account for both use and non-use? How do families incorporate rules regarding interactive media use into child rearing practices? How do families use the various technological aids such as blocking devices and ratings systems to guide their children's use of interactive media? We need to understand how children use new media in the context of their relationships with other people and with social institutions such as schools, museums, and libraries. How do children use interactive technologies in each of these environments?

Social and economic policies are likely to influence each child's opportunity to use new interactive media. Correspondingly, what are the long-term ramifications for children who do not have adequate access or the necessary skills required to experience the full potential of new technologies? Furthermore, how do children's early experiences with interactive media influence later interests, technological literacy, and career opportunities? These are just a few of the research questions we need to investigate, not only to gain insight into developmental aspects of children's media use and access, but also to help inform the policies that affect children, be they media use policies in the home, media access policies in the library, or national regulatory policies that affect the distribution of content developed by the interactive media industry.

6.2.2 Interactive Media & Cognitive Outcomes

Research on the influence of interactive media on children's cognitive development should first provide conceptual descriptions and analyses of these media and their content. All too often, people see one example of a violent video game or disturbing chat room conversation and assume that all games or chats are the same. But are they? What is needed is a "road map" to these interactive media: a classification of the different types of interactive experiences children might have and the kinds of

content they might encounter. For example, we might establish a national media laboratory or consortium of media laboratories to examine, review, and evaluate each new computer game. This would create a library that parents or game designers could use to learn about typical game design practices and how to evaluate game content targeted to children and adolescents. Parents, teachers, and others could use this information to find valuable online experiences for youth and to protect them from doubtful ones.

The national lab could be a repository for the huge variety of interactive media targeted to youth, along with research findings pertinent to those media. Perhaps the lab could physically house a collection of technological devices; however, one of the most important functions of the media lab would be to make media content and the research findings available online. This would allow access from any location. The road map developed by the consortium of labs should consider interface and instructional design elements of interactive media, which may influence both their usability for children and children's ability to learn with them. These elements are becoming more complex as interactive content is becoming available in an ever-widening assortment of screens, smart toys, and virtual environments.

Critical elements of interactive media, such as interactive feedback and personalization of content, and their influence on cognitive engagement and learning outcomes, should be studied further. Similarly, more research is needed to help us understand how various modalities of messaging, such as the presentation of visualizations, data, or agents using images and or sound, can impact young users' engagement and learning.

6.2.3 The Importance of Interactivity

"Interactivity" itself, regardless of content, may have an effect on the way children create and process information, and research is needed to understand its potential impacts. For example, does interactivity facilitate learning? Does active involvement with computer–based content increase children's comprehension and retention, and does it influence their perceptions of the task so that they are more highly motivated to sustain their attention and engagement?

Before investigating effects of interactive media on cognitive, social, or health-related outcomes, the concept of interactivity itself needs to be further conceptualized and empirically demonstrated. For

instance, research examining Salomon's (1990) four characteristics of successful educational software (i.e., interactivity, guidance and informative feedback, multiple symbol systems, and supplanting users' memories allowing them to engage in higher order thinking) would be useful. How do children respond to these characteristics, and how do such characteristics influence children's subsequent learning? Furthermore, different types of interactive activities or environments will likely result in different types of interactive experiences. For instance, interactive pets probably engage children differently than interactive computer games. The characteristics of various interactive activities and materials will differentially influence children's ability to create, build, and design.

6.2.4 Impact of Interactive Media on Social Development

Public questions about the role of interactive media in children's social development suggest that we need to know much more about whether and how the use of online networks influences children's isolation or social involvement, and participation with peers, family, and other social groups. How does role-playing online affect identity formation, or even detachment from reality, as children grow older? Interactive media provide a particular challenge to social development with regard to how imagination and imaginary social worlds impact development. The two environments – "real life" and "virtual" – can differ in many ways and how children's understanding of the virtual world relates to their development is of much speculation.

Children and adolescents are increasingly using new technologies to communicate with others in their immediate environment and with those across geographic distances. Does the use of the Internet and e-mail, as well as collaborative technologies, facilitate children's self-expression and communication skills? Do particular genres of content have particular learning effects on children's offline social behavior?

Research findings suggest that media provide children with powerful social models that can influence their pro-social and anti-social behaviors. Today's commercially-available interactive media, however, possess unique qualities (e.g., character identification, active participation and control by the child, reward for anti-social behavior), which may amplify the likelihood of subsequent aggressive thoughts and behaviors. Are interactive games more potent than other media in teaching aggressive behavior? How do other variables (e.g., home environment, parenting practices, peer relationships, sibling relationships) weaken or strengthen the impact of violent games and other violent interactive content?

These same questions can be posed regarding the effects of pro-social content on beneficial and constructive emotions and behaviors.

What are the health issues that should be addressed in the design of interactive technologies? For example, are children at risk in the same way adults are for development of stress-related disabilities? How can we design ergonomically appropriate technologies that are usable and safe for children? Are there guidelines from industry research that should be examined in a systematic research endeavor?

6.3 Recommendations Regarding Research Methods

Research attention should be given to the development of appropriate methodologies for the study of children's interactive media experiences. These experiences are complex, and when they have an identifiable effect it is often hard to determine exactly why. We need research to distinguish effects of technology from effects of content, as well as studies designed to specify the personal characteristics of children most likely to be affected and most likely to affect the interactive experience. The lessons from research on children and television tell us that only *some* television affects *some* children under *some* circumstances. We need well-designed, programmatic research to specify the qualified statements regarding interactive media effects on children.

Proprietary design research and market research have the potential to inform, as well as to be informed by, academic research efforts. Specifically, design research focuses on refining and improving the design of the product itself. This process may include assessment of user responses to the product, effectiveness of specific product features, or the product's influence on users' behavior. In contrast, market research tries to identify product features that will attract the user or purchaser. Market research focuses on the presentation of the product and what will sell. Creating links between the industry-based design/market research community and the academic research community, in addition to encouraging interdisciplinary research efforts, will be mutually beneficial. Researchers suggest that knowledge of the industries that create the hardware and software is important to better understand the context in which children, parents, and families approach the interactive world. Experts in child development, communication, human-computer interaction, education, psychology, public policy, sociology, and interactive media development all contribute valuable perspectives necessary to inform future directions.

Multiple methods of study are required to answer the complex sets of questions posed in the area of children and interactive media. Content areas in which we have limited knowledge and understanding may require a number of small descriptive studies or targeted experimental studies to determine which questions are most valuable to pursue, and which assessments are valid and reliable. Large national surveys provide important demographic information necessary for making decisions regarding telecommunication policy. In contrast, such surveys may not provide specific information about attitudes toward technology, context of use, patterns of use, media hardware and content available in the home, and so forth. What is required is a *systematic* body of literature incorporating multiple methods (e.g., natural observations, national surveys, experiments, and longitudinal field studies), and research efforts investigating children of different genders, socio-economic, and ethnic backgrounds.

Investigators are increasingly using the online environment as a research tool for searching out information, conducting research, and collecting data. Accordingly, we must consider the general guidelines and ethical principles set forth by institutional and federal governing boards. The broad issues and principles include: (1) use of human subjects' concerns, which have been articulated by the Department of Health and Human Services Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978); (2) specific concerns regarding how various institutional research boards (IRBs) interpret these general guidelines; and (3) the specific issue of gaining parental consent when children and adolescents are the subjects in a study (for in-depth coverage of these topics, see Huston, Wartella, Donnerstein, Scantlin, & Kotler, 1998).

Federal guidelines require special considerations in conducting research with children (anyone below the legal age of 18). These include obtaining parental consent for children's participation, and insuring the protection of their rights and welfare. Getting informed consent, however, may be more difficult for online studies. If research is conducted with children who are using their home computers, it may be impossible to determine if they really asked their parents for permission. Use of the online environment for research does seem to produce unique issues. Further conceptualization and expansion of these issues will be necessary as more investigators consider the advantages and disadvantages of collecting their data online. Given the rampant use of the Internet to obtain marketing information about children and the recent passage of the Children's Online Privacy Protection Act (COPPA, April, 2000) special attention to obtaining active parental consent and full

disclosure of the research to be conducted online is necessary when children are the subjects of online developmental research studies.

6.4 Recommendations for a Community of Scholars

Through funding initiatives and academic organizations, a multidisciplinary community of scholars devoted to studying children and media should be encouraged and developed. This community should draw upon both academic and industry researchers to share their knowledge and to encourage the use of this knowledge in the development of quality interactive media products for children. Indeed, our Experts' Conference highlighted the fact that there is a wealth of design research and market research on children and interactive media, but it is not accessible to audiences outside of the particular media company or market industry. Can we find a way for industry-based researchers to collaborate with academic researchers, to create the highest quality interactive children's media products? This should be the goal of such a community of scholars.

The consortium of children's interactive media laboratories proposed in the previous section might be an entity that would organize a community of academic and industry-based scholars. By providing a central repository and dissemination point for all research related to children and interactive media, such a lab(s) could very naturally extend its role and serve as a catalyst for collaboration and the exchange of ideas. In addition, the recent establishment of the *Research and Public Education Initiative on New Media, Children and Youth* by the Center for Media Education (http://www.cme.org/initiative/whatis-init.htm)

can facilitate partnerships among academic researchers, industry leaders, child advocates, educators, and health professionals. The goals of this new initiative include serving as a clearinghouse for research as well as providing a mechanism to encourage a community of scholars and advocates devoted to quality children's interactive media. This is a very encouraging development.

Another way to help develop a community of scholars would be to hold multi-disciplinary and multi-industry conferences focused on children and interactive media, with research presentations, product demonstrations, and roundtable discussions. Springing from the conferences could be high profile, peer-reviewed publications of the academic and industry-based research presented there. The national

children's interactive media lab could serve as conference organizer and could edit an annual review of top research in the field.

6.5 Recommendations for Dissemination of Research

An extremely important component of the research process is dissemination of findings. All too often, groundbreaking theory-based research on children and interactive media languishes unnoticed in academic journals, when it ought to serve as a foundation for other studies of children and interactive media across the academic disciplines, and ought to be applied to interactive media product development and implementation.

Once again we turn to the idea of a consortium of children's interactive media laboratories that could serve pivotal roles in disseminating research findings and interpreting the practical applications of the findings for major constituencies, including parents, educators, children's media producers, and policymakers. Much like the national centers on drug abuse around the country, such national centers could publish research updates, in print and online, targeted to each constituency, using clear language that avoids using the jargon or "academese" of researchers and instead clearly lays out the research methods, findings and implications.

Such a consortium could also be funded to create press releases announcing major findings in the field, and establish and maintain relationships with the press. Reporters should easily discover that lab affiliates are excellent sources for discussing the research related to many topics that tend to be covered in the media, ranging from the potential negative impacts of video games on children's attitudes and behavior to child safety on the Internet to socio-economic gaps in media access to regulatory issues. Academic and industry scholars affiliated with the various research centers in the consortium could be listed in a Speakers' Directory and a Consultants' Directory, so that other organizations could find leading experts to work with them. And they could sponsor newsworthy events that draw attention to issues surrounding the use, design, and effects of children's interactive media. We feel strongly that there is an extraordinary amount of research to be done and that interactive media will become increasingly dominant in the lives of future generations of children. Accordingly, many researchers from around the country at several research centers should be encouraged to develop this research domain.

7.0 Conclusions

For children and adolescents, the promise of interactive technologies and networked environments is their potential to influence learning and social growth in positive ways. We can achieve this by developing exciting educational and entertaining materials that young people can use out of school, and that can traverse the home to school environment. The first step, however, is to understand how these interactive media affect children – their cognitions, emotions, social relationships, and even their health. Our review of the literature has found numerous effects of interactive media on these domains of development. Clearly, however, there is a need for coordinated and systematic research to tackle what we do not yet know. This research will provide useful findings for academics engaged in research on interactive technologies, for parents and other children care givers, for educators who want to teach about and utilize interactive media, for the production community interested in developing quality interactive entertainment and educational materials for children, and for policymakers interested in ensuring that media exert a positive influence. Thoughtful, programmatic research can help all these constituencies advance the promise and limit the potential perils of interactive media in the lives of our children.

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Children and Interactive Media: Setting a National Research Agenda

Selected Annotated Bibliography *(Revised 8/23/00)*

Content Area: Reviews & Overviews

Calvert, S.L. (1999). Children's journeys through the information age. Boston, MA: McGraw-Hill College.

In *Children's Journey through the Information Age,* Calvert describes the current and emerging information technologies that influence children's lives, summarizes what is known about their effects, and discusses their meaning for parents, teachers, and policymakers. Calvert also identifies the major messages that TV, computer games, CD-ROMs, and other information technologies convey to the children who use them. We learn about the gender roles and ethnic and racial stereotypes that are implicit in many programs. We discover the power of the media to educate and to heighten either aggressive or prosocial tendencies in young viewers. Throughout this journey down the highway of information technology, Calvert cautions her readers against simplistic conclusions about the media's influence on children. Contrary to those who either idolize or demonize the information technologies, her assessment is a more balanced recognition of its multifaceted potential for improving or blunting children's understanding, depending on how it is used. (PsycINFO)

Char, C.A. (1990). Interactive technology and the young child: Insights from research and design. Center for Learning Technology Reports and Papers in Progress, 90 (2), 1-9.

This paper offers historical, present, and futuristic perspectives on the role of interactive technology in the lives of young children. In the early 1980s, debate tended to center on the question, " Are computers good for young children?" At the time, educational software consisted almost exclusively of animated drill and practice programs. Now, advances in software technology have resulted in more exploratory, open-ended software programs and tools and better guidelines for evaluating and designing developmentally appropriate software with features intended for 3- to 6-year-olds. In the future, researchers, designers and educators should assume a more active role in determining how technology might enhance young children's learning and development. Interactive technologies might offer children powerful tools and environments for: 1) creating multimedia compositions;
2) enhancing intuitive knowledge and decision-making processes; 3) extending mathematical exploration and problem solving; and 4) supporting social interaction, collaboration, and perspective. Several aspects of young children's uses of computers are addressed that illustrate the ways in which technical developments in computer hardware could broaden our conceptions of young children's interactions with technology. (Author Abstract)

Cocking, R.R., & Greenfield, P.M. (1996). Effects of interactive entertainment technologies on children's development. In I.E. Sigel (Series Ed.) & P.M. Greenfield & R.R. Cocking (Vol. Eds.), Interacting with video: Vol. 11. Advances in applied developmental psychology (pp. 3-7). Norwood, NJ: Ablex Publishing Corp.

The authors of this volume address a number of significant issues related to the role of interactive media in the emotional, social, and intellectual life of children, adolescents, and young adults. The electronic media on which this volume focuses include video games and virtual reality games. What are the effects of media, such as video games and virtual reality on development? This volume examines this question in three conceptually distinct parts: What are the developmental effects

of interactive media content? What are the developmental effects of interactivity itself? What are the developmental effects of interactive media forms? (PsycINFO)

Dorr, A., & Kunkel, D. (1990). Children and the media environment: Change and constancy amid change. Communication Research, 17, 5-25.

American children's media environment has changed dramatically in the last several decades. This article reviews these technological advances and their impact. As reported in five other articles in this issue, there have been some changes in the media that children interact with and how they interact with them. However, there is also considerable continuity despite the media changes. Also discussed are issues the other five articles raise about when different technologies are functionally the same for the user and about the relative importance of the technical features and the content of each technology. Finally, policy issues involving newer and older communication media and orientations to the study of children and the media environment are considered. (Author Abstract)

Durkin, K. (1995). Computer games and their effects on young people: A review. Sydney, NSW: Office of Film and Literature Classification.

Provides a critical review of research concerning the effects of interactive video games on young people. Strengths and weaknesses of the available research are discussed, gaps in current knowledge are identified and priorities for future research are suggested. Research topics examined include: characteristics of video game players; the negative effects of video games (e.g., Are video games additive? Do video games impair family life and school performance? Does video game play promote aggression? Do video games have negative health effects?); community attitudes toward video game materials; children's and parents' perceptions of violence in video games; and the positive effects of video games (e.g., Do video games promote cognitive and educational progress? Can video games promote social interaction among young people?). (Mediascope Abstract)

Dutton, W., Kovaric, P., & Steinfield, C. (1985). Computing in the home: A research paradigm. Computers and the Social Sciences, 1, 5-18.

Proposes a typology as an initial framework for the study of patterns of computer use in the home, along with four sets of independent factors--social status, technical features, socio-cultural setting, and personal attributes such as attitudes and values. This approach integrates patterns of computer utilization with technological, social, and psychological factors to account for the implications of computing in the home. A model of computer use is discussed with reference to research in such areas as human factors, social learning theory, TV viewing habits, and the impact of computing in organizational settings. (PsycINFO)

Emes, C.E. (1997). Is Mr. Pac Man eating our children? A review of the effect of video games on children. Canadian Journal of Psychiatry, 42, 409-414.

Reviews the English-language literature in MEDLINE and PsycINFO from 1966 to 1996 regarding the effects of playing video games on the well-being of children. Results show that playing video games is associated with a variety of physical effects, including increased metabolic and heart rate, seizures, and tendonitis. Aggressive behavior may result from playing video games, especially among younger children. There is no direct relationship between psychopathology or academic performance and playing video games. Overall findings indicate that although video games have some adverse effects, they are also valuable learning tools. (PsycINFO)

Federman, J., Carbone, S., Chen, H., & Munn, W. (Eds.) (1996). The social effects of electronic interactive games: An annotated bibliography. Ventura Boulevard, CA: Mediascope. http://www.mediascope.org.

This is an annotated bibliography on the social effects of interactive game use, including many of the earlier studies (mid 1980s – early 1990s) in the area. The bibliography is divided into nine topic categories: 1) research and literature reviews, 2) cognitive development and game performance, 3) educational use and academic performance, 4) use by elderly adults, 5) game usage, habituation, and skills, 6) gender issues, 7) health issues, 8) personality and motivation, and 9) violence and aggression.

Funk, J.B. (1992). Video games: Benign or malignant? Journal of Developmental and Behavioral Pediatrics, 13, 53-54.

Describes the current status of research on the effects of video game playing in the areas of video game epilepsy, aggression, psychopathology and personality features, and academic performance. The article concludes that playing video games may have an important influence on the lives of frequent players, but research is preliminary.

Funk, J.B. (1993). Reevaluating the impact of video games. Clinical Pediatrics, 2, 86-90.

Surveyed 357 7th- and 8th-graders (183 girls and 174 boys) to assess frequency and location of play and video game preference. About two thirds of girls played video games at least 1-2 hrs/wk at home, but only 20% played in arcades. About 90% of boys played in the home and about 50% in arcades. Half of preferred games were from one of two categories of violent games, while 2% of preferred games were educational. Parent education about the influence of the media should include recommendations to monitor game playing and influence game selection. (PsycINFO)

Funk, J.B., & Buchman, D.D. (1995). Video game controversies. Pediatric Annals, 24, 91-94.

Provides an overview of issues related to video games, including physical health (video game-related seizures, cardiorespiratory fitness, musculoskeletal injuries, and chemotherapy), eye-hand coordination, psychopathology, violence, educational impact, prosocial applications, and future trends. While the limited research on possible harms and benefits of video game play is inconclusive, increased behavioral problems, lower self-esteem, and feeling "addicted" to game playing have been reported by some players. The story-directing, interactive, repetitive nature of game playing may amplify the potential impact of video games. Although research in this area is preliminary, it is possible that playing violent games may increase the likelihood of subsequent aggressive behavior through disinhibition of aggressive responses, identification with game characters, and by gradually diminishing empathy toward victims of violence. Authors believe that an informational rating system should be able to provide the guidance most parents would appreciate, while avoiding the "censorship" forecast by some opponents. The article mentions that students have benefited from the introduction of video games as instructional aids and to encourage positive behavior. The question as to whether recreational game playing has negative impact on school performance remains unresolved. Two trends that will define the future of video games are increasing access and realism. (PsycINFO)

Greenfield, P.M. (1996). Video games as cultural artifacts. In I.E. Sigel (Series Ed.) & P.M. Greenfield & R.R. Cocking (Vol. Eds.), Interacting with video: Vol. 11. Advances in applied developmental psychology (pp. 85-94). Norwood, NJ: Ablex Publishing Corp.

(From the chapter) the study of the cognitive process elicited or stimulated by video games is the study of one particular example of everyday cognition that depends upon interaction with one particular class of cultural artifact: the action video game / a major theme of [this research] is that video games are cultural artifacts that both depend on and develop the iconic mode of representation, particularly one important aspect of iconic representation: the dynamic representation of space. (PsycINFO)

Haddon, L. (1993). Interactive games. In P. Hayward & T. Wollen (Eds.), Future visions. New technologies of the screen (pp. 123-147). London: British Film Institute.

The chapter examines three histories of the development of interactive games: (1) the development of game hardware, (2) the evolution of software industries and specific games texts, and (3) the nature of game playing itself and the frequently discussed negative outcomes (e.g., fears of addiction or desensitization) of such playing generated in the public and academic communities.

Hofstetter, F.T. (1994, Winter). Is multimedia the next literacy? Educators' Tech Exchange, 2, 6-13.

Multimedia is the buzzword of the decade. Like most buzzwords, it has been used in many contexts. You find it on the covers of books, magazines, CD-ROMs, video games, and movies. It is used in advertising shoes, hairstyles, drugs, cars, computers, soft drinks, beer, kitchen floors, vacations, airplanes, televisions, telephones, houses, museums, newspapers, arcades, theme parks, Olympic games, and shopping malls. Sometimes the term is used to add hype to products that have nothing to do with multimedia. The many uses and abuses of the word multimedia have led to confusion over just what it is. (Author Abstract)

Huston, A.C., Donnerstein, E., Fairchild, H., Feshbach, N., Katz, P., Murray, J., Rubinstein, E., Wilcox, B., & Zuckerman, D. (1992). Big world, small screen: The role of television in American society. Lincoln, NE: University of Nebraska Press.

"Big World, Small Screen" assesses the influence of television on the lives of the most vulnerable and powerless in American society: ethnic and sexual minorities and women. Many in these groups are addicted to television, although they are not the principal audiences sought by commercial TV distributors because they are not the most lucrative markets for advertisers. The authors explore the power of television in stereotyping the elderly, ethnic groups, gays and lesbians, and the institutionalized and, thus, in contributing to the self-image of many viewers. They go on to consider how television affects social interaction, intellectual functioning, emotional development, and attitudes (toward family life, sexuality, and mental and physical health, for example). They illustrate the medium's potential to teach and inform, to communicate across nations and cultures--and to induce violence, callousness, and amorality. Finally, they offer suggestions for research and public policy with the aim of producing programming that will enrich the lives of citizens all across the spectrum. (PsycINFO)

Huston, A.C., & Wright, J.C. (1997). Mass media and children's development. In W. Damon, I. Sigel, & A. Renniger (Eds.), Handbook of child psychology (5th ed., Vol 4: pp. 999-1058). New York: Wiley.

The authors provide a comprehensive review of the literature related to the effects of viewing television on children's cognitive and social development. The chapter begins with a discussion of the ecology of television viewing (e.g., measurement of viewing, characteristics of children, influences of family, impact of child care, and influences of SES). The following chapters examine the effects of viewing television on various developmental outcomes: school achievement, attention span, language, pro-social behavior, comprehension, perceived reality, social behavior (specifically the influence of violent and sexual content), and public policy implications. There is also a brief section dealing with new technologies (e.g., video games, computers, and Internet).

Kinder, M. (1991). Playing with power in movies, television and video games: From Muppet Babies to Teenage Mutant Ninja Turtles. Berkeley, CA: University of California Press.

Presents perspectives on mass media and offers parents useful insights on how children's minds are shaped by media experience. Traces the commercial and stylistic exchanges and interconnections among movies, videotapes, cartoons video games, theme parks, spin-off toys, and other products—and shows how they position today's youngster both as a passive consumer of a boundless 24-hour media feast and as an interactive player skilled in mastering ingenious electronic imagery. Includes systematic observations of the author's own child's early experience with Saturday morning television cartoons and other mass media.

Lepper, M.R., & Gurtner, J.L. (1989). Children and computers. American Psychologist, 44, 170-178.

The "effects" that various forms of "computer" use are likely to have on different children's learning, motivation, and social behavior have been a source of heated debate and continuing controversy. In this article, various aspects of this controversy are characterized, and sources of disagreement concerning educational computing are examined. Difficulties in the current state of empirical research in this area are then considered, and recommendations regarding directions for future research are proposed. (Author Abstract)

Lindlof, T.R. (1991). New communications media and the family: Practices, functions, and effects. In B. Dervin (Ed.), Progress in communication sciences (pp.103-141). Norword, NJ: Ablex.

In this chapter, the author examines the role of "new" communications media in the processes of family life, and proposes that the family is the social setting in which most mediated communication is situated and in which initial learning about media takes place. A number of research topics are briefly overviewed, including forms of family mediation, and perspectives on audience formation. The literature review on home computer use is organized into the following topics: (1) changes in household time allocations, (2) content or software use practices, (3) relational communication, and (4) child socialization processes and outcomes.

Montgomery, K.C. (1998). Creating an electronic legacy for our children. Washington, D.C.: Center for Media Education. http://www.cme.org

The Center for Media Education (CME) is a non-profit organization devoted to improving the quality of electronic media for children and their families. CME is involved in research, advocacy, public education, and outreach initiatives. In this article, the author emphasizes the potential role of interactive media in the lives of children and our opportunity to help shape children's experiences in that environment. Several issues, however, must be addressed if children's needs will be met in the digital age: (1) electronic equity, or making technology accessible to all families, (2) attention to the quality of content and services developed, and (3) the role of public policy in shaping children's electronic future.

Pavlik, J.V. (1998). New media technology: Cultural and commercial perspectives. Needham Heights, MA: Allyn & Bacon.

The author provides a roadmap to the emerging technologies on today's media horizon. This timely, comprehensive, detailed guide to the new media landscape includes a new chapter on the Internet, as well as coverage of such topics as laboratory experimental technologies, theoretical implications of new technologies, marketing issues, and legal ramifications affecting the industry. Examples of specific topics covered include: the Internet, convergence of technologies, designing

quality multimedia content, government regulation, and the social and cultural consequences of using new media.

Provenzo, E.F. (1991). Video kids: Making sense of Nintendo. Cambridge, MA: Harvard University Press.

Like computers, video games are now an integral part of the educational, social, and cultural experience of childhood. This book explores the meaning of this phenomenon and raises significant questions about the role of video games and their impact on the lives and values of young people. Attention is focused particularly on the Japanese Nintendo Corporation because of its overwhelming domination of the video game industry. The author argues that from a social and cultural point of view, video game technology is neither neutral or trivial. Video games reflect and pass on the particular views of mainstream culture. Recurring themes in games include gender stereotyping, aggression, and violence.

Reeves, B., & Nass, C. (1996). The media equation: How people treat computers, television, and new media like real people and places. New York, NY: Cambridge University Press.

According to popular wisdom, humans never relate to a computer or a TV program in the same way they relate to another human being. Or do they? Byron Reeves and Clifford Nass demonstrate . . . in "The Media Equation" that interactions with computers, TV, and new communication technologies are identical to real social relationships and to the navigation of real physical spaces. The authors . . . present the results of numerous psychological studies that led them to the conclusion that people treat computers, TV and new media as real people and places. Their studies show that people are polite to computers; that they treat computers with female voices differently than male-voiced computers; that large faces on a screen can invade a person's body space; and that motion on a screen affects physical responses in the same way that real-life motion does. One of their startling conclusions is that the human brain has not evolved quickly enough to assimilate 20th-century technology. The authors detail how this knowledge can help us better design and evaluate media technologies, including computer and Internet software, TV entertainment, news, and advertising, and multi-media. This book is intended for general readers with an interest in . . . research at the intersection of psychology, communication and computer technology. (PsycINFO)

Shade, D.D. (1994). Computers and young children: Software types, social contexts, gender, age, and emotional responses. Journal of Computing in Childhood Education, 5, 177-209.

Seventy-two children, aged four to eight, were randomly divided into two conditions: alone and with a peer. Each child was videotaped for three 10-minute sessions using software randomly selected from each level of software developmental appropriateness (high, medium, low) as defined by Haugland and Shade (1990). Children's facial expressions of emotion (e.g., interest, joy, anger, sadness) and other affect-related behaviors (e.g., self absorption, physical exuberance) were examined as a function of the child's age, gender, the presence of a peer and the "developmental appropriateness" of the software. Repeated measures ANOVA's revealed that young children's responses to computer software were not as straight forward as predicted. For a first-time 10-minute exposure to software, responses were mediated more by age, gender, and social condition than by the developmental appropriateness of the software. Suggestions for practitioners and future research are provided. (Author Abstract)

Steinfield, C.W., Dutton, W.H., & Kovaric, P. (1989). A framework and agenda for research on computing in the home. In J.L. Salvaggio & J. Bryant (Eds.), Media use in the information age:

Emerging patterns of adoption and consumer use (pp. 61-85). Hillsdale, NJ: Lawrence Erlbaum Associates.

The authors present a framework to guide research on personal computing. The chapter topics focus attention on the ways in which a personal computer is used in the home, the major sets of variables that influence usage, and the implications that might flow from computer use in the household. The diffusion of home computing, the impact of home computing perspectives on computing in the home, patterns of personal computing use, factors shaping the use of personal computing (including social status, socio-cultural setting, and personal attributes) are addressed. Finally an integrated model toward a research agenda, typology development, testing independent factors, applied research, and social policy issues are discussed. (PsycINFO)

Tapscott, D. (1998). Growing up digital: The rise of the net generation. New York, NY: McGraw-Hill.

This eye-opening, fact-filled book profiles the rise of the net generation, which is using digital technology to change the way individuals and society interact. Essential reading for parents, teachers, policy makers, marketers, business leaders, social activists, and others, *Growing Up Digital* makes a compelling distinction between the passive medium of television and the explosion of interactive digital media, sparked by the computer and the Internet. Tapscott shows how children, empowered by new technology, are taking the reins from their parents and making inroads into all areas of society, including our education systems, the government, and economy. The result is a timely, revealing look at our digital future that both kids and adults will find fascinating and instructive.

Vivian, J. (1997). The web: Newest mass medium. The Medium of Mass Communication (4th Edition) (pp. 219-247). Boston, MA: Allyn and Bacon.

Explores the advent of the World Wide Web and provides useful definitions of commonly used terms, such as web site, web page, browsing, server, and Internet. The author then continues defining and describing the development of technological concepts and topics: the information highway, database services, content providers and users, online advertising, transistors, fiber optics, hypertext, hypermedia, and technological convergence. Finally, public policy concerns are addressed including the issue of universal access and cyberpornography.

Content Area: Media Use & Access

Media Use

Barnett, M.A., Vitaglione, G.D., Harper, K.K.G., Quackenbush, S.W., Steadman, L.A., & Valdez, B.S. (1997). Late adolescents' experiences with and attitudes toward videogames. Journal of Applied Social Psychology, 27, 1316-1334.

A total of 229 adolescents (85.9% aged 15 – 19 yrs) completed a questionnaire assessing a broad range of video game (VG) – relevant experiences, preferences, and attitudes. VG playing was found to be a more popular, and a more highly regarded, activity among males than females. Gender differences were also found in Ss' ratings of their motivations for playing VG, their evaluations of particular characteristics of VGs, and their selection of the most favorite VGs. The differences between frequent and infrequent VG players appeared to be limited to differences in the extent to which VG playing is pursued and evaluated as a positive leisure activity, rather than reflecting broad differences in interest or personality. Some relations were found between Ss' self-reported personality characteristics (i.e., self-esteem, empathy, conscientiousness) and their attitudes toward VGs. (PsycINFO)

Buchman, D.D., & Funk, J.B. (1996). Video and computer games in the '90s: Children's time commitment and game preference. Children Today, 24, 12-15.

The results of surveys documenting the electronic game-playing habits of 900 fourth through eighth grade children are discussed. Using pre-specified time categories (ranging from no time to more than 10 hours per week), children indicated amount of time spent playing computer and video games in a typical week. In general, children reported steadily decreasing game playing in the home from fourth to eighth grade, while reporting increases in game playing at the arcade from fourth to eighth grade. Children were also asked about their favorite games. Girls were much more likely than boys to list educational games as their favorites, and for all children, preference for educational content decreased with age. Girls expressed a stronger preference for fantasy (cartoon) violence, whereas boys preferred games categorized as containing human violence. Sports games were also more popular with boys than girls. The authors suggest that data are needed to describe the time commitment of younger children to playing video and computer games. Moreover, parents should carefully monitor children's involvement with electronic games.

Coffey, S, & Stipp, H. (1997). The interactions between computer and television usage. Journal of Advertising Research, 37, 61-67.

The discussion about the impact of the new digital media on the use of the traditional mass media has been dominated by predictions of a rapid decline in television viewing as a result of the increased popularity of the Internet and other computer-based activities. New data do not support such predictions, not even among regular PC users. Instead of replacement, the data show interactions between the media in which television often impacts PC activity and Internet use. Data (from server logs) demonstrates that television actually promotes and drives the use of web sites (i.e., web site hits increase dramatically immediately following on-air promotions). This suggests that users are on their PC while the television is on. Statistical Research, Inc. (1996) found that over 40% of computer owners have a PC and a TV in the same room, enabling them to use media together or go back and forth between them. The research suggests that speculations about the disappearance of television should be dismissed and that content providers and advertisers should further explore the evolving interactions between the media. (Author Abstract)

Colwell, J., Grady, C., & Rhaiti, S. (1995). Computer games, self-esteem and gratification of needs in adolescents. Journal of Community & Applied Social Psychology, 5, 195-206.

The study examined the relationship between gratification of needs, self-esteem, and computers games. 120 youth (ages 11-27 years) from North London were given a questionnaire concerning computer game use, companionship, and solitude/escape. Results show that 92.5% of subjects played regularly. Playing computer games was equally popular with males and females, but males spent more time on it. Positive correlations between playing and items on the needs scales were obtained. Males who were heavy players scored highly on the preference to friends' need, but interestingly, they were also likely to see their friends more often outside school, thus providing no support for the theory that computer games are taking the place of normal social interaction. For females there was evidence of a negative relationship between self-esteem and need gratification through playing computer games. (PsycINFO)

Downes, T. (1994). Children and electronic media in the home. In J. Wright & D. Benzie (Eds.), Exploring a new partnership: Children, teachers and technology (pp. 203-214). Amsterdam: Elsevier Science Publishers.

The theme of the conference is "Exploring a New Partnership: Children, Teachers and Technology". Too often, children are the ignored members of the partnership. Teachers and educators

worry away at issues of teaching, learning, and technologies in the classroom, without acknowledging that today's children and their world are being dramatically changed by electronic media and communication technologies. If there is to be a true partnership in the classroom, children's life experiences, attitudes, knowledge and skills with these new technologies need to be acknowledged and exploited in the classroom. This paper will focus on one aspect of children's changing world – electronic media in the home. This study has been undertaken within the context of working with teachers to examine the classroom implications of the growing incidence of use of electronic media in the home. (Author Abstract)

Dutton, W.H., Rogers, E.M., & Jun, S. (1987). Diffusion and social impacts of personal computers. Communication Research, 14, 219-250.

Reviews survey research on personal computers in American households to examine (1) factors related to the adoption of computing, (2) how personal computers are used in households, and (3) the social implications that extend from these patterns of adoption and use of computing in the household. Analysis of 11 surveys indicated that formal education was a strong factor in explaining the adoption and use of home computers. Instrumental uses of home computers were increasing more rapidly than were entertainment uses. Changes in leisure-time activities, such as decreased TV viewing, were found in adopting households. (PsycINFO)

Funk, J.B., Germann, J.N., & Buchman, D.D. (1997). Children and electronic games in the United States. Trends in Communication, 2, 111-126.

Electronic games are a relative media newcomer. However, in many countries, including the United States, electronic games have achieved permanence as a favorite children's leisure activity. The term "electronic games" includes video games played on dedicated systems such as Nintendo and Sega, recreational computer software, arcade games, and hand-held games. This review examines knowledge about electronic games in the following areas: demographics of game playing; the implications and applications for health, education, personality and adjustment; and the importance of violent content. (Author Abstract)

Giacquinta, J.B., & Lane, P.A. (1990). Fifty-one families with computers: A study of children's academic uses of microcomputers at home. Educational Technology Research & Development, 38, 27-37.

This paper examines the extent to which children in a 51-family, qualitative study used their home computers for learning school subjects such as reading, mathematics, science, and social studies. Logs and analytic documents gathered over two years were content analyzed. This analysis revealed that most of the children who used their home computers were not using them for academic learning. The absence of home academic computing by children was found to be associated with a set of factors which included the lack of parental pressure and support for home academic computing, the schools' emphasis on programming and computer literacy, the unreceptivity of the children and their peers to home academic computing, and the dearth of academic software in the homes. The implications of these findings for the fostering of home academic computing are discussed. (Author Abstract)

Griffiths, M.D. (1991). Amusement machine playing in childhood and adolescence: A comparative analysis of video games and fruit machines. Journal of Adolescence, 14, 53-73.

Attempts to put into an empirical perspective the debates in the United States and United Kingdom on whether amusement machines are harmful. A comparative analysis of video games and fruit machines (slot machines) is presented by examining incidence of play, sex differences, and psychological characteristics of machine players, observational findings in arcade settings, and alleged negative consequences of amusement machine playing (i.e., increased aggression and addiction), and

an appraisal of amusement machines' positive aspects. Also discussed is an expanded version of Brown's (1989) developmental model of pathology of man-machine relationships. (PsycINFO)

Griffiths, M. (1997). Computer game playing in early adolescence. Youth & Society, 29, 223-237.

Home computer game playing appears to be one of the social and leisure phenomena of the nineties, yet there is still little know about the acquisition, development, and maintenance of computer game playing among children and adolescents. A survey of 147 eleven-year-old computer game players attending a summer camp revealed that their main reasons for playing were for fun, for a challenge, because there was nothing else to do, and because of peer pressure. Males played computer games significantly more regularly than did females and were significantly more likely to play sports simulation games and violent games. Females were found to play platform games and puzzlers significantly more than males. It is suggested that computer playing for most children is a fairly absorbing and harmless activity, but that for a small minority of children, it may be problematic. (Author Abstract)

Griffiths, M.D., & Hunt, N. (1995). Computer game playing in adolescence: Prevalence and demographic indicators. Journal of Community & Applied Social Psychology, 5, 189-193.

The authors examines the prevalence of computer game playing in 387 adolescents (aged 12-26 years) in the UK. Subjects were given a questionnaire concerning the time spent playing computer games, who they first started playing with, the reasons why they first started and why they play now and negative consequences of play. Results reveal that for many subjects, home computer game playing can take up considerable time with 7% of the sample playing for at least 30 hours a week. Although there were no significant differences between males and females in who played computer games, it was established that males played more regularly than females. It was also found that males preferred violent games whereas females preferred those with identifiable fun characteristics. Fun was stated as the main reason for playing for both sexes. (PsycINFO)

Harrell, J.S., Gansky, S.A., Bradley, C.B., & McMurray, R.G. (1997). Leisure time activities of elementary school children. Nursing Research, 46, 246-253.

The three most common leisure time activities of 2,200 third and fourth grade children (mean age 8.8 + 0.8; 50.7% girls) and the association of the intensity levels of those activities with demographic variables and risk factors for cardiovascular disease are reported. Activities reported most often by boys were playing video games (33%), playing football (32%), bicycling (31%), watching television (28%), and playing basketball (26%). The girls reported doing homework (39%), bicycling (31%), watching television (30%), dancing (27%), and reading (23%). Overall, the children, especially girls, reported fairly sedentary activities, with an average metabolic equivalent level of 4.2 for girls and 4.8 for boys. Among boys, African Americans reported more vigorous activities than Whites, but the activities reported by White girls were somewhat more vigorous than those reported by non-White girls. Children from a higher socioeconomic status (SES), especially boys, reported a greater proportion of sedentary activities than lower SES children. The risk factors of cholesterol, blood pressure, skinfold thickness, and body mass index were not significantly associated with total activity score. However, significantly more non-obese than obese children reported a vigorous (high-intensity) activity as one of their top three activities. (Author Abstract)

Huston, A. C., Wright, J. C., Marquis, J., & Green, S.B. (1999). How young children spend their time: Television and other activities. Developmental Psychology, 35, 912-925.

Time-use diaries were collected over a 3-year period for 2 cohorts of 2- and 4-year old children. TV viewing declined with age. Time spent in reading and educational activities increased

with age on weekdays but declined on weekends. Time-use patterns were sex-stereotyped, and sex differences increased with age. As individuals' time in educational activities, social interaction, and video games increased, their time watching entertainment TV declined, but time spent playing co-varied positively with entertainment TV. Educational TV viewing was not related to time spent in non-TV activities. Maternal education and home environment quality predicted frequent viewing of educational TV programs and infrequent viewing of entertainment TV. The results do not support a simple displacement hypothesis; the relations of TV viewing to other activities depend on the program content, the nature of the competing activity, and the environmental context. (Author Abstract)

Kinnear, A. (1995). Introduction of microcomputers: A case study of patterns of use and children's perceptions. Journal of Educational Computing Research, 13, 27-40.

Children's attitudes toward and perceptions of the use of computers were monitored in two upper primary classrooms over a nine-month period, following the introduction of computer use. Unstructured use during non-class hours became the dominant pattern in both classrooms, with boys dominating the access and use in one of these classrooms. The resulting reduced computer use by girls contributed to the boys' and teacher' perceptions that girls are less interested in computers. Girls tended to be less positive than boys about the usefulness of computers in the classroom and their attitude scores were even more polarized after the year's experiences. The research highlights the potential role that patterns of computer use in classrooms may play in the formulation of children's attitudes toward and perceptions of computers. (Author Abstract)

Kubey, R., & Larson, R. (1990). The use and experience of the new video media among children and young adolescents. Communication Research, 17, 107-130.

The media habits and experiences of 483 subjects whose ages ranged from 9 to 15 years were studied via the Experience Sampling Method. Respondents carried electronic paging devices and reported on their activities and subjective experiences when signaled. General descriptive findings on the use and experience of three forms of new video entertainment, music videos, video games, and videocassettes, are reported. For boys, these new video media were associated with higher reports of arousal and more positive affective states than was the case for the activities of television viewing, reading, and listening to popular music. Relative to boys, girls reported lower affect and arousal, especially during video games and music videos. (Author Abstract)

Lin, S., & Lepper, M.R. (1987). Correlates of children's usage of videogames and computers. Journal of Applied Social Psychology, 17, 72-93.

Fourth-, fifth-, and sixth-grade students responded to a questionnaire concerning their experiences with electronic videogames and computers. Teacher ratings of academic achievement, personality characteristics, and behavior patterns were also obtained for each student. These data were used to examine a number of hypotheses concerning potential harmful or beneficial effects of electronic videogames on school-age children, and to provide preliminary evidence concerning the correlates of computer usage by school-age children. Videogame usage showed significant positive correlations with teacher ratings of impulsivity, significant negative correlations with ratings of academic achievement, and little relationship to rated sociability. Videogame use also positively related to other social activities and to microcomputer use. (Author Abstract)

Orleans, M., & Laney, M.C. (2000). Children's computer use in the home: Isolation or sociation? Social Science Computer Review, 18, 56-72.

Cross-referenced in Social Development/Relationships section

Phillips, C.A., Rolls, S., Rouse, A., & Griffiths, M.D. (1995). Home video game playing in schoolchildren: A study of incidence and patterns of play. Journal of Adolescence, 18, 687-691.

The recent increase in the home video games market has resulted in the ready availability of such games. This study attempted to quantify the extent of home video game playing in a typical population of 11 – 16-year-olds (429 males and 387 females). Of the children questioned 77.2 % played video games. The most common pattern of play was daily with most of the players playing for between one half and one hour per day. A small population of players (7.5% of players; 5.7% of total sample) was identified whose behavior might be considered to be addictive. (Author Abstract)

Rideout, V.J., Foehr, U.G., Roberts, D.F., & Brodie, M. (1999). Kids and media @ the new millenium. Executive summary. Menlo Park, CA: Kaiser Family Foundation. http://www.kff.org

Kids and media @ the new millennium is one of the most comprehensive national public studies ever conducted of young people's media use. The study, based on a nationally representative sample of more than 3.000 children ages 2 – 18, shows how much time kids spend watching TV and movies, using computers, playing video games, listening to music, and reading. The report also looks at how much oversight parents exert over their children's media use, and addresses numerous other issues such as how kids use media, whether "new" media is replacing traditional media, and whether use of new media varies by age, gender or race. (Author Abstract)

Roberts, D.F., Foehr, U.G., Rideout, V.J., & Brodie, M. (1999). Kids and media @ the new millenium. Menlo Park, CA: Kaiser Family Foundation. http://www.kff.org

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Rocheleau, B. (1995). Computer use by school-age children: Trends, patterns, and predictors. Journal of Educational Computing Research, 12, 1-17.

Patterns of computer use are studied based on analyses of data from the Longitudinal Study of American Youth (LSAY) in which a cohort of students and their parents were surveyed for five consecutive years. Special attention is given to students who were heavier users of computers. Heavier use is associated with high SES as well as superiority in grades. Heavier use declined as this cohort progressed from the seventh grade to high school despite increasing access to computers at home. Parents with computers at home reported that their children used computers mostly for educational purposes. Males were significantly more likely to be heavier users until the 1992 survey when the gap with females narrowed. A substantial proportion but less than half (42%) of heavier users, remained more frequent users from 1988 to 1992. Analysis suggests that computer ownership and parental interest in their children using computers exerted the biggest impacts on the likelihood of being a heavier user. (Author Abstract)

Schement, J.R. (1996). Toward an analysis of household information consumption as a dimension of the emerging information infrastructure. Social Science Computer Review, 14, 69-74.

This article suggests the importance of studying households as a focus for understanding the consequences of the new information infrastructure. Households represent not only private space, but also information environments in which an increasing range of activities is conducted. The variety of

experiences in American households cautions against simple generalizations. As households reflect ongoing demographic shifts, the uses of information technologies in households also will change. Social cleavages due to status and working conditions will influence the uses of media and information technologies. This article also proposes a function-based approach to studying media in households. (Author Abstract)

Stanger, J.D, & Jamieson, K.H. (1998). Television in the Home 1998: The Third Annual National Survey of Parents and Children. Pennsylvania, PA: Annenberg Public Policy Center, University of Pennsylvania. http://www.appcpenn.org

Cross-referenced in Media Use/Access section

Turow, J. (1999). The Internet and the family: The view from parents. The view from the press (Report Series No. 27). Philadelphia, PA: The Annenberg Public Policy Center. http://www.appcpenn.org

A national survey of parents in computer households suggests that parents are conflicted about the Internet's influence on their children. The 1998 survey was conducted with 1,102 parents in households with at lease one working computer and at least one child between the ages of 8 and 17 years. Turow reports that 70% of parents believe the Internet is a place for children to discover "fascinating and useful" things, while at the same time 75% of parents are concerned their children may give out personal information or view sexually explicit images on the Internet. Interestingly, education and income were not major determinants of whether the family had online connections; rather, parents' experiences with the Internet outside the home environment were highly predictive of household Internet connections.

Turow, J., & Nir, L. (2000). The Internet and the family 2000: The view from parents. The view from kids (Report Series No. 33). Philadelphia, PA: The Annenberg Public Policy Center. http://www.appcpenn.org

This is the second study of *The Internet and the Family* conducted at the Annenberg Public Policy Center. One goal of the second survey was to track differences from last year's findings regarding what parents generally think and do about the web. The 2000 survey was conducted with 304 youth aged 10 – 17 and 1001 parents with at least one child between ages 8 to 17. Interviews took place between January 13 and February 17, 2000. Turow and Nir report that parents and children have very different ideas and opinions when it comes to giving out personal information to Web sites. American 10 –17 year olds were much more likely than parents to say it is OK to give sensitive personal and family information to commercial Web sites in exchange for a free gift. Almost half of the parents were not aware that Web sites gather information on users without their permission. Furthermore, 61% of the parents said they were more concerned about their 13 – 17 year olds than they were about their younger children revealing sensitive information.

Venkatesh, A., & Vitalari, N. (1987). A post-adoption analysis of computing in the home. Journal of Economic Psychology, 8, 161-180.

Using a sample of 282 households that owned personal computers, issues connected with the patterns of utilization and problems in adopting a new technology were examined. Results show that utilization patterns varied according to prior knowledge, household structure, and length of ownership. Implications are drawn for further research in the area of household/technology interaction. (PsycINFO)

Von Schie, E.G.M., & Wiegman, O. (1997). Children and videogames: Leisure activities, aggression, social integration, and school performance. Journal of Applied Social Psychology, 27, 1175-1194.

A survey was conducted among 346 children from the 7th and 8th grades of 7 elementary schools in Enschede, Netherlands, to examine possible positive and negative effects of playing video games. Analyses revealed that playing video games did not appear to take place at the expense of children's other leisure activities, social integration, and school performance. A gender difference arose: Boys spent more time playing video games that did girls. There was no significant relationship between the amount of time children spend on video games and aggressive behavior. A negative relationship between time spent playing video games and pro-social behavior was found; however, this relationship did not appear in separate analyses for boys and girls. Furthermore, a positive relationship was found between time spent on video games and a child's intelligence. (PsycINFO)

Welch, A.J. (May, 1995). The role of books, television, computers and video games in children's day to day lives. ERIC Document.

A study assessed the role of various mass media in the day-to-day lives of school-aged children. Research questions dealt with the nature of children's media experiences at home, how the use of media affects school activities, the social context of media use, interior responses to different media, and whether gender or socioeconomic differences among children figure in media use. Children (all in grades 3 and 4) from opposite ends of Connecticut participated in the study. Respondents were approached through letters sent home -- in the first community, children were interviewed at home; in the second community, they were interviewed at school. Children were evenly divided by sex; almost all were white. A broad array of questions was posed. Results showed that children had extensive access to media, including VCRs, cable television, and personal computers. A large number live in media-rich environments. As for media use – books are a nighttime activity, computers are used any time, and entertainment media seems to be an after-school relaxer. How media use affects school activities is not clear, but the differences in media use among higher and lower achieving children needs to be explored in greater depth. Findings also suggest that the social contexts of media use are many and varied. (ERIC)

Wright, J.C., Huston, A.C., Vandewater, E.A., Bickham, D.S., Scantlin, R.M., Kotler, J.A., Caplovitz, A.G., & Lee, J. (in press). American children's use of electronic media in 1997: A national survey. Journal of Applied Developmental Psychology.

Researchers for this project are in the process of analyzing a nationally representative database of some 3500 families with children between the ages of 1 and 12. The data come from an ongoing University of Michigan project called the Panel Study of Income Dynamics (PSID). The PSID is a continuing longitudinal survey of a nationally representative sample of U. S. families that has been conducted annually since 1968, and includes information on family economics (e.g., income, occupation, wealth), family structure (persons present in the family), marriage and divorce, births and deaths, health, and type of housing. In 1997, the Child Development Supplement (CDS) was added to the PSID to provide rich cognitive, social, and emotional assessments of the children in the PSID sample. Many different measures of children's well-being were collected, including standardized achievement tests (reading, math, and vocabulary), and parent and teacher ratings of the children's mental and physical health. The core data analyzed for this paper are time-use diaries of children's media use, particularly their use of television, videos, and computer and video games. Highlights of the interactive game findings include boys spent significantly more time per week playing sports games than girls (boys = 62.43 min; girls = 7.54 min), and the 9 – 12 year-old children spent more time playing sports games than any of the younger age groups (older = 60.56 min and youngest = 26.82 min, respectively). The youngest children (0 – 5 years) spent significantly more time per week playing

educational content than the older children (83.77 minutes and 22.44 minutes, respectively). General information pertaining to both the CDS and PSID project can be located at http://www.isr.umich.edu/src/psid/.

Access

Anderson, R.E., Lundmark, V., Harris, L., & Magnan, S. (1994). Equity in computing. In C. Huff & T. Finholt (Eds.), Social issues in computing: Putting computing in its place (pp. 352-385). Columbus, OH: McGraw-Hill, Inc.

The authors ask to what extent participation in computing is mediated by gender roles, social stratification, and ethnicity. The chapter begins with a definition of inequity – injustice and unfairness, and not only referring to a lack of equality, but implying an ethical or moral problem. For example, girls may receive socialization messages (e.g., computers are nerdy, software engineering is not for girls) that influence whether they conform to specific gender roles. New technology often initially provides the wealthy with advantage over the poor. Many urban schools struggle with limited resources, thereby decreasing their ability to purchase computers and train teachers to use the technology. The authors review the literature and conduct secondary analysis of equity data (from the United States) related to gender, income, and ethnicity. Their findings indicated that boys were more likely than girls to use computers in the home, that low-SES students were often disadvantaged when compared with high-SES students in both school and home settings, and racial inequity were found in nearly all domains considered.

Armitage, D. (1993). Where are the girls? Increasing female participation in computer, math, and science education. In D. Carey, R. Carey, J. Willis & D.A. Willis (Eds.), Technology and teacher education annual 1993 (pp. 19-24). Charlottesville, VA: Association for the Advancement of Computing in Education.

Computers are commonplace in our society, and they have significantly influenced the way we learn, communicate, and work. Data indicate, however, that women are underrepresented in the fields of mathematics, science, and technology. The authors discuss the *Computer Equity Expert Project* in which educators learned how to coordinate computer equity activities in their schools with teams of faculty members, parents, and students. Strategies were implemented to increase girls' participation in math, science, and computing. The project was successful in increasing educators' awareness of the gender gap and in teaching them how to implement strategies to reverse that trend.

Becker, H.J., & Sterling, C.W. (1987). Equity in school computer use: National data and neglected considerations. Journal of Educational Computing Research, 3, 289-311.

Since schools began using computers for instruction, social critics have questioned the equity of the apportionment of computer resources by sex, race, and social status. Data from our national survey of schools describe how computers are used with different groups of students. We find that the use of school computers differs most dramatically by student interest and ability. Boys and "better' students tend to dominate computer use. But the evidence is weak on the actual consequences of differential uses of computers. We raise, without resolving, the issue of whether schools should reallocate computer resources toward girls and less able students. A fair policy depends upon the relative value of computer-based instruction to fill the educational needs of all children. We need more experimental research to assess the relative value of computer applications in education. (Author Abstract)

Bhargava, A., Kirova-Petrova, A., & McNair, S. (1999). Computers, gender bias, and young children. Information Technology in Childhood Education,1999, 263-274.

This article discusses the discrepancy that exists with regard to the girls' and boys' access and use of computers in classrooms and suggests strategies to minimize gender biases before stereotypic behaviors are established. It is argued that differences between genders in computer usage can be attributed to gender biased classroom practices, lack of female role models, computer gender gap in homes, and the scarcity of bias-free software programs. It is suggested that increased awareness on the part of teacher and parents with regard to sex role stereotyping in conjunction with selection of anti-bias software programs, and equitable use of computers and software in classrooms can minimize biased attitudes towards technology. A proactive rather than a retroactive approach to dealing with biases will prepare children to be competent users of this technology in the 21st century.
(Education Abstract)

Bikson, T.K., & Panis, C.W.A. (1997). Computers and connectivity: Current trends. In S. Kiesler (Ed.), Culture of the Internet (pp. 407-430). Mahwah, NJ: Lawrence Erlbaum Associates.

Email has swept the world during the last decade, but this revolution has not altered one fundamental feature of society: An information elite still exists, made up of those with access to, and knowledge about, computers and email. The gap between the information haves (richer, better educated people) and information have-nots has actually increased in the last few years, even as computers and online services have become less expensive. We describe here how data from national surveys (*Current Population Survey* – collected by the U.S. Bureau of the Census) can be used to understand this important social issue. There are four important reasons technology trends should be studied: (1) access and exposure to sources of information, (2) opportunities for group affiliation, (3) participation in civic affairs, and (4) ability to create and shape economic opportunities and advantages. (Author Abstract)

Chambers, S.M., & Clarke, V.A. (1987). Is inequity cumulative? The relationship between disadvantaged group membership and students' computing experience, knowledge, attitudes and intentions. Journal of Educational Computing Research, 3, 495-518.

The study uses a pretest/posttest design to investigate the relationship between disadvantaged group membership and students' participation in computing activities. Disadvantage was defined by gender, school ability, SES level, and ethnic background. The sample of 951 students was drawn from four elementary and three secondary school that were substantially increasing their computing resources. Following class computing experience there was a cumulative effect of membership of disadvantaged groups, with the more disadvantaged students reporting significantly less participation in class computing activities and non-class computing activities gaining lower computing knowledge scores and having less positive attitudes to computing. Thus, inequities were created rather than reduced. Class computing participation was positively related to prior participation in non-class computing activities, with those students with no prior non-class computing experience participating less in class computing activities. The results were interpreted as demonstrating a general cumulative effect of "disadvantage," which is based on differences in voluntary non-class computing experiences. Strategies for reducing these inequities are implicated. (Author Abstract)

Civille, R. (1995). The Internet and the poor. In B. Kahin & J. Keller (Eds.), Public access to the internet (pp. 175-207). Cambridge, MA: MIT Press.

In this chapter, the author examines a survey of home computer use conducted by the U.S. Bureau of the Census in October 1993 (Current Population Survey) and compares results to previously collected data from 1989. The use of the Internet has been growing most rapidly within households of

higher income and educational levels. As the Internet becomes more valuable, it creates more opportunities for those with access. This condition will likely have serious implications for low-income households who tend to lack access to this technology. The problem, however, is not only one of access, but also possession of the knowledge and skills required to use the technology. The Internet delivers social and economic value to those individuals who can use it effectively, and without such skills the Internet will be of limited benefit.

Clark, L. (1996). Inner-city access to information technology. Social Science Computer Review, 14, 55-56.

Inner-city residents confront numerous obstacles when they use advanced information technology. Lack of education and experience are perceived as barriers to the use of computers. Information available on computer networks is stratified by race, class, and gender and rarely provides the full range of information of interest to inner-city residents. (Author Abstract)

Hoffman, D.L., & Novak, T.P. (1999). The evolution of the digital divide: Examining the relationship of race to Internet access and usage over time. Manuscript in progress. http://www2000.ogsm.vanderbilt.edu

The research findings of Hoffman and Novak demonstrate evidence of a digital divide. The analyses for this paper come from three surveys (Spring 1997, Fall 1997, and Spring 1998) of the CommerceNet/Nielsen Internet Demographic Study. An important focus of the project is the collection of Internet and Web-use data from persons (16 years or older) of different racial and ethnic groups, particularly Caucasians and African Americans. Highlighted findings include Whites were more likely to have access to the Internet and to have ever used the Web than African Americans and these gaps seem to be increasing over time. Moreover, gaps in computer ownership and Internet access persisted even after controlling for educational differences. The authors suggest that it is necessary to understand what motivates individual-level adoption and use of home computers and the Internet, both within and outside the home environment.

Katz, J., & Aspden, P. (1997). Motivations for and barriers to Internet usage: Results of a national public opinion survey. Internet Research – Electronic Networking Applications and Policy, 7, 170.

Analyzes a national random telephone survey, carried out in October 1995, on the motivations for and barriers to Internet usage. Eight percent of the random sample reported being Internet users, while surprisingly another 8 percent reported being former users. In total, 85 percent of respondents reported having heard of the Internet. The survey showed evidence of a digital divide, Internet users being generally wealthier and more highly educated, and blacks and Hispanics disproportionately unaware of the Internet. Social and work networks appear to be important for stimulating interest in the Internet and providing users with support. As to reasons for using the Internet, socio-personal development appears to be the key driver, while nonusers have a decidedly different set of beliefs about the Internet's value. As to the barriers to Internet usage, even experienced users find it difficult to get started, which confirms other studies of this topic. Barriers include cost and difficulties in understanding how to use the Internet. Concludes that the results of the survey indicated that people strongly desire an easier-to-use Internet. (Institute for Scientific Information)

Lazarus, W., & Mora, F. (2000). Online content for low-income and underserved Americans: The digital divide's new frontier. Santa Monica, CA: The Children's Partnership. http://www.childrenspartnership.org

This report, the result of nine months of research, analyzes this new frontier of the digital divide, providing an analysis of the "state of the art" along with recommendations for policymakers,

corporate leaders, technology center staff, philanthropists, and those who work with and on behalf of under-served Americans. (Underserved Americans, for the purpose of this report, include people who have low incomes, live in rural communities, have limited education, or are members of racial or ethnic minorities.) Research included discussion groups with more than 100 low-income Internet users, interviews with nearly 100 community technology leaders and other experts, analysis of 1,000 Web sites, and a review of the literature and promising activities across the country. This report is the latest in a series of "Strategic Audits" produced by The Children's Partnership on subjects of national importance that affect large numbers of young people. The Children's Partnership research found that, though many underserved communities are gaining access to the Internet, many are not benefiting fully because of barriers they face related to content. In order to develop a map of the key issues, the report focused on four significant barriers that affect large numbers of Americans: (1) Lack of local information, (2) literacy barriers, (3) language barriers, and (4) lack of cultural diversity. (From Executive Summary)

McAdoo, M. (1994). Equity: Has technology bridged the gap? Electronic Learning, 13, 24-30.

Technology advocates have long touted the computer as the great leveler – a powerful but patient tool that would help educated every student, regardless of sex, race, or class. But what is the reality? Has technology enabled the student from the poor, inner-city school or the tiny, isolated rural one to get an education equal to the student in the wealthy suburb? The answer is mixed. Individual projects have shown the way technology can work to promote equity, though so far they have not become the norm. Technology has not yet proved itself to be the greater leveler. (From author introduction)

McConnaughey, J.W., & Lader, W. (1998). Falling through the net II: New data on the digital divide. Washington, D.C.: U.S. Department of Commerce and National Telecommunications and Information Administration. http://www.ntia.doc.gov/ntiahome/net2/falling.html

The U.S. Bureau of the Census in collaboration with the National Telecommunications and Information Administration (NTIA) provides one source of information about computer ownership and individual use via the *Current Population Survey*. This report is the second profile released by NTIA, the first published in *Falling Through the Net: A Survey of the 'Have Nots' in Rural and Urban America* (July, 1995). In *Falling Through the Net II*, the NTIA reported that significant growth in computer ownership and usage overall from 1994 – 1997 occurred to a greater extent within some income levels, demographic groups, and geographic areas, than in others. Highlights of the findings include, households below $35,000 had ownership rates of 36.6% and online access rates of 26.3% (below the national average). In contrast, households earning more than $75,000 in urban areas had the highest computer ownership rates (76%) and online access rates (50.3%). White households were twice as likely (40.8%) to own a computer as Black (19.3%) or Hispanic (19.4%) households.

Metzendorf, D. (1988). An urgent need: Equal access of computers among the poor. In B. Glastonbury, W. LaMendola, & S. Toole (Eds.), Information technology and the human services (pp. 347-349). Chichester, England: John Wiley & Sons.

The chapter explores the issue of computer equity for the poor in the United States; describes a program, Hands-On Community Computer Center, Inc., located in Philadelphia designed to help combat the inequities that do exist.

Michaelson, K.L. (1996). Information, community, and access. Social Science Computer Review, 14, 57-59.

Communication in cyberspace creates the possibility of forming communities of interest that can either compete with or reinforce communities in place. For some individuals, computer networks offer opportunities for greater participation in public life; for others, participation in on-line groups has the potential to diminish commitment to local communities. On-line communities contain unique forms of immediacy, asynchronicity, and anonymity that give them dynamics not shared by communities based on physical presence and face-to-face interaction. These new forms of community, and the technological and cultural resources required for participation, have the potential for creating new forms of stratification and hence new barriers to universal access. (Author Abstract)

Montgomery, K.C. (1998). Creating an electronic legacy for our children. Washington, D.C.: Center for Media Education.

Cross-referenced in Reviews/Overviews section

Mueller, M. (1996). New definitions and measures of telecommunications access. Social Science Computer Review, 14, 60-61.

Current definitions of telecommunications access are antiquated and overly simplistic. They overlook technological alternatives, overlaps, and interdependencies, as well as patterns of usage and the integration of usage into daily lives. Ethnographic observation of communication behavior can be used to construct social indicators of telecommunications access and usage that are based on theories about communication and behavior, not technologies. (Author Abstract)

National Telecommunications and Information Administration. (1995). Falling through the net: A survey of the "have-nots" in rural and urban America. Washington, DC: U.S. Department of Commerce.

In 1994, the National Telecommunications and Information Administration (NTIA) contracted with the U.S. Bureau of the Census to include specific questions on computer/modem ownership and use in the November 1994 *Current Population Survey (CPS)*. The additional information was collected via the *Computer Ownership/Usage Supplement* to the *CPS*. This report summarizes nationwide ownership and use of home computers at the time of data collection. The computer-use information was cross-tabulated with demographic variables (income, race, age, educational attainment, and region) and three geographic categories (rural, urban, and central city). The findings in the this report include the following: (1) Information "have nots" were disproportionately found in America's rural areas and central cities; (2) The lowest phone service subscribership existed in the central cities; and (3) The lowest computer/modem ownership existed in poor rural areas.

Nie, N.H., & Erbring, L. (2000). Internet and society: A preliminary report. Menlo Park, CA: Stanford Institute for the Quantitative Study of Society. http://standford.edu/dept/news/report/february16/internetsurvey-216.html

Cross-referenced in Social Development/Relationships section

Pulos, S., & Fisher, S. (1987). Adolescents' interests in computers: The role of attitude and socioeconomic status. Computers in Human Behavior, 3, 29-36.

This study investigates adolescents' interests in using computers, as well as academic and social activities, which are associated with an interest in computers among students in lower and middle class schools. The image that adolescents have of those who use computers, and how that related to their own interest in computers was also examined. One hundred and eighty five students were given a list of activities and were also asked to describe, "What kind of kid likes computers." The results include the following: A) Most adolescents are indifferent to computers. They are about as interested in them as they are in other intellectual activities. B) There is a social class difference in

computer interest. The students from lower socioeconomic school and less exposure to computers show more interest. C) Interest in computers is associated with an interest in intellectual activities, video games, and a lack of interest in typical adolescent activities across gender and socioeconomic status.
D) Adolescents who liked computers were seen as the "smart" kids, particularly by adolescents without intellectual interests. This attitude was also found across gender and in both schools. (Author Abstract)

Schall, P.L., & Skeele, R.W. (1995). Creating a home-school partnership for learning: Exploiting the home computer. The Educational Forum, 59, 244-249.

Computers are rapidly changing the way we live and learn. After years of technological development and cultural adaptation, the computer is accepted at work, home, and school. Educators, however, have not fully explored the capabilities of the computer as a tool for linking the learning environments of home and school. Evidence suggests that one of the most important variables in developing computer literacy and related skills is home access/use of computers. Moreover, children can experience extended and uninterrupted time on the computer at home. There are, however, several impediments to home use of computers, including socioeconomic factors, cost of the technology, quality of the available software, and gender bias. Educators must address these factors and strive to support each child's computer use experiences. Schall and Skeele emphasize that teachers and families need adequate training and support to become confident computer users and to realize the full potential of computers for learning. Furthermore, as computers link home and school, they have the potential to increase family involvement in children's educational lives, and this commitment can shape children's attitudes toward learning.

Schement, J.R. (1996). Toward an analysis of household information consumption as a dimension of the emerging information infrastructure. Social Science Computer Review, 14, 69-74.

Cross-referenced in Media Use section

Skeele, R. (1993). Technology and diversity: Resolving computer equity issues through multicultural education. In D. Carey, R. Carey, J. Willis, & D.A. Willis (Eds.), Technology and teacher education annual 1993 (pp. 14-18). Charlottesville, VA: Association for the Advancement of Computing in Education.

In this article, the authors address several domains of technological inequity. Disparity in educational computing occurs in the following areas: (1) Socioeconomic status – low SES parents were content with whatever computer skills were offered by their children's school; (2) Race – there is a strong correlation between SES and race and minority students may experience less rigorous curriculum and less parental involvement; (3) Gender – girls have generally not aggressively pursued equitable computing time in the classroom; (4) Ability Level – higher level ability students may receive task require more thinking skills while lower level ability students may be using more drill and practice; (5) Exceptionalities – students with disabilities may not have access because of the physical lay out of the computer lab, absence of modifications or special equipment, or budgetary constraints. The authors suggest that learning activities should be multidisciplinary and include a variety of learning techniques.

Stanger, J.D, & Jamieson, K.H. (1998). Television in the Home 1998: The Third Annual National Survey of Parents and Children. Pennsylvania, PA: Annenberg Public Policy Center, University of Pennsylvania. http://www.appcpenn.org

This is the third Annenberg Public Policy Center survey of parents and children – Television in the Home. Inaugurated in 1996, the national poll has measured parents' and children's opinions of

television programming, their viewing and other media-related behaviors, and knowledge of, and attitudes toward, relevant policy issues such as the Federal Communication's three-hour processing guideline, the new ratings system for television programming, and the V-chip. In addition to containing elements found in prior surveys, this year's report addresses three new issues – public affairs and news, diversity on television, and adoption and use of computer and online technologies in the home. The 1998 national survey of media use among families with children provides further evidence of a digital divide. Stanger and Jamieson found that 32.5% of families with annual household incomes below $30,000 reported owning a home computer, while 61% of those between $30,000 and $50,000, 73.8% between $50,000 and $75,000, and 88.1% above $75,000 reported home computer ownership. Online access for families in each income level was 12.9%, 24.6%, 39.9%, and 61.1%, respectively. (From Author Introduction)

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

This review summarizes the research conducted during the 1980s on race/ethnicity, gender, and social class differences in K-12 educational uses of computers is summarized in terms of access, processes, and outcomes. First, gender, social class, and racial inequalities in access to computers are documented. Second, equity in four aspects of process is considered: type of use, teachers' attitudes towards equity and equality, curriculum content, and interactions among students. Third, the literature on three outcome variables is considered: student attitudes, computer-related competence (literacy and programming), and traditional achievement measures using computer-aided instruction. Finally, implications from the decade of research are drawn. These include the conclusions that the use of computers maintained and exaggerated inequities, that equity issues are complex and future research should reflect this, that between-school differences in equality should be examined, and that much more research on poor and minority children is a priority. (Author Abstract)

Treitler, I. (1996). Culture and the problem of universal access to electronic information systems. Social Science Computer Review, 14, 62-64.

The technical design of information systems tends to drive the information structure and content of the systems and is not driven by the social and cultural needs of end users. The content, structure, and context of end user communication strategies should be a component of systems design for the National Information Infrastructure (NII). Without such integration of the communication strategies of multiple end user groups and communities, universal access to the NII cannot be guaranteed. (Author Abstract)

Content Area: Cognitive Development

Attewell, P., & Battle, J. (1999). Home computers and school performance. The Information Society, 15, 1-10.

This article assesses the effects of home computers on school performance, and examines inequalities in educational payoff among those children who have home computers. We find that having a home computer is associated with higher test scores in mathematics and reading, even after controlling for family income and for cultural and social capital. However, children from high socio-economic status (SES) homes achieve larger educational gains from home computers than do lower SES children. Boys' performance advantage is larger than girls'. Ethnic minorities gain far less of a performance boost than whites. Home computing may generate another "Sesame Street effect" whereby an innovation that held great promise for poorer children to catch up educationally with more affluent children is in practice increasing the educational gap between affluent and poor, between boys

and girls, and between ethnic minorities and whites, even among those with access to the technology. (Author Abstract)

Blumberg, F.C. (1998). Developmental differences at play: Children's selective attention and performance in video games. Journal of Applied Developmental Psychology, 19, 615-624.

This study investigates developmental differences in children's performances on a popular video game. Second and fifth graders played a video game for 10 minutes and then were asked questions about the game features that they paid attention to while playing, and about specific game and attention strategies that they would recommend to a novice player. Older children and children identified as frequent players showed better performance. Post-game responses also indicated developmental differences in references to game features, strategies, and evaluative assessments. Younger children focused more on evaluative assessments. Older children, by comparison, focused more on specific goals for game play, and such a focus predicted better task performance. This study begins to provide additional insight into children's goals and motivation for learning in the context of intrinsically motivating tasks and the implications of that motivation for attention and performance. (PsycINFO)

Brown, D.L. (1996). Kids, computers, and constructivism. Journal of Instructional Psychology, 23, 189-195.

With the proliferation of computers in classrooms, educators must verify the effectiveness of computer-assisted instruction in early childhood education. This article focuses on research findings and the relationship between computer use in the classroom and constructivist education. Three ways of using computers emerged: computers as books or workbooks; computers for word processing; and computer programming of graphics. It was concluded that the word processing use of computers was the most compatible with constructivist education for young children. (Author Abstract)

Burgstahler, S. (1998). New kids on the net: Internet network for young learners. Needham Heights, MA: Allyn and Bacon.

This guide provides useful materials to help young children get started using Internet tools. The activities included in this resource can be used with individual children or with groups in settings such as home use, day care, camps, or traditional school settings. The activities are organized to accommodate the child's level of knowledge and familiarity with using the Internet. Each chapter provides an initial section for parents or teachers outlining prerequisites, objectives, student activities, and references for that chapter. These activities facilitate valuable parent-child or teacher-child interactions, and can provide safe and educational sites for children.

Calvert, S.L. (1994). Developmental differences in children's production and recall of information as a function of computer presentational features. Journal of Educational Computing Research, 10, 139-151.

Developmental differences in children's production and recall of computer-presented information is examined at varying levels of action and verbal labels when presented in list or story conditions. Forty children, equally distributed by grades kindergarten and second, were randomly assigned to a list or story condition. Within each condition, the same twenty-four objects (six sets of four objects) were presented with or without action and verbal labels. Kindergartners were more responsive to, and dependent upon, action and verbal labels for their production and recall of object names than were second graders. Results suggest a developmental shift from feature-dependence to feature-independence in children's computer information processing activities. (Author Abstract)

Calvert, S.L. (1999, June). Media forms for children's learning. Invited paper presented at the Summer Institute in the Educational Psychology Program, Fordham University Graduate School, New York, NY.

Children in the 20th century are developing in a world of electronic media. These representational media present information to children in visual, verbal, and musical forms. These forms must be decoded for children to make sense of the stream of information being presented to them. This grammar of the information technologies, referred to as formal features, provides visual and auditory codes that can help children to select, represent, and think about educational content. Sound effects and loud music, for example, can call attention to important contiguous information, thereby improving children's retention of that material. Actions in television and computer programs can provide a visual way of thinking about content that children can then use to represent and remember that information, particularly when visual content is paired with language. Singing, by contrast, seems to foster superficial rote learning. Children who master these representational media will have access to, and control of, the information highway, the place where knowledge will be increasingly stored in the 21st century. (Author Abstract)

Clark, R.E. (1983). Reconsidering research on learning from media. Review of Educational Research, 53, 445-459.

Recent meta-analyses and other studies of media's influence on learning are reviewed. Consistent evidence is found for the generalization that there are no learning benefits to be gained from employing any specific medium to deliver instruction. Research showing performance or time-saving gains from one or another medium are shown to be vulnerable to compelling rival hypotheses concerning the uncontrolled effects of instructional method and novelty. Problems with current media attribute and symbol system theories are described and suggestions made for more promising research directions. (Author Abstract)

Clark, R.E. (1994). Media will never influence learning. Educational Technology Research & Development, 42, 21-29.

The purpose of this discussion is to explain and sharpen different points of view about the impact of media and attributes of media on learning, motivation and efficiency gains from instruction. This paper summarizes arguments about the research and theory in this area and responds to Robert Kozma's criticism of the author's earlier discussion of these issues. Clark first briefly summarizes his arguments about media effects; then characterizes the many reactions to the controversial claim that media do not influence learning or motivation. Finally, the author responds to the specific criticisms advanced by Robert Kozma on this issue.

Clark, R.E., & Craig, T.G. (1992). Research and theory on multi-media learning effects. In M. Giardina (Ed.), Interactive Multimedia Learning Environments: Human Factors and Technical Consideration. New York: Springer-Verlag.

A survey of available multi-media and interactive videodisc research. Conclusions are offered that: (1) multiple media, including videodisc technology, are not the factors that influence learning; (2) the measured learning gains in studies of the instructional uses of multiple media are mostly likely due to instructional methods (such as interactivity) that can be used with a variety of single and multiple media; (3) the aspects of dual coding theory which formed the basis for early multi-media studies have not been supported by subsequent research; and (4) future multi-media studies and interactive videodisc research should focus on the economic benefits (cost and learning time advantages) of new technology. Two tacit assumptions, the additive assumption and the multiplicative assumption, seem to govern past and present enthusiasms for the use of multiple media in instruction and training: (1) The additive assumption – instructional media, if used properly, make valuable contributions to

learning and therefore instruction presented in two or more media produce more learning than instruction presented by only one medium because the learning benefits of each of the combined media are additive; (2) The multiplicative assumption – multi-media benefits are sometimes multiplicative, that is, greater than the sum of the benefits of individual media. (Author Introduction)

Cordova, D.I., & Lepper, M.R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice. Journal of Educational Psychology, 88, 715-730.

This experiment examines the effects on the learning process of three complementary strategies-contextualization, personalization, and provision of choices-for enhancing students' intrinsic motivation. Elementary school children in one control and four experimental conditions worked with educational computer activities designed to each arithmetical order-of-operations rules. In the control condition, this material was presented abstractly. In the experimental conditions, identical material was presented in meaningful and appealing learning contexts, in either generic or individually personalized form. Half of the students in each group were also offered choices concerning instructionally incidental aspects of the learning contexts; the remainder were not. Contextualization, personalization, and choice all produced dramatic increases, not only in students' motivation, but also in their depth of engagement in learning, the amount they learned in a fixed time period, and their perceived competence and levels of aspiration.

Dede, C. (1995). The evolution of constructivist learning environments: Immersion in distributed, virtual worlds. Educational Technology, 35(5), 46-52.

Part of a special section on constructivist learning environments. The writer explores the role of virtual reality in constructivist learning environments. Examples of distributed, synthetic virtual environments and their benefits for the user in terms of entertainment and learning enhancement are presented. A project called ScienceSpace, which is a series of artificial realities exploring the potential usefulness of physical immersion to enhance science education, is described. The writer concludes that with careful design, the occasional immersion of learners in virtual worlds and distributed simulations can improve their understanding of phenomena and culture. (Education Abstracts)

DeJean, J., et al. (1995). CD-ROM talking books: A case study of promise and practice. ERIC Document.

This study describes and analyzes the use of CD-ROM talking books in a third grade classroom over a four-month period. One area of interest was how the teacher used the storybooks in day-to-day efforts to foster learning, especially in the area of language arts. Also examined was the sense children made of these media and the overall impact the books made in the classroom. Data was gathered through observation, the use of a video camera (so that data could be analyzed repeatedly), and formal interviews. The data was divided into four categories for analysis: 1) the suitability of CD-ROM books in language arts and thematic units-based curriculum; 2) the teacher's best intentions; 3) CD-ROM books as personality; and 4) the children's use of the books in terms of cooperation vs. competition. The data revealed congruencies and incongruencies in terms of the suitability and the teacher's intentions; also noted was the fact that computers can take on a role that goes beyond their utility and in a class where cooperation was the norm—characteristics of the CD-ROM books seemed to bring out power struggles and selfish behavior. (ERIC)

Druin, A., & Solomon, C. (1996). Designing multimedia environments for children: Computers, creativity, and kids. New York: John Wiley & Sons.

Provides a valuable resource to help producers, educators, and researchers develop multimedia environments that enhance children's educational and play experiences. The authors emphasize the importance of multimedia environments that support children's curiosities, enjoyment of repetition, and need for control, rather than "glitz" production features. The authors draw on 30 years of research in children's software development to provide a framework for designing environments suited to the needs of children. Examples of the chapter topics include: constructionism, "edutainment," children's multimedia authoring tools, online multimedia environments, product development, and discussions of future technologies.

Elkind, D. (1985). The impact of computer use on cognitive development in young children: A theoretical analysis. Computers in Human Behavior, 1, 131-141.

Technological innovations of the past have extended our muscles and our senses and have also increased the number and variety of our social interactions. These increased social interactions tend to produce changes in social institutions, which in turn affect child rearing and mental development. When young children experience increased social interactions this can have a negative effect upon mental development. Computer technology is unique in that it decreases as well as increases the number and frequency of social interactions. Moreover, only computers increase the number of self-self interactions. If these computer-related trends continue, and if technology makes it possible for children to engage in self-self interactions, mental development will be enhanced.

Fischer, M.J. (1996). Integrated learning systems: An application linking technology with human factors and pedagogical principles. Educational Technology Research and Development, 44, 65-72.

The development of integrated learning systems (ILSs) holds great promise for enhancing the instructional process and for improving student learning. This article describes an application of an ILS that takes into account learning theory research, principles of instructional design, and other factors related to human learning. The application presented utilizes IBM's " Advanced Technology Classroom" to verify the efficacy of integrated learning systems from both a student-user perspective and the perspective of instructors in a university setting. (Author Abstract)

Gouzouasis, P. (1994). Multimedia constructions of children: An exploratory study. Journal of Computing in Childhood Education, 5, 273-284.

This exploratory study examines and analyzes the multimedia constructions of children 8-10 years of age. Multimedia are composed of both acoustic and visual elements and are deeply rooted in the performing and visual arts. Because there is much commonality across a broad variety of arts and non-arts software applications, computer literacy in arts monomedia and multimedia may serve as an interesting, creative platform in the acquisition of general computer skills. The problems of the study were a) to elaborate children's construction processes in multimedia projects and b) to gain insight in the acquisition of general computer literacy through multimedia. (Author Abstract)

Greenlee-Moore, M.E., & Smith, L.L. (1996). Interactive computer software: The effects on young children's reading achievement. Reading Psychology: An International Quarterly, 17, 43-64.

The intention of this study was to investigate the effects on reading comprehension when reading shorter and easier narrative text and longer and more difficult narrative texts on the printed page as compared to reading the same narrative texts using interactive CD-ROM software displayed by the computer. Specifically, the ability of two classes of above-average fourth-grade children to answer comprehension questions about seven narrative stories was compared. One class of 4th grade children read each narrative from the actual book and answered six multiple-choice questions about the story, while the second class of 4th grade children read the same narrative from interactive CD-ROM

software displayed on the computer and answered six multiple-choice questions about the story. A three-way analysis of variance on comprehension scores revealed that reading from computers increased comprehension scores when subjects were reading longer and more difficult narratives. Results indicated no difference when the two treatment groups were reading shorter and easier narratives. (Author Abstract)

Griffin, P., Belyaeva, A., & Soldatova, G. (1992). Socio-historical concepts applied to observations of computer use. European Journal of Psychology of Education, 7, 269-286.

Observations of children using mathematics software are the empirical base for this article. The conceptual base is the socio-historical school of psychology. Our purpose was to develop an ability to characterize and contribute to the children's learning. To guide observations of the children and interactions with them, we relied on some aspects of the theory that have often been used in studies of learning and development (the use of auxiliary means, the contrast between reduced and elaborated forms, the zone of proximal development) and other concepts that are less well promulgated (activity variations, analysis by units, and models). At the same time, an enriched understanding of the theoretical concepts arose as we grappled with the children's varied performance on the specific tasks embedded in the software (representation, repetition, and re-analysis). The data are collapsed and annotated field notes of the experience, reshaped to make them available for more general use. The main point is that the two bases are mutually informative. (Author Abstract)

Harel, I., & Papert, S. (Eds.) (1991). Constructionism: Research Reports and Essays, 1985-1990 by the Epistemology & Learning Research Group. New Jersey: Ablex Publishing.

In 1985 the Media Lab was created at MIT [Massachusetts Institute of Technology] to advance the idea that computation would give rise to a new science of expressive media. Within the Media Lab, the Epistemology & Learning Group, directed by Seymour Papert, extends the traditional definition of media by treating as expressive media materials with which children play and learn. The group's work follows Papert's paradigm for learning research called Constructionism. Several of the chapters directly address the theoretical formulations of Constructionism, and others describe experimental studies, which enrich and confirm different aspects of the idea. Thus this volume can be taken as the most extensive and definitive statement to date of this approach to media and education research and practice. The book is structured around four major themes: learning through design and programming; epistemological styles in constructionist learning; children and cybernetics; [and] video as a research tool. (PsycINFO)

Haughland, S.W. (1999). What role should technology play in young children's learning? Young Children, 54, 26-31.

The author addresses critical issues facing early childhood educators and parents – whether and how technology should be used with young children. The first recommendation is that computers should not be used with children below the age of 3; there are a number of developmental skills children must master (crawling, walking, talking, toilet training, to name a few) as well as learning about themselves and their environment. Generally, computers are not the best choice to help facilitate the development of those important tasks. Other topics covered include using developmentally appropriate computer activities (as opposed to drill-and-practice software), parental support of computers in the classroom, models for computer integration, benefits of using computers for young children, and teacher training.

Haughland, S.W., & Wright, J.L. (1997). Young children and technology: A world of discovery. Boston: Allyn and Bacon.

A computer is just a computer; it is the quality of the software used that determines outcomes for young children. This unique and practical book looks closely at the issues of using technology with pre-school, kindergarten and primary school age children. The book emphasizes the "how to" of computer integration into the classroom and across the curriculum. It includes vignettes, most commonly asked questions, and tips for implementing a technology plan into an early childhood setting. In addition, the authors provide evaluations of 130 developmentally appropriate software programs currently available and congruent with the standards set by the National Association for the Education of Young Children (NAEYC).

Hess, R.D., & McGarvey, L.J. (1987). School-relevant effects of educational uses of microcomputers in kindergarten classrooms and homes. Journal of Educational Computing Research, 3, 269-287.

The purpose of this study was to examine effects of microcomputer use on school-readiness skills of kindergarten children. Three classes (N=88) were provided with microcomputers and eleven software programs, of which nine focused on pre-reading skills, one on pre-mathematics skills, and one on both. One of the three classes (N=22) was also provided with micros to use at home. Two classes (N=98) constituted a comparison group. Students were pre- and post-tested on items selected to assess reading readiness, mathematics readiness, Piagetian operations, and keyboard knowledge. The computer-use group gained more on reading readiness and keyboard knowledge; moreover, the home-use group gained more than classroom-use students. No sex differences appeared in gain scores. Teacher implementation strategies and the techniques that nonreaders used to deal with software are described. (Author Abstract)

Hunt, P. (1996). The child, the book, and the Internet. ERIC Document.

This paper focuses on book-centered and "non-book" children and the role of the internet in changing literature and children's reading habits. Highlights include diversity in children's books; differing magazine readership across the continents; the concept of narrative; the problem of book-centered children becoming outsiders in a more technology-oriented environment; the "classics" and literary standards; changes brought about by computers; and the evolution of the new female-dominated "intermedia" era. It is suggested that the role of the library may either become that of the archive or that of the interstices of the net, the facilitator, or the traffic police. (ERIC)

Kafai, Y.B. (1995). Minds in play: Computer game design as a context for children's learning. Hillsdale, NJ: Lawrence Erlbaum Associates.

Minds in Play takes a closer look at games as a context for learning by placing children in the roles of producers rather than consumers of games. The author follows a class of 16 4th-grade students from an inner-city public elementary school as they were programming games in Logo to teach fractions to 3rd graders. In this context, programming became a medium for children's personal and creative expression: in the design of their games children engaged their fantasies and built relationships with other pockets of reality that went beyond traditional school approaches. (PsycINFO)

Kafai, Y.B. (1996). Electronic play worlds: Gender differences in children's construction of video games. In Y.B. Kafai, & M. Resnick (Eds.). Constructionism in practice: Designing, thinking, and learning in a digital world. Mahwah, NJ: Lawrence Erlbaum Associates.

This chapter describes the research context and methodologies used to gather the data in the Game Design Project (a 6-month-long project with 16 10-year-old 4th grade children, who created imaginary worlds, characters, and stories in the context of educational and recreational video game design.) The author: 1) Presents the games developed by the children and analyzes them in regard to their features, themes, and interactions; 2) Raises issues concerning the extent to which these choices

were gender related and which particular cultural values they reflected, if any; 3) Addresses the potential of different game-making activities, tools, and contexts with more powerful computational technologies; 4) Briefly reviews what is known about the video games in the research literature. (PsycINFO)

Kahn, K. (1996). ToonTalk™ - An animated programming environment for children. Journal of Visual Languages and Computing, 7, 197-217.

Seymour Papert once described the design of the Logo programming language as taking the best ideas in computer science about programming language design and 'child engineering' them. Twenty-five years after Logo's birth, there has been tremendous progress in programming language research and in computer-human interfaces. Programming languages exist now that are very expressive and mathematically very elegant and yet are difficult to learn and master. We believe the time is now ripe to attempt to repeat the success of the designers of Logo by child engineering one of these modern languages.

When Logo was first built, a critical aspect was taking the computational constructs of the Lisp programming language and designing a child friendly syntax for them. Lisp's 'CAR' was replaced by 'FIRST', 'DEFUN' by 'TO', parentheses were eliminated, and so on. Today there are totally visual languages in which programs exist as pictures and not as text. We believe this is a step in the right direction, but even better than visual programs are animated programs Animation is much better suited for dealing with the dynamics of computer programs than static icons or diagrams. While there has been substantial progress in
graphical user interfaces in the last twenty-five years, we chose to look not primarily at the desktop metaphor for ideas but instead at video games. Video games are typically more direct, more concrete, and easier to learn than other software. And more fun too.

We have constructed a general-purpose concurrent programming system, ToonTalk, in which the source code is animated and the programming environment is a video game. Every abstract computational aspect is mapped into a concrete metaphor. For example, a computation is a city, an active object or agent is a house, birds carry messages between houses, a method or clause is a robot trained by the user and so on. The programmer controls a 'programmer persona' in this video world to construct, run, debug and modify programs. We believe that ToonTalk is especially well suited for giving children the
opportunity to build real programs in a manner that is easy to learn and fun to do. (Institute for Scientific Information)

Kirkman, C. (1993). Computer experience and attitudes of 12-year-old students: Implications for the UK National Curriculum. Journal of Computer Assisted Learning, 9,
51-62.

The computer experience of 12-year-old students who had just started their secondary education was investigated. Data was collected on home and school computer use, attitudes towards computers, academic ability, gender and socio-economic group. The results highlight the widely varying and often inadequate computer experience that students have received in their primary education. The computer experience of the majority of students was a long way from being sufficient to fulfill the requirements of the UK National Curriculum. For most students, home computer use formed the major part of their IT experience. Home computer use was found to have the strongest effect on attitudes toward computers. Several significant differences in attitude were apparent between boys and girls. Analysis of academic ability and socio-economic group showed that these factors related to boys and girls in very different ways. All these factors need to be considered when implementing the computer content of the UK National Curriculum. (Author Abstract)

Kirkpatrick, H., & Cuban, L. (1998). Computers make kids smarter – Right? TECHNOS Quarterly, 7, 1-11. http://www.technos.net (1999, August 26).

As money for technology pours into US schools, policymakers, practitioners, and parents must sift their way through corporate ads, reformers' slogans, and academic studies in an attempt to answer this question: What should we spend the money on? The answer from current wisdom, which assumes that students profit mightily from new technology, is to spend it on computers. Two intrepid California educators, after a thorough survey of the best research available, aren't ready to go along with current wisdom. The authors suggest that we cannot assume that all technology is equally valuable and effective. Effectiveness statements are of little use unless they elaborate the children's ages, the subject, the software used, the kinds of outcomes that were sought, and how the study was conducted.

Kozma, R.B. (1991). Learning With Media. Review of Educational Research, 61, 179-211.

Describes learning with media as a complementary process within which representations are constructed and procedures performed, sometimes by the learner and sometimes by the medium. It reviews research on learning with books, television, computers, and multimedia environments. These media are distinguished by cognitively relevant characteristics of their technologies, symbol systems, and processing capabilities. Studies are examined that illustrate how these characteristics, and the instructional designs that employ them, interact with learner and task characteristics to influence the structure of mental representations and cognitive processes. Of specific interest is the effect of media characteristics on the structure, formation, and modification of mental models. (PsycINFO)

Kozma, R.B. (1994). Will media influence learning? Reframing the debate. Educational Technology Research & Development, 42, 7-19.

Examines the potential relationship between learning and media. The results of two significant and effective instructional environments, one using computers and the other using video, are analyzed to identify causal mechanisms by which media may influence learning. Ss were 42 6th-grade students in a science class who were exposed to a computer-based learning environment to study Newtonian mechanics. Ss were compared to 37 6th graders in the same school who received the standard science curriculum. Ss in the computer-based environment demonstrated greater improvement and scored significantly higher on science tests than the Ss in the standard instruction environment. A previous study using a videodisc environment showed similar results. Implications for theory, research, and practice are discussed. (PsycINFO)

Krendl, K.A., & Broihier, M. (1992). Student responses to computers: A longitudinal study. Journal of Educational Computing Research, 8, 215-227.

The results of this study support critiques of the methodological limitations of the dominant approach to the study of computer effects in learning environments. That is, reports of short-term experimental applications of the technology have led to misleading generalizations about the computer's instructional potential. Using Clark's concept of media attributions, this study examines the evolution of student's (4^{th} through 10^{th} grade) perceptions about computers on three dependent variables-preference, perceived learning, and perceived difficulty-over the course of three years. The findings demonstrate clear evidence of novelty effects. Students' judgments regarding preferences for computers declined significantly as did their perceptions of learning from the technology during the three years. Perceived difficulty of using computers, which was expected to decline, remained stable. In addition, both gender and age proved to be significantly related to all three dependent variables. Other students were consistently more skeptical to all three dependent variables. Other students were consistently more skeptical about the technology than were younger students, and boys were

consistently more positive than girls. These relationships showed no evidence of change over the course of three years. (Author Abstract)

Krendl, K.A., & Lieberman, D.A. (1988). Computers and learning: A review of recent research. Journal of Educational Computing Research, 4, 367-389.

This literature review examines recent research on computers and learning. It covers investigations of the computer in relation to: 1) effects on learning, 2) development of cognitive skills, 3) academic motivation, 4) learning environments, and 5) methodological issues. It notes three emerging trends; though these trends do not characterize the field as a whole, they set new and rigorous standards for research in the field. They include the integration of educational and psychological theory into research, precision in concept specification, and improvements in research design. The review notes the predominance of quantitative methods for hypothesis testing, with new interest emerging in the application of qualitative approaches for hypothesis formation. In addition, several new directions for research are proposed. (Author Abstract)

Lajoie, S. P., & Derry, S. J. (Eds.) (1993). Computers as cognitive tools. Hillsdale, NJ: Erlbaum.

The goal of this volume was to highlight and illustrate several important and interesting trends that have emerged in the continuing evolutionary development of instructional technology. A framework was developed based on the notion of two opposing camps, one evolving out of the intelligent tutoring movement, which employs artificial-intelligence technologies in the service of student modeling and precision diagnosis, and the other emerging from a constructivist/developmental perspective that promotes exploration and social interaction, but tends to reject the methods and goals of the student modelers. The cognitive tools incorporated into systems described in this book assist in all stages of problem solving, ranging from tools that help learners conceptualize problem representations . . . to those that are more deliberately designed to assist learners in reviewing and reflecting upon the entire problem-solving process. (PsycINFO)

Levine, T., & Donitsa-Schmidt, S. (1997). Commitment to learning: Effects of computer experience, confidence, and attitudes. Journal of Educational Computing Research, 16, 83-105.

Based on attitude-behavior theory which suggests that beliefs about an object lead to an attitude toward it, and that attitudes are an important precursor of behavior, this study proposes a causal model relating measures of computer-experience (degree of computer use at home and at school), computer-related attitudes (dispositions concerning the computer as an important, interesting, educational, and stereotypical tool), computer-related confidence (degree of confidence when using a computer), and commitment to computer learning (difference between self-perceived current level of computer-application knowledge and perceived level of desired knowledge). The model hypothesizes that computer experience positively affects perceived computer self-confidence and computer-related attitudes. The model further hypothesizes that computer attitudes and computer confidence reciprocally affect one other in a positive way, and that both positively affect commitment to computer learning. Questionnaires were administered to 309 seventh to twelfth grade students. The theoretical model was tested by structural equation analysis (LISREL). Contrary to prediction, when attitudes were held constant, computer confidence was found to have a negative effect on commitment to learning. All other causal effects, including reciprocity were confirmed. The contribution and relevance of these findings to future educational research are discussed. (Author Abstract)

Liu, M. (1996). An exploratory study of how pre-kindergarten children use the interactive multimedia technology: Implications for multimedia software design. ERIC Document.

Literature has indicated that computers have a potential to support children in all stages of development. To enhance children's learning through technology, it is important to understand how children use computers. This study explores the use of interactive multimedia by three-to five-year olds. Through a close examination of the young children's verbal and facial expressions, their use of the mouse, their body movement, and their attitudes toward multimedia as well as their teachers' comments. This study showed that multimedia technology with its use of video, audio, and graphics could engage children for a longer period of time. The children demonstrated a great interest in using the technology and had little difficulty in adjusting to the new learning environment. Although many children were exposed to the technology for the first time, it was obvious that these children were ready for the technology. The results also indicated that using developmentally appropriate materials and allowing children to have control of the program are important factors in keeping them interested. Implications for multimedia software design based upon the findings of the study are also discussed. (ERIC)

Margalit, M., Rochberg, Y., & Al-Yagon, M. (1995). Home-computing model and children with learning disabilities: A systemic approach. Learning Disability Quarterly, 18, 68-75.

Examines the introduction of computers to the home environment and parental determination to extend the advantages and benefits of technology to promote their children's academic performance and emotional growth. Using a dynamic and individualistic approach based on observations and research, a home-computing model considers parents' often controversial tendencies related to their child's education. Parents would like to be more involved in their children's education, but they have difficulty staying involved as a result of stress related to their child with disabilities, a lowered sense of coherence, and overload of caring duties. Two suggested strategies are viewed as representing a continuum of parent-child interactions: creating a supportive climate for home computing and parental tutoring. (PsycINFO)

Mayer, R.E., Quilici, J.L., & Moreno, R. (1999a). What is learned in an after-school computer club? Journal of Educational Computing Research, 20, 223-235.

An after-school computer club was developed in which language-minority children learned to master a series of educational computer games through reading instructions, interacting with peers, and interacting with adult mentors. Did twenty-five elementary school children who regularly participated in an after-school computer club during an academic year (treatment group) learn generalizable problem-solving skills as compared to 25 non-participating peers who were matched for grade level, gender, and English language proficiency (comparison group)? Based on a dynamic assessment given at the end of the academic year, treatment student were more successful than comparison students in learning how to play a new educational computer game that was presented as a paper-and-pencil mathematics puzzle learning task. This study shows how an informal educational environment can foster generalizable problem-solving skills that transfer to learning in a school environment.

Mayer, R.E., Schustack, M.W., & Blanton, W.E. (1999b). What do children learn from using computers in an informal, collaborative setting? Educational Technology, 39, 27-31.

The article examines the cognitive consequences of children's learning to use educational technology in an informal, collaborative environment. In particular, we explore ways in which learning to master educational computer programs can promote problem-solving transfer. Studies at three after-school computer clubs reveal that children who use educational software may learn content knowledge about computer literacy, comprehension skills for understanding instructions, planning skills for learning new games, and some basic academic skills. (Author Abstract)

Miller, M.D., & McInerney, W.D. (1994). Effects on achievement of a home/school computer project. Journal of Research on Computing in Education, 27, 198-210.

This study investigates a home/school computer project and its effects on reading, language, and mathematics achievement for students after one year and two years in the project. The treatment group consisted of 142 4th and 5th grade students, each of whom received a computer, printer, and telecommunications equipment for use in learning activities in their homes. The comparison group consisted of 147 4th and 5th grade students at a different school in the same district. The data for the study were collected from the California Achievement Test and the Comprehensive Test of Basic Skills, 4th edition. The dependent variables were the changes in scale scores over the time period investigated in the study. The findings indicated that participation in the project was not associated with increased academic achievement. Therefore, educators should enter home/school computer projects with caution and realistic expectations. (Author Abstract)

Okagaki, L. & Frensch, P. (1996). Effects of video game playing on measures of spatial performance: Gender effects in late adolescence. In I.E. Sigel (Series Ed.) & P.M. Greenfield & R.R. Cocking (Vol. Eds.), Interacting with video: Vol. 11. Advances in applied developmental psychology (pp. 115-140). Norwood, NJ: Ablex Publishing Corporation.

The authors examine three specific aspects of the relation between video game play and spatial skills among older adolescents (college undergraduates). They examined whether gender differences can be obtained in initial visual spatial performance and in video game play, and examined the impact of video game play on spatial performance. The effect of video game play on the specific component of spatial skills utilized in the game were studied; that is, if a video game relies heavily on two spatial skills, is the impact on those skills predictable? The chapter presents two experiments in which measures of spatial performance were obtained from subjects both before and after they practiced the video game *Tetris*. In Exp 1, paper-and-pencil measures of spatial performance were used, and in Exp 2, computerized measures of spatial performance were used. (PsycINFO)

Park, I., & Hannafin, M.J. (1993). Empirically-based guidelines for the design of interactive multimedia. Educational Technology Research, and Development, 41, 63-85.

While interest in interactive multimedia continues to grow, thus far its activities have been driven more by technological capacity than research and theory. Typically, guidelines for interactive multimedia design are based not upon empirical evidence, but on the intuitive beliefs of designers. In this article, relevant research and theory are organized within an overarching framework, and their principles and implications for the design of interactive multimedia are derived. (Author Abstract)

Pea, R. (1994). Seeing what we build together: Distributed multimedia learning environments for transformative communications. The Journal of the Learning Sciences, 3, 285-299.

The author discusses the processes and products associated with collective learning and examines how to create computer support for collaborative learning. The social and material embeddedness of everyday communication is noted. Two concepts of communication, as transmission and as ritual, are currently used in education. There is a need for a 3rd view of communication as transformation. A project is described that investigated the use of diagrams in science learning and how computer technologies might help. The use of optics dynagrams changed both the instructional practices and the student learning outcomes. (PsycINFO)

Pea, R.D. (1997). Practices of distributed intelligence and designs for education. In G. Salomon (Ed). Distributed cognitions: Psychological and educational considerations. Learning in doing: Social, cognitive, and computational perspectives. (pp. 47-87). New York, NY: Cambridge University Press.

The author lays out the central ideas of the distributed-intelligence framework and then provides a background to its development, before closing with considerations of some implications for education. Distributed intelligence is not a theory of mind, or culture, or design, or symbol systems and their impact on human thought so much as it is a heuristic framework for raising and addressing theoretical and empirical questions about these and other topics when we think about intelligence as manifest in activity and as distributed in nature, we may wish to ask a descriptive question for learning: How do learners enact the cultural practices for designing, constructing, and displaying distributed intelligence in activity? How should learners acquire such cultural practices? The author examines trade-offs in the design of distributed intelligence that may influence our considerations. (PsycINFO)

Presno, C. (1997). Bruner's three forms of representation revisited: Action, pictures and words for effective computer instruction. Journal of Instructional Psychology, 24, 112-118.

This article centers on Jerome S. Bruner's theory of the three forms of representation which, it is argued, can be successfully applied for effective computer learning and instruction. The three categories of representation include: action (enactments and demonstrations), icons (summarizing pictures) and symbols (words and numbers). In order to show the relevance of Bruner's ideas today, the article examines how studies regarding Paivio's dual-coding theory and studies focusing on procedural knowledge support his theory. In the last section of the article, it is suggested that using action and demonstrations; pictures and diagrams; and verbal instructions are the most comprehensive and effective ways to teach student's how to use the computer. Specific examples for instruction are provided.

Reiber, L.P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. Educational Technology Research, and Development, 44, 43-58.

Little attention has been given to the psychological and sociological value of play despite its many advantages to guiding the design of interactive multimedia learning environments for children and adults. This paper provides a brief overview of the history, research, and theory related to play. Research from education, psychology, and anthropology suggests that play is a powerful mediator for learning throughout a person's life. The time has come to couple the ever-increasing processing capabilities of computers with the advantages of play. The design of hybrid interactive learning environments is suggested based on the constructivist concept of a microworld and supported with elements of both games and simulations.

Riding, R.J., & Rayner, S. (1995). The information superhighway and individual learning. Educational Psychology, 15, 365-378.

In recent times there have been considerable advances in both communications technology and in the psychological understanding of the factors affecting individualized learning. The technological developments have resulted in the establishment of the Information Superhighway, which permits the interactive transfer of information on a world-wide basis. Psychological studies have considered the effect of individual characteristics such as prior knowledge, intelligence, personality and cognitive style on learning performance. Separately these developments have consequences for education and training, but their effect is greatly enhanced when they are integrated. This paper considers some of the implications and possibilities of this integration.

Risden, K., Hanna, E., & Kanerva, A. (April, 1997). Dimensions of intrinsic motivation in children's favorite computer activities. Poster presented at the Society for Research in Child Development, Washington, DC.

This study investigates children's motivations for using computer software. Children's responses to questions about their favorite computer software program were submitted to a principle components analysis. The dimensions of Positive Affect, Familiarity, Control, Challenge, and Curiosity emerged from the analysis as independent factors. The Familiarity dimension received lower mean ratings than the other dimensions, particularly from older children. The Control dimension was rated higher by younger children than older children. Familiarity may become less important as children develop the capability of abstract, "possibility-based" thinking. The importance of Control for younger children suggests that this age group needs more support and guidance from software in order to feel competent. By understanding what questions accurately measure these dimensions, and which dimension are more or less important for different age groups, we can better assess the motivational value of a software product and suggest design changes to increase that value.

Robertson, J.W. (1994). Usability and children's software: A user-centered design methodology. Journal of Computing in Childhood Education, 5, 257-271.

This article outlines the Human Factors usability issues involved in the design, development, and implementation of educational software. The lack of attention to educational software usability is addressed and followed by a financial evaluation of social spending on educational technology. Industrial usability issues are presented, followed by suggestions for ways in which educational software can meet the language, physical, social, and cognitive needs of children. A consideration of current usability testing methods is presented, including the application of surveys, heuristic, and think-aloud methods for children's software. Guidelines and recommendations are provided for adapting usability engineering and testing procedures to educational software to create a quasi-user-centered design approach for educational software development.

Salomon, G. (1990). Cognitive effects with and of computer technology. Communication Research, 17, 26-44.

A distinction is offered between cognitive effects with computers, whereby one's performance is redefined and upgraded during intellectual partnership with the computer, and effects of computers, whereby such partnership leaves durable and generalizable cognitive residues later on. Concerning effects with computers, it is argued that the quality of effects with computer programs greatly depends on the setting in which the computer-related activity takes place, on the user's goals, and on his or her mindful engagement in the activity. Concerning effect for the computer, two mechanisms for affecting cognition are discussed: skill stretching by means of novel cognitive requirements and skill internalization al a Vygotsky.

Salomon, G., & Almog, T. (1998). Educational psychology and technology: A matter of reciprocal relations. Teachers College Record, 100, 222-241.

Technology and instruction have recently entered an alliance of reciprocal influences. Technology serves instruction and at the same time opens up novel opportunities. Concerning the former, a major justification for the employment of computers is the acceptance of constructivist conceptions and a growing understanding of learning as a social process. Technology thus comes to facilitate the realization of the learning environments that emanate from constructivist conceptions. Concerning technology's influence on education, ever-newer technological affordances pull instruction in new and promising directions. However, many of these lack purpose or rationale. Why, for example, should students design their own web sites? New questions arise that need to be answered, such as whether hypermedia programs offer frail and casual webs of information that lead to the cultivation of similarly flimsy mental networks (the "Butterfly Defect"), for whether computer-mediated communication (CMC) might create virtual, faceless learning environments. It also becomes evident that the new learning environments rely more heavily than their predecessors on students'

proclivity for self-regulated and mindful learning. Can technology facilitate the cultivation of these? Educational psychology and technology are now engaged in an intense duet that, if seriously studied, explored, and evaluated, may offer novel and improved instruction. (Author Abstract)

Sargent, R., Resnick, M., Martin, F., & Silverman, B. (1996). Building and learning with programmable bricks. In Y.B. Kafai, & M. Resnick (Eds.). Constructionism in practice: Designing, thinking, and learning in a digital world. Mahwah, NJ: Lawrence Erlbaum Associates.

The authors discuss the applications and implications of the Programmable Brick, a tiny, portable computer embedded inside a LEGO brick that is capable of interacting with the physical world in a large variety of ways. Programmable Bricks make possible a wide range of new design activities for students in robotics and ubiquitous computing, a new research field that aims to spread computation throughout the environment by embedding computation in all types of objects and artifacts. They describe initial results from three types of applications: building active environments in which children use Programmable Bricks as sensors and regulators; making autonomous creatures that display various behaviors; and doing personal science experiments to monitor and control everyday phenomena. The chapter concludes with a list of 20 things to do with Programmable Bricks. (PsycINFO)

Schacter, J., & Fagnano, C. (1999). Does computer technology improve student learning and achievement? How, when, and under what conditions? Journal of Educational Computing Research, 20, 329-343.

There have been widespread claims that technology can make learning easier, more efficient, and more motivating. This article argues that ease and efficiency should not be the leading criteria for advocating and implementing computer technology in schools. The authors assert that to produce more meaningful learning, computer technologies need to be designed according to sound learning theories and pedagogy. When administrators, teachers, and parents understand that different computer technologies serve and augment different learning experiences, they can make informed judgments about which technologies are best suited to enhance student learning and achievement. (Author Abstract)

Shade, D.D., & Watson, J.A. (1990). Computers in early education: Issues put to rest, theoretical links to sound practice, and the potential contribution of microworlds. Journal of Educational Computing Research, 6, 375-392.

Over the years, since computers were first introduced to early childhood education, much debate and research has centered on the issue of appropriateness. In spite of recent gains in understanding, the debate rages on. The purpose of this article is threefold. First, research evidence is presented taking issue with a number of the most often cited reasons for not including computers in preschool environments. Secondly, a theoretical base for computer use in early childhood is developed that includes: Papert, Piaget, Erikson, and competence development. Finally, direction for software development is offered through review and description of successful microworld programs. It is concluded that the microcomputer, when coupled with appropriate software, has the potential to empower the development of young children.

Strommen, E.F. (1993). "Does yours eat leaves?" Cooperative learning in an educational software task. Journal of Computing of Childhood Education, 4, 45-56.

Twenty-eight pairs of fourth grade children (mean age 10 years) were observed using an educational software game under two conditions. In the cooperative condition, two children played as a team against the computer. In the competitive condition, two children played against each other. No special instructions were given in either condition. Results indicated that the cooperative condition

gave rise to more correct answers than did the competitive condition. An analysis of strategies used in both conditions indicated that the only strategies significantly related to obtaining the correct answer were those that involved the two children working together and that these strategies were significantly more frequent in the cooperative condition. (Author Abstract)

Strommen, E.F. (1993). Is it easier to hop or walk? Development issues in interface design. Human-Computer Interaction, 8, 337-352.

Examined the ability of 36 children (aged 3 years) to use a Nintendo controller to play a video game requiring them to capture both moving and stationary onscreen targets by jumping. Two forms of character movement were tested: moving in discrete steps (hopping) and moving in a smooth, continuous motion (walking). Targets were the same for both movement types. Although there was no difference between movement types in number of targets children captured, continuous movement was significantly more challenging for children, both when positioning the cursor and when trying to capture targets. Moving targets actually appeared to be easier to capture. Cognitive factors governing children's game performance included levels of working memory and the motivational context of the task. (PsycINFO)

Strommen, E., & Revelle, G. (1990). Research in interactive technologies at the Children's Television Workshop. Educational Technology Research and Development, 38, 65-80.

This article presents a model for integrating research into the software design process, based on the experience of the Interactive Technologies Division of the Children's Television Workshop. The model has three components: (a) using existing research literature to inform initial design decisions and suggest possible issues to be tested during the development of prototype products, (b) conducting in-house basic research studies to provide information unavailable in the published literature, and (c) conducting formative research studies on products in development to assess their usability and to ensure their effectiveness as learning tools. Issues in interpreting published studies are considered, and insights from the results of basic and formative studies conducted by the Interactive Technologies Division are also reviewed.

Subrahmanyam, K., & Greenfield, P.M. (1996). Effect of video game practice on spatial skills in girls and boys. In I.E. Sigel (Series Ed.) & P.M. Greenfield & R.R. Cocking (Vol. Eds.), Interacting with video: Vol. 11. Advances in applied developmental psychology (pp. 94-114). Norwood, NJ: Ablex Publishing Corporation.

This chapter examines the relationship among gender, video game experience, and spatial skills. The authors hypothesize that there would be gender differences favoring boys in both spatial skills and past video game experience, and expected to find that gender and past experience would contribute to spatial scores prior to the experimental practice. The participants were selected based on the age--10 yrs old--at which gender differences in spatial skills first become reliably evident. The experimenters used a computerized spatial battery [because it used the same medium as the video games--the computer]. Video game practice, but not practice on a computerized word game, led to significant improvement in dynamic spatial skills, an improvement that was concentrated in those Ss who started out with relatively poor spatial performance. Results strongly show that, irrespective of gender, video game practice could serve as compensatory education for relatively weak spatial skills. (PsycINFO)

Underwood, J., & Underwood, G. (1990). Computers and learning: Helping children acquire thinking skills. UK: Basil Blackwell.

This book aims to demonstrate the usefulness of classroom computers and to suggest how they can be used as powerful tools in fostering children's thinking and learning. What are the goals that

should be set for computer use? Should we think of classroom computers as we think of pencils, books and TV programs, or as a means of developing cognitive skills? How can girls, in particular, be encouraged to participate fully in computer-based activities? How can software be evaluated, and how should a teacher assess the effectiveness of computer-based learning? In answering these and other questions, Jean and Geoffrey Underwood bring to bear insights drawn both from cognitive psychology and teacher education. Computers, they conclude, can provide real intellectual gains when properly used as open-ended tools. (PsycINFO)

Weinberger, J. (1996). A longitudinal study of children's early literacy experiences at home and later literacy development at home and school. Journal of Research in Reading, 19, 14-24.

Studies of literacy attainment in the early years of school have identified various measures at school entry, which predict later attainment. The study sought not only to replicate earlier findings, but also to investigate significant home factors from a younger age. Literacy experiences of 42 children at ages 3, 5, and 7 were investigated, and the relationship of home factors to literacy development explored. Findings are reported concerning two outcome measures at age 7: children's reading level, as determined by the difficulty level of their school reading book, and whether or not children at age 7 were judged to have literacy difficulties. Significant factors included having favorite books at age 3; letter knowledge and parents reading to children at school entry; and at age 7, access to home computers, and parents' knowledge of literacy teaching in school. Children with literacy difficulties owned fewer books, were less likely to read to themselves or their parents, and generally had less support for literacy at home. Implications for teachers, highlighting the relevance of home literacy, are discussed. The findings underlie the importance of home factors for children's literacy development. (Author Abstract)

Wild, M. (1996). Investigating verbal interactions when primary children use computers. Journal of Computer Assisted Learning, 12, 66-77.

This paper is based upon some early results of a research project currently underway at Edith Cowan University to investigate the nature of young children's interactions centered on and around the use of new technologies for learning. The research focuses on children working in dyads on a single computer-based language task; the software used was chosen to facilitate children's talk. This paper reports a number of findings, including the difficulties of predicting the quality of children's interactions at the computer; the likely significance of a wide range of factors that influence children's interactions; and, the lack of patterns in children's interactions over time. From the analysis of the data, two categorizations are given that might be useful to guide further research into the nature of children's interactions using the computer. The first categorization is a checklist of verbal interaction types, and the second, a checklist for meta-cognitive components in children's interactions.

Wright, J.L., & Shade, D.D. (Eds.) (1994). Young children: Active learners in a technological age. Washington, D.C.: National Association for the Education of Young Children.

Emphasis is placed on the concept of children as active learners and active discovers of their environments. Young children can be designers, authors, and logical thinkers in well-designed interactive environments. The authors address: (1) issues regarding use of technology in early childhood education (developmental considerations, concept taught in pre-school, school-related learning, and evaluation); and the uniqueness of the computer as a learning tool (reading & writing, mathematics, creativity & problem solving, and collaboration); (2) the role of technology in the early childhood curriculum (software evaluation, staff development, applications in special education, the home-school connection); and (3) challenges for early childhood educators (equal access for all children, collaboration with others).

Yuji, H. (1996). Computer games and information-processing skills. Perceptual and Motor Skills, 83, 643-647.

To assess the association of past use of computer games and parallel-processing skills as measured by tests of discrimination perception using computers, 46 boys and girls in kindergarten, aged 4 to 6 years, were classified into 17 player and 17 non-player groups by their enthusiasm for computer games. There were no significant differences between the two groups in correct responses; however, RTs of players were significantly faster than those of non-players. RTs were different to color and shape. Experiences with computer games might develop information-processing skills. (Author Abstract)

Content Area: Social Development

Social Relationships

Abbott, C. (1998). Making connections: Young people and the Internet. In J. Sefton-Green (Ed.), Digital diversions: Youth culture in the age of multimedia (pp. 84-105). London, UK: UCL Press.

The author argues that publishing on the Web for young people is motivated by the desire to participate in, or create, some kind of community. The chapter explores some of the literature that theorizes about the concept of online communities and then considers ways of modifying this work to make it applicable for the specific needs of young people. Topics of interest include Multi-User Domains (MUDs), synchronous electric communication (Internet Relay Chat), and web page development by youth.

Bier, M.C., Sherblom, S.A., & Gallo, M.A. (1996). Ethical issues in a study of Internet use: Uncertainty, responsibility, and the spirit of research relationships. Ethics & Behavior, 6, 141-151.

In this article ethical issues arise in a study of home Internet use by low-income families. Authors consider questions of responsibility as educational researchers and discuss the ethical implications of some unanticipated consequences of the study. Authors illustrate ways in which the principles of research ethics for use of human subjects can be ambiguous and possibly inadequate for anticipating potential harm in educational research. In this exploratory research of personal communication technologies, participants experienced changes that were personal and relational. The participants expressed growing fears of the time when the temporary (loaned) equipment would be returned; they had integrated the technology into their lives to such a degree that they felt dependence on the resources provided, and which they could not afford to replace. Participants reported positive changes in their sense of identity, education, and sense of community. These unanticipated changes in their way of being complicated our research relationships, testing the boundaries of our commitment to the principle of trustworthiness and forcing us to reevaluate our responsibilities.

Bruckman, A., & Resnick, M. (1996). The MediaMOO project: Constructionism and professional community. In Y.B. Kafai, & M. Resnick (Eds.). Constructionism in practice: Designing, thinking, and learning in a digital world (pp. 207-221). Mahwah, NJ: Lawrence Erlbaum Associates.

The chapter documents individuals' experiences with the MediaMOO project to date and evaluates its success as a virtual professional community. The authors explore the importance of constructionist principles in virtual reality design MediaMOO is a text-based, networked virtual reality environment or "MUD"…running on the Internet. Users from around the world connect to this virtual place to socialize, talk about research projects, interact with the virtual world, and create new objects and places. (PsycINFO)

Calvert, S.L. (in press). The social impact of virtual reality. In K. Stanney (Ed.), Handbook of Virtual Environment Technology. Hillsdale, NJ: Lawrence Erlbaum.

How will virtual experiences affect social relationships and social behaviors with people both inside virtual reality (VR) and outside in real life (RL)? Can virtual relationships substitute for, or supplement, face-to-face relationships, or will people feel lonely and isolated? Who will people be in the information age? What will identities be like when people are no longer constrained by a physical body, when they are free to embody themselves in diverse characters and develop multiple facets of their identities? How will virtual actions impact real behavior? Currently, there is limited empirical literature in the virtual reality area to address these questions. Because media issues tend to recur, three primary sources of information are examined: 1) studies in virtual reality; 2) studies about the Internet; and
3) studies about television. Because virtual reality will be delivered across the Internet in the future, current and future Internet social interactions are particularly germane to this review. Even so, answers to questions about the social impact of virtual reality are preliminary and require additional empirical investigations.

Center for Media Education (1997, Fall). Plugging in parents: Web sites to help moms and dads. InfoActive Kids. Washington, D.C.: Center for Media Education. http://www.cme.org

(From the Newsletter) This issue examines an important source of information about children and families – online parenting services. Web sites now offer parents and caregivers instant information on a large number of topics, ranging from education to meal planning. CME believes that all those concerned with children should become familiar with the new online marketplace for parenting information and its expanding influence over parents. Child advocates, health professionals, and parent groups need to evaluate and work with those maintaining parenting web sites in order to ensure that these sites ultimately benefit all families.

Constant, D., Sproull, L., & Kiesler, S. (1997). The kindness of strangers: On the usefulness of electronic weak ties for technical advice. In S. Kiesler (Ed.), Culture of the Internet (pp. 303-322). Mahwah, NJ, USA: Lawrence Erlbaum Associates.

People use weak ties--relationships with acquaintances and strangers--to seek help unavailable from friends or colleagues, but help through weak ties may have doubtful value. The authors studied how employees of a global computer manufacturer used weak ties to obtain technical advice by email, what motivated people to provide advice, and what influenced seekers' receiving more or less useful advice. Theories of weak ties suggest that the usefulness of advice may depend on the number of weak ties, the diversity of ties, or the resources of help providers. It was predicted that providers' firm-specific resources and organizational motivations would predict the usefulness of advice. The data supported this hypothesis and provided some support for resource and diversity explanations of weak tie influence. The way in which the organization's culture sustained useful information exchange through weak ties is discussed. (PsycINFO)

Funk, J.B., & Buchman, D.D. (1996). Children's perceptions of gender differences in social approval for playing electronic games. Sex Roles, 35, 219-232.

Gender differences characterize children's commitment to playing electronic games and are consistent with common stereotypes that may be triggered by their context and content. If conforming to gender stereotypes in electronic game playing maintains social approval, then those children who choose alternate playing patterns risk social sanction. The present study was designed to characterize children's views of gender differences in social approval for electronic game playing. A questionnaire was administered to 364 4th and 5th graders. Approximately 12% of the students represented

minorities, and the majority were African-American. Children responded to 14 statements describing the social acceptability by gender of certain playing habits. Results identified important gender and grade differences. Many children endorsed statements indicating that social approval for game playing is consistent with common gender stereotypes. The most striking gender differences in perceived social approval were found in statements referencing "fighting games". Children whose game playing deviates from approved patterns may represent a group of "high-risk" electronic game players. (PsycINFO)

Griffiths, M. (1997). Friendship and social development in children and adolescents: The impact of electronic technology. Educational and Child Psychology, 14, 25-37.

It has been noted that friendships are more than just friendly interaction. Most importantly, friends form emotional ties with each other, and by the age of about seven years a children will spend as much social time with friends and peers as they do with adults. However, there has been much debate about the effects that electronic forms of entertainment (television, computer games, slot machines, etc.) may have on a child's or adolescent's social development. This paper examines the impact of interactive electronic technology in the lives of children and adolescents and also examines "electronic friendship". By reviewing the relevant literature, a number of questions are addressed (e.g., Can children use machines as "electronic friends"? What effect does interactive technology have on friendship and social development? What are the implications of children being able to access the Internet?)

Huston, A.C, Wright, J.C. (1996). Television and socialization of young children. In T.M. MacBeth (Ed), Tuning in to young viewers: Social science perspectives on television. (pp. 37-60). Thousand Oaks, CA: Sage Publications.

The chapter addresses two major questions. The first is how are young children socialized to use the TV medium? What influences in the larger society, the family, and the child are important in determining the amount and type of TV viewing the child does? The second is how do early patterns of viewing affect some aspects of children's cognitive and social development? (PsycINFO)

Katz, J.E., & Aspden, P. (1997). A nation of strangers? Communications of the ACM, 40, 81-86.

There is debate regarding the potential of building social relationships via use of the Internet versus social isolation. The authors address these issues and discuss their 1995 telephone survey, which had the following objectives: to compare "real-world" participation for Internet users and non-users, and to examine friendship creation via the Internet. After controlling for demographic differences (e.g., age, education, gender, race, and income), Katz & Aspden found that long-time Internet users reported more contact with family members than recent users. Use of the Internet did not appear to have a significant impact on the time spent with friends and family. Individuals with higher levels of Internet skills appeared more likely to make friends via the Internet. Overall, the authors found no support for negative effects of using the Internet on real-world community involvement or social isolation, and furthermore suggest that the Internet can facilitate relationship development and social connectivity.

Kiesler, S. (Ed.) (1997). Culture of the internet. Mahwah, NJ: Lawrence Erlbaum Associates.

This volume is a compendium of essays and research reports representing how researchers are thinking about the social and cultural processes of electronic communication. The chapters were selected to represent a variety of fields, perspectives, and methods, and together comprise an early gathering of social psychological, sociological, and anthropological research on electronic communication and the Internet. This book is intended primarily for researchers and others who seek

exposure to diverse approaches to studying the "people" side of electronic communication and the Internet. For this audience, the book has three purposes: (a) to illustrate how scientists are thinking about evolving social behavior on the Internet, (b) to encourage research-based contributions to current debates on design, applications, and policies, and (c) to suggest, by example, how studies of electronic communication can contribute to social science itself. (PsycINFO)

Kiesler, S., Lundmark, V., Zdaniuk, B., Kraut, R.E., Scherlis, W. & Mukhopadhyay, T. (1999). Troubles with the Internet: The Dynamics of Help at Home. Working paper. Pittsburgh, PA: HCII, Carnegie Mellon University. http://homenet.hcii.cs.cmu.edu

Despite advances in technology, nearly everyone experiences technical difficulties and challenges using a home computer. In a field trial of household Internet usage, 89 percent of 93 families needed external technical support in the first year they used the Internet. However, usually only the most technically involved members of the family requested external technical support, and this behavior was associated with other computer-related behaviors in the household. We explore the process by which a family member with comparatively high technical skill or enthusiasm, often a teenager, becomes the most involved Internet user, the family guru to whom others in the family turn for technical help, and the person who makes external help requests. The family guru benefits from this role, influences the household's adoption of technology, and represents an important link between households and computer support professionals. The role also is a fascinating social phenomenon in the evolution of inter-generation relationships.

Kiesler, S., & Kraut, R. (1999) Internet use and ties that bind. American Psychologist, 54, 783-784.

The authors respond to the concerns of the previous authors. In response to Silverman, they note that most online relationships formed by participants in their study resulted primarily in informational rather than emotional support, unlike the participants in Silverman's group. In response to Rierdan, the authors argue that the importance of results were not in the size of the effects, but in their direction; even small negative changes experienced by many people using the Internet can be significant. The authors also respond to Shapiro's methodological concerns and her alternative explanation of results. (PsycINFO)

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukophadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? American Psychologist, 53, 1017-1031.

The Internet could change the lives of average citizens as much as did the telephone in the early part of the 20th century and television in the 1950s and 1960s. Researchers and social critics are debating whether the Internet is improving or harming participation in community life and social relationships. This research examined the social and psychological impact of the Internet on 169 people in 73 households during their first 1 to 2 years on-line. We used longitudinal data to examine the effects of the Internet on social involvement and psychological well-being. In this sample, the Internet was used extensively for communication. Nonetheless, greater use of the Internet was associated with declines in participants' communication with family members in the household, declines in the size of their social circle, and increases in their depression and loneliness. These findings have implications for research, for public policy, and for the design of technology. (PsycINFO)

Michaelson, K.L. (1996). Information, community, and access. Social Science Computer Review, 14, 57-59.

Cross-referenced in Media Use/Access section

Mickelson, K.D. (1997). Seeking social support: Parents in electronic support groups. In S. Kiesler (Ed.), Culture of the Internet (pp. 157-178). Mahwah, NJ: Lawrence Erlbaum Associates.

The Internet contains hundreds of electronic groups and mailing lists whose ostensible purpose is to discuss problems and to provide social support. Thousands of other special interest groups also may provide social support indirectly. Social support is the transaction of empathy and concern, information and advice, or tangible aid (i.e., goods and services) between two or more individuals. Social support is an important process; when encountering a stressful life event such as illness, unemployment, or bereavement, social support can shield people from the negative consequences of these events (see Cohen & Wills, 1985, for a review). Though we know social support is useful, even necessary, researchers do not fully understand how it works. For instance, do people seek out support for all types of stressful events, and if so, do they always receive it? A key question in my research is whether an observable stigma such as obesity, physical deformity, or use of a prosthetic device discourages people from seeking support or prevents them from receiving support.

I describe data from a larger research study on social support. These data bear on how interactions in electronic groups influence social support processes. The study was not intended, at the outset, to address questions of electronic support. However, because I solicited participants-parents of children with special needs-from a non-electronic population and from electronic support groups, I am able to compare the responses of these two groups to a survey about how they seek social support. My data show how people in electronic support groups differ from others with similar problems, and how the process of exchanging support electronically may differ form the support process people experience in "real life." My study also indicates that the Internet is a social setting in which strangers can exchange useful support. (Author Abstract)

Nie, N.H., & Erbring, L. (2000). Internet and society: A preliminary report. Menlo Park, CA: Stanford Institute for the Quantitative Study of Society. http://standford.edu/dept/news/report/february16/internetsurvey-216.html

These preliminary findings are from a new study assessing the social consequences of Internet use. The results are based upon a large, representative sample of American households (4,113 adults in 2,689 households), including both Internet users and non-users. The study was conducted by researchers at the Stanford Institute for the Quantitative Study of Society (SIQSS). A key finding suggests that frequent Internet users do experience more social isolation. Specifically, the more hours people used the Internet, the less time they spent with real human beings. Other highlights included, 60% of regular Internet users reported that such use reduced their television viewing. The least educated and the oldest Americans were least likely to have Internet access, but when they did use the Internet, their use was similar to others who did have access. Nie and Erbring emphasize that their analyses are preliminary, and SIQSS plans to conduct follow-up studies on at least an annual basis.

Orleans, M., & Laney, M.C. (2000). Children's computer use in the home: Isolation or sociation? Social Science Computer Review, 18, 56-72.

The researchers examined social interactions of children using home computers. The main concern was whether computers tended to isolate youthful users. Adult anxiety regarding the damaging effects of computers on children was assessed. Parental involvement, orientation to computers, and gender were the main independent variables. A case study approach was employed to gather observational data regarding the variety of interactional networks that framed the computer experience of 32 participants. The findings challenged the notion that heavy computer users experience social isolation. It was found that the interpersonal lives and computer activities of children reflexively amplified each other and that boys were more likely to socialize in relation to computers than were girls. The findings were explained as consequences of context and gender-based

differentiated styles of world-creating activity. Recommendations were made to parents and teachers encouraging a less apprehensive and more integrative/developmental view of the social effects of children's computer use. (Author Abstract)

Parks, M.R., & Floyd, K. (1996). Making friends in cyberspace. Journal of Communication, 46, 80-97.

Examines the relational world being created through Internet discussion groups (newsgroups). Two conflicting visions that have dominated popular and academic debate are that relationships developed on the Internet are either shallow, impersonal, and hostile, or are capable of liberating interpersonal relations from the confines of physical locality and creating opportunities for new, but genuine personal relationships and communities. 176 members of Internet newsgroups and their contributors were interviewed. 61% reported forming a new personal relationship via a newsgroup. Predictors of whether an individual formed such a relationship were frequency and duration of newsgroup participation. On-line relationships often reached high levels of relational development and broadened to include interaction in other channels and settings. (PsycINFO)

Parks, M.R. & Roberts, L.D. (1998). Making MOOsic: The development of personal relationships online and a comparison to their off-line counterparts. Journal of Social and Personal Relationships,15, 517-537.

Examines relational topography in real-time, text-based virtual environments known as MOOs (multiuser dimensions, object oriented), using survey data on MOO relationships vs off-line relationships (N = 235 & 155, respectively) in an international sample ages 13-74 (the majority young adults from the US, Canada, & Australia). Almost all survey respondents (93.6%) had formed ongoing personal relationships on MOOs. The most commonly reported types of relationships were close friendships, friendships, & romances. The majority of these relationships (83.6%) were with members of the opposite sex. Levels of relational development (interdependence, depth, breadth, code change, commitment, predictability/understanding, network convergence) were typically moderate to high. Most relationships had migrated to other virtual environments, & 33% had resulted in face-to-face meetings. On average, MOO relationships were found to be more developed than newsgroup relationships, but less developed than off-line relationships. It was concluded that MOOs provide an inherently social & powerful context for the formation of personal relationships, many of which will transfer to other settings.

Riva, G., & Galimberti, C. (1997). The psychology of cyberspace: A socio-cognitive framework to computer-mediated communication. New Ideas in Psychology, 15, 141-158.

The authors outline a framework for the study of computer-mediated communication defining three psychosocial roots by which the subjectivity of user is constructed: networked reality, virtual conversation, and identity construction. This has resulted in new ways of describing cyberspace, the virtual space inhabited by electronic network users. Community, for persons interacting in a technological environment, is shifting from culture defining mass media to that of a proliferation of media as alternative sources of mediated experience. In fact, the key feature of cyberspace is interaction, from which a new sense of self and community can be built. The authors also consider some implication of this approach for current research in communication studies, with particular reference to the role of context, the link between cognition and interaction, and the use of interlocutory models as paradigms of communicative interaction. (PsycINFO)

Turkle, S. (1995). Life on the screen: Identity in the age of the Internet. New York: Simon & Schuster.

(From cover) Every day millions of people interact on the Internet. They navigate simulated worlds, create virtual personalities, and forge online relationships that both challenge and enrich their sense of what's "real." In this ground-breaking study of the psychology of online life, Sherry Turkle explores not only what the computer does for us, but what it does to us – from the way it changes children's ideas about what is alive to the way it provokes new ways of thinking about politics, community, sexual identity, and our most basic concepts of self.

Turkle, S. (1997). Constructions and reconstructions of self in virtual reality: Playing in the MUDs. In S. Kiesler (Ed), Culture of the Internet (pp. 143-155). Mahwah, NJ: Lawrence Erlbaum Associates.

There are over 300 multi-user games based on at least 13 different kinds of software on the international computer network known as the Internet. Here the author uses the term "MUD" to refer to all the various kinds. All provide worlds for social interaction in a virtual space, worlds in which you can present yourself as a "character," in which you can be anonymous, in which you can play a role or roles as close or as far away from your "real self" as you choose. In the MUDs, the projections of self are engaged in a resolutely postmodern context. Authorship is not only displaced from a solitary voice, it is exploded. The self is not only decentered, but multiplied without limit. There is an unparalleled opportunity to play with one's identity and to "try out" new ones. MUDs are a new environment for the construction and reconstruction of self. (PsycINFO)

Turow, J. (1999). The Internet and the family: The view from parents. The view from the press (Report Series No. 27). Philadelphia, PA: The Annenberg Public Policy Center.

Cross-referenced in Media Use and Health & Safety sections

Turow, J., & Nir, L. (2000). The Internet and the family 2000: The view from parents. The view from kids (Report Series No. 33). Philadelphia, PA: The Annenberg Public Policy Center. http://www.appcpenn.org

Cross-referenced in Media Use and Health & Safety sections

Turow, J. (in press). Family boundaries, commercialism, and the Internet: A framework for research. Journal of Applied Developmental Psychology.

Cross-referenced in Health & Safety section

Von Schie, E.G.M., & Wiegman, O. (1997). Children and videogames: Leisure activities, aggression, social integration, and school performance. Journal of Applied Social Psychology, 27, 1175-1194.

Cross-referenced in Media Use and Social Development/Violence sections

Wellman, B., Salaff, J., Dimitrova, D., Garton, L., Gulia, M., & Haythornthwaite, C. (1996). Computer networks as social networks: Collaborative work, telework, and virtual community. Annual Review of Sociology, 22, 213-238.

When computer networks link people as well as machines, they become social networks. Such computer-supported social networks (CSSNs) are becoming important bases of virtual communities, computer-supported cooperative work, and telework. Computer-mediated communication, such as electronic mail and computerized conferencing, is usually text-based and asynchronous. It has limited social presence, and on-line communications are often more uninhibited, creative, and blunt than in-person communication. Nevertheless, CSSNs sustain strong, intermediate, and weak ties that provide information and social support in both specialized and broadly based relationships. CSSNs foster virtual communities that are usually partial and narrowly focused, although some do become

encompassing and broadly based. CSSNs accomplish a wide variety of cooperative work, connecting workers within and between organizations who are often physically dispersed. CSSNs also link teleworkers from their homes or remote work centers to main organizational offices. Although many relationships function off-line as well as on-line, CSSNs have developed their own norms and structures. The nature of the medium both constrains and facilitates social control. CSSNs have strong societal implications, fostering situations that combine global connectivity, the fragmentation of solidarities, the de-emphasis of local organizations (in the neighborhood and workplace), and the increased importance of home bases. (Author Abstract)

Violence & Aggression

Anderson, C.A. (in press). Aggression and violence. In A.E. Kazdin (Ed.), Encyclopedia of psychology. New York & Washington, D.C.: Oxford University Press and the American Psychological Association.

This chapter defines human aggression and violence and presents major findings and issues concerning these human behaviors. A knowledge structure approach is used to understand the development and modification of aggressive personality. Key distinctions include the affective/instrumental, the proactive/reactive, and the thoughtful/thoughtless distinctions. Situational variables such as provocation and frustration, and individual difference variables such as hostile perception, expectation, and attribution biases are discussed. Prevention and treatment issues are also presented. (Author Abstract)

Anderson, C.A., & Dill, K.E. (2000). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. Journal of Personality and Social Psychology, 78, 772-790.

Two studies examined violent video game effects on aggression-related variables. Study 1 found that real-life violent video game play was positively related to aggressive behavior and delinquency. The relation was stronger for individuals who are characteristically aggressive and for men. Academic achievement was negatively related to overall amount of time spent playing video games. In Study 2, laboratory exposure to a graphically violent video game increased aggressive thoughts and behavior. In both studies, men had a more hostile view of the world than women did. The results from both studies are consistent with the General Affective Aggression Model that predicts that exposure to violent video games will increase aggressive behavior in both the short term (e.g., laboratory aggression) and long term (e.g., delinquency). (Author Abstract)

Anderson, C.A., & Morrow, M. (1995). Competitive aggression without interaction: Effects of competitive versus cooperative instructions on aggressive behavior in video games. Personality and Social Psychology Bulletin, 21, 1020-1030.

Two experiments extended and tested Deutsch's (1993) theory of competition effects. A knowledge structure approach predicted that people view competitive situations as inherently more aggressive than cooperative ones. Furthermore, it was predicted that leading people to think of an ambiguously aggressive situation in competitive terms would increase aggressive behavior. In experiment 1, knowledge structures of competitive situations had more aggressive content than cooperative ones. In experiment 2, competition-primed subjects unnecessarily killed more video game characters (Mario Brothers) than cooperation-primed subjects. The increase in kill ratio occurred in the absence of changes in hostility, friendliness, or liking for one's game partner. Implications for

understanding cooperation and competition, and for further research on such "affectless aggression" were discussed. (Author Abstract)

Ballard, M.E., & Weist, J.R. (1996). *Mortal Kombat*: The effects of violent video game play on males' hostility and cardiovascular responding. Journal of Applied Social Psychology, 26, 717-730.

The study examined cardiovascular reactivity (CVR) and hostility among 30 male undergraduates (aged 18-23 yrs), after either nonviolent (billiards) or 1 of 2 levels of violent video game play using *Mortal Kombat* (R) (MK). A computer video game system was used for the video game stimuli. Systolic BP, diastolic BP, and heart rate were monitored using an automatic electro-sphygmomanometer and an adult size BP cuff positioned on the non-dominant arm. The hostility questionnaire was composed of items from the Adjective Checklist. Participants who played MK1 or MK2 had higher heart rate reactivity than those who played billiards. Participants who played MK2 showed greater systolic BP reactivity than those who played MK1 or billiards. Participants who played MK2 scored higher on the hostility measures than those who played MK1, who in turn scored higher than those who played billiards. (PsycINFO)

Calvert, S.L., & Tan, S.L. (1994). Impact of virtual reality on young adults' physiological arousal and aggressive thoughts: Interaction vs. observation. Journal of Applied Developmental Psychology, 15, 125-139.

Examined the impact of participating in versus observing aggressive acts, as represented in a virtual reality game (VRG) on 36 young adults' arousal levels, feelings of hostility, and aggressive thoughts (ATs). It was hypothesized that physiological arousal and ATs would increase more for those who participated directly in the VRG than for those who observed. Individual variations were considered by including both gender and a priori levels of hostile personality traits. Ss who played the aggressive VRG exhibited increased physiological arousal and increases in ATs more so than those who observed the game or who simulated VRG movements. Increases in heart rates provided support for the arousal theory, and increases in ATs provided support for the social cognitive theory. However, the observational condition did not produce more aggression, as would be predicted by the social cognitive theory. (PsycINFO)

Calvert, S.L., & Tan, S.L. (1996). Impact of virtual reality on young adults' physiological arousal and aggressive thoughts: Interaction vs. observation. In I.E. Sigel (Series Ed.) & P.M. Greenfield & R.R. Cocking (Vol. Eds.), Interacting with video: Vol. 11. Advances in applied developmental psychology (pp. 67-81). Norwood, NJ: Ablex Publishing Corp.

This study compares the impact of participation versus observing an aggressive virtual reality [video] game on young adults' arousal levels, feelings of hostility, and aggressive thoughts / the major hypothesis was that physiological arousal and aggressive thoughts would increase more for those who participated directly in the virtual experience than for those who observed it / the arousal and social cognitive theories were expected to provide the best fit for explaining how virtual reality impacts adults' aggressive behaviors / no support was expected for a tension-reduction hypothesis / Ss were 36 middle class college students. (PsycINFO)

Dietz, T.L. (1998). An examination of violence and gender role portrayals in video games: Implications for gender socialization and aggressive behavior. Sex Roles, 38, 425-442.

Using content analysis, this research examines the portrayal of women and the use of violent themes in a sample of 33 popular Nintendo and Sega Genesis video games. It is proposed that video games, like other media forms, have an impact on the identity of children. This analysis reveals that traditional gender roles and violence are central to many games in the sample. There were no female

characters in 41% of the games with characters. In 28% of these, women were portrayed as sex objects. Nearly 80% of the games included aggression or violence as part of the strategy or object. While 27% of the games contained socially acceptable aggression, nearly half included violence directed specifically at others and 21% depicted violence directed at women. Most of the characters in the games were Anglo. (Author Abstract)

Dill, K.E., & Dill, J.C. (1998). Video game violence: A review of the empirical literature. Aggression & Violent Behavior, 3, 407-428.

The popularity of video games, especially violent video games, has reached phenomenal proportions. The theoretical line of reasoning that hypothesizes a causal relationship between violent video game play and aggression draws on the very large literature on media violence effects. Additionally, there are theoretical reasons to believe that video game effects should be stronger than movie or television violence effects. This paper outlines what is known about the relationship between violent video game playing and aggression. The available literature on virtual reality effects on aggression is discussed as well. The preponderance of the evidence from the existing literature suggests that exposure to video game violence increases aggressive behavior and other aggression-related phenomena. However, the paucity of empirical data, coupled with a variety of methodological problems and inconsistencies in these data, clearly demonstrate the need for additional research. (PsycINFO)

Fallas, S. (1996). The ratings controversy: Labeling the industry – is it working? Lunar Tide Communications.

The author surveyed a random sample of 50 customers of an entertainment retail software store regarding their awareness and use of the ESRB rating system. Awareness of or familiarity with the ESRB rating system was fairly low. Thirty-four percent of the respondents claimed to be aware of the rating system while the other 66% were not. Furthermore, only 38% claimed to have used the ESRB ratings when making purchase decisions. The author concludes that ESRB had not put enough effort toward educating the consumer, and those who were aware of the system were not using it as it was intended.

Federman, J. (1996). Media ratings: Design, use and consequences. Studio City, CA: Mediascope, Inc.

A comprehensive review of ratings, warnings and advisories used for film, television, music, the Internet, video games and computer games. Includes: 1) a comparison of rating systems in 31 countries, 2) a survey of the v-chip and other television and Internet blocking technologies; 3) a critical analysis of the effects of media ratings on audiences; and 4) an examination of how ratings impact profits and can lead to commercial censorship.

Fling, S., Smith, L., Rodriguez, T., Thornton, D., Atkins, E., & Nixon, K. (1992). Video games, aggression, and self-esteem: A survey. Social Behavior and Personality, 20, 39-45.

The researchers administered a survey to 104 male and 49 female 6th-12th graders that included items on video game play as well as items related to self-esteem and aggression. Teachers also rated the children on self-esteem and aggression. Amount of video game playing correlated with aggression and not with self-esteem. 47% said some video games might foster anger or aggression. Boys played video games more than girls and were more aggressive. Self-esteem and aggression were correlated positively on teacher ratings, but negatively on self-ratings. (PsycINFO)

Funk, J.B. (1992). Video games: Benign or malignant? Journal of Developmental and Behavioral Pediatrics, 13, 53-54.

Cross-referenced in Reviews/Overviews section

Funk, J.B. (1993). Reevaluating the impact of video games. Clinical Pediatrics, 2, 86-90.

Cross-referenced in Reviews/Overviews section

Funk, J.B., & Buchman, D.D. (1995). Video game controversies. Pediatric Annals, 24, 91-94.

Cross-referenced in Reviews/Overviews section

Funk, J.B., & Buchman, D.D. (1996). Playing violent video and computer games and adolescent self-concept. Journal of Communication, 46, 19-32.

Adolescents are primarily consumers of video and computer games, and the games they prefer are often violent. Related research suggests that exposure to media violence may affect attitudes and behavior. Self-concept is a key indicator of core attitudes and coping abilities, particularly in adolescents. This study documents current adolescent electronic game-playing habits and explores associations among preference for violent games, frequency and location of play, and self-concept. Multivariate analyses identify marked gender differences in game-playing habits and in scores on the Harter Self-Perception Profile for Adolescents. For girls, more time playing video or computer games is associated with lower Harter scores on six subscales, including self-esteem. (Author Abstract)

Funk, J.B., Buchman, D.D., & Germann, J.N. (in press). Preference for violent electronic games, self concept, and gender differences in young children. American Journal of Orthopsychiatry, 70.

Electronic game playing has been linked to adjustment problems in player subgroups. This study examines relationships among time commitment, gender, preference for violent games, and self-concept in 364 fourth and fifth graders. Three-way MANOVA identified main effects for game preference and gender. Stronger preference for violent games was associated with lower self-perceived behavioral conduct. (Author Abstract)

Funk, J.B, Flores, G., Buchman, D.D., & Germann, J.N. (1999). Rating electronic games: Violence is in the eye of the beholder. Youth & Society, 30, 283-312.

Commercial ratings assist parents in monitoring their children's media experiences. Exposure to media violence may affect attitudes and behavior, and rating systems should accurately reflect the presence of violent content. This study examines whether the commercial electronic game rating systems reflect consumer perception of central content themes, specifically violent themes. Ss were 4th and 6th graders, their parents, and non-parents (college students). A comparison of commercial ratings for popular electronic games with consumer perceptions of game content indicated that for games with obviously nonviolent or very violent content, there was agreement between consumers and the commercial system. However, there was considerable disagreement about notable violent content in games with cartoon-type violence. Recommendations include incorporating consumer perceptions into a comprehensive, content-based, informational rating system for all entertainment media. (PsycINFO)

Funk, J.B., Germann, J.N., & Buchman, D.D. (1997). Children and electronic games in the United States. Trends in Communication, 2, 111-126.

Cross-referenced in the Media Use section

Goldstein, J. (1995). Aggressive toy play. In A.D. Pellegrini (Ed.), The future of play theory: A multidisciplinary inquiry into the contributions of Brian Sutton-Smith. SUNY series, children's play in society (pp. 127-147). Albany, NY: State University of New York Press.

The author considers issues related to play with aggressive toys and video games. He introduces theoretical perspectives and raises issues that may enlighten us about the nature, purposes, and effects of such play. The chapter begins with an overview of data on war play and war toys, and theories and methods used in the study of war play are then reviewed. Aggressive play, who plays aggressive games, sex differences in aggressive play, effects on aggression, and attitudes toward war play are explored. Theories and methods used in the study of aggressive play (biological/ethological approaches, psychoanalytic views, social learning theories, frustration-aggression and arousal theories) and further approaches to the study of war toys and play (psychological and social approaches) are discussed. (PsycINFO)

Goldstein, J. (1998). Immortal kombat: War toys and violent video games. In J.H. Goldstein (Ed.), Why we watch: The attractions of violent entertainment (pp. 53-58). New York, NY: Oxford University Press.

In this chapter the author considers the appeals of playing with war toys and violent video games. The author considers the passive witnessing of violence and its mock reenactment in play. The author begins with play fighting and go on to toy soldiers, war toys, and video games with violent themes. The pronounced sex differences in this kind of play are examined to better understand its appeal to some youngsters, particularly boys. (PsycINFO)

Graybill, D., Strawniak, M., Hunter, T., & O'Leary, M. (1987). Effects of playing versus observing violent versus nonviolent video games on children's aggression. Psychology-A Quarterly Journal of Human Behavior, 24, 1-8.

This report examines the short-term effects of playing versus observing violent versus nonviolent video games on the aggression of 146 second through sixth graders. Subjects played or observed their violent or nonviolent games for 14 minutes, then completed three measures of aggression. The behavioral measure was an apparatus on which subjects could push buttons to hurt or help another child. Subjects also completed two self-report measures, A.D. Leifer and D.F. Robert's (1972) response hierarchy measure and the Rosenzweig Picture-Frustration Study. There were no differences between the violent and nonviolent conditions on the measures of aggression. (PsycINFO)

Griffiths, M. (1997). Video games and aggression. Psychologist, 10, 397-401.

Notes that video games might have the capacity to promote aggressive tendencies (as predicted by social learning theory), or to release aggressive tendencies (as predicted by catharsis theory). To put the debate concerning whether there is a possible "aggression" link between video games and children's subsequent behavior into an empirical context, the author examines observational studies, self-report studies, experimental studies, and other studies. The evidence suggests that there is more empirical evidence supporting social learning theory than catharsis theory, particularly in younger children. However, there is much speculation as to whether the procedures to measure aggression levels are valid and reliable. There is also the question of developmental effects, whether the social context of playing may affect the results, and problems concerning the definition of "violent" or "aggressive." The question of whether video games promote aggressiveness cannot be answered at present because the available literature is relatively sparse and conflicting, and there are many different types of video games, which probably have different effects. (PsycINFO)

Griffiths, M. (1999). Violent video games and aggression: A review of the literature. Aggression & Violent Behavior, 4, 203-212.

One of the main concerns that has constantly been raised against video games is that most of the games feature aggressive elements. This has led many people to assert that this may have a detrimental effect on individuals who play such games. Despite continuing controversy for over 15

years, there has been little in the way of systematic research. This article reviews the empirical studies in this area, including research methodologies such as the observation of free play, self-report methods, and experimental studies. The article argues that all the published studies on video game violence have methodological problems and that they only include possible short-term measures of aggressive consequences. The one consistent finding is that the majority of the studies on very young children – as opposed to those in their teens upward – tend to show that children do become more aggressive after either playing or watching a violent video game. However, all of these come from the use of one particular research methodology (i.e., observation of children's free play.) (PsycINFO)

Griffiths, M.D., & Hunt, N. (1995). Computer game playing in adolescence: Prevalence and demographic indicators. Journal of Community & Applied Social Psychology, 5, 189-193.

Cross-referenced in Media Use section

Huesmann, L.R., & Miller, L.S. (1994). Long-term effects of repeated exposure to media violence in childhood. In L.R. Huesmann (Ed.), Aggressive behavior: Current perspectives (pp. 153-186). New York, NY: Plenum Press.

The book provides an overview of the longitudinal research on media violence and aggression [in children] conducted over the past 25 years. The authors place this research in the framework of social-cognitive theories of aggressive behavior and show how dramatic media violence can exert its effect on behavior through multiple psychological processes. They argue that media violence can have long-term effects through a variety of observational learning processes. At the same time, media violence can produce short-term effects by cueing cognitive schema that promotes aggressive behavior. (PsycINFO)

Irwin, A.R., & Gross, A.M. (1995). Cognitive tempo, violent video games, and aggressive behavior in young boys. Journal of Family Violence, 10, 337-350.

The study examines the impact of violent video games on the behavior of impulsive and reflective children. Sixty 7 – 8 year old boys were categorized as reflective or impulsive, according to their responses on the Matching Familiar Figures Test. In a factorial design, children then played video games with aggressive or non-aggressive themes. Interpersonal aggression and aggression toward inanimate objects were assessed in a free-play setting, and interpersonal aggression was assessed during a frustrating situation. Results indicate that children who played the video game with aggressive content exhibited significantly more object aggression during free play and more interpersonal aggression during the frustrating situation than youngsters who played non-aggressive video games. Aggressive behavior was unaffected by cognitive tempo. (PsycINFO)

Kinder, M. (1996). Contextualizing video game violence: From *Teenage Mutant Ninja Turtles 1* to *Mortal Kombat 2*. In I.E. Sigel (Series Ed.) & P.M. Greenfield & R.R. Cocking (Vol. Eds.), Interacting with video: Vol. 11. Advances in applied developmental psychology (pp. 25-37). Norwood, NJ: Ablex Publishing Corp.

This discusses the link between violence and video games [and] explores two closely related issues that thus far have tended to be ignored: what is unique about the representation of violence in an interactive medium (that is, what are its distinctive structures of identification, player positioning, and socialization) and how is the representation of violence contextualized in video games / take into account at least three evels of contextualization [media specificity, the immediate environment where games are played, and the larger cultural environment] in exploring the cultural specificity of the violence in [the] two games [Ninja Turtles and Mortal Kombat], we see that it consistently linked with seven related concepts [humor, empowerment, transformability, technical mastery, special effects, action, and masculinity.] (PsycINFO)

Kirsh, S.J. (1998). Seeing the world through mortal kombat-colored glasses: Violent video games and the development of a short-term hostile attribution bias. Childhood, 5, 177-184.

This study investigates the effects of playing violent vs. non-violent video games on the interpretation of ambiguous provocation situations. The participants played either a very violent video game or a relatively non-violent video game for several minutes. Children were then read five stories in which a same-sex peer caused a clearly negative event to happen but where the peer's intent was ambiguous. After each story, children were asked a series of questions about the peer's intent, subsequent actions and potential punishment. Responses were coded in terms of amount of negative and violent content. Results indicated that children playing the violent video game responded more negatively on three of the six ambiguous provocation story questions than children playing the non-violent video game. These data suggest that playing violent video games leads to the development of a hostile attribution bias. (Author Abstract)

Potter, W.J. (1999). On media violence. Thousand Oaks, CA: SAGE Publications.

On Media Violence is a definitive examination of this hotly debated social topic. Media scholar W. James Potter asks provocative questions inlcuding: How much media violence is there? What are the meanings conveyed in the way violence is portrayed? What effect does it have on viewers individually, as members of particular groups, and as members of society? The book begins by offering a thorough review of more than 40 years of research on media violence, context, levels of phenomena, human development, effects, risk, and the media industries. In the latter half of the book, Potter addresses the necessity for a reconfiguration of the methodological tasks used to assess media violence. Finally, he introduces the concept of Lineation Theory, a suggested perspective for thinking about media violence and a new theoretical approach to explaining it. *On Media Violence* is essential reading for students and scholars of media studies, communication theory, popular culture, social psychology, and sociology.

Roberts, D.F. (1996). Media content rating systems: Informational advisories or judgmental restrictions? Presentation at Johannesburg, RSA. (http://www.rsac.org) (October, 28, 1999).

Roberts presents information regarding media ratings and explores why the ratings issue gained such momentum in the 1990s. He discusses the research literature on media violence in general and specifically presents findings from the National Television Violence Study. The history and implementation of the V-chip are addressed. The paper concludes with a discussion of the Recreational Software Advisory Council (RSAC), the process of developing the rating systems, and the public policy issues related to the use of interactive game ratings.

Scott, D. (1995). The effect of video games on feelings of aggression. Journal of Psychology, 129, 121-132.

Fueled by the media, the controversy over whether playing popular arcade/computer games increases aggressiveness has only been compounded by inconsistencies within empirical research. This experiment, conducted with *university students* in Scotland, was designed to explore some of these inconsistencies. Aggressiveness was manipulated as the independent variable. As dependent variables, the Buss-Durkee Hostility Inventory (Buss & Durkee, 1957) and the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) were used. There was no linear pattern in aggressive affect change across three games that contained varying levels of violence. Results are discussed in terms of the general lack of support for the commonly held view that playing aggressive computer games causes an individual to feel more aggressive. (PsycINFO)

Willis,E., & Strasburger, V.C. (1998). Media violence. Pediatric Clinics of North America, 45, 319.

American media are the most violent in the world, and American society is now paying a high price in terms of real life violence. Research has confirmed that mass media violence contributes to aggressive behavior, fear, and desensitization of violence. Television, movies, music videos, and computer/video games are pervasive media and represent important influences on children and adolescents. Portraying rewards and punishments and showing the consequences of violence are probably the two most essential contextual factors for viewers as they interpret the meaning of what they are viewing on television. Public health efforts have emphasized public education, media literacy campaigns for children and parents, and an increased use of technology to prevent access to certain harmful media materials. (Institute for Scientific Information)

Walsh, D.A. (1999). Video game violence – A research update. 1999 video and computer game report card. Minneapolis, MN: National Institute on Media and the Family. http://www.mediafamily.org

The National Institute on Media and the Family (NIMF) is an independent, non-profit organization with the goal of maximizing the benefits and minimizing the potential harm that mass media have on children. The means through which this goal is accomplished are research and education. The *1999 Video and Computer Game Report Card* provides a snapshot of current happenings in the area of interactive games including: an evaluation of the use of industry ratings, an evaluation of the accuracy of those ratings, an evaluation of retail and rental stores provision of educational information about the ratings, an assessment of marketing activities (such as marketing violent toys or games to young children), and recommendations by the NIMF. The report card also includes a brief review of the video game violence research and a parents' guide to interactive games.

Van der Voort, T.H.A., & Beentjes, J.J.W. (1997). Effects of extremely violent audiovisual products on young people's aggressive behavior and emotional reactions. In P. Winterhoff-Spurk & T.H.A. van der Voort (Eds.). New horizons in media psychology. Research cooperation and projects in Europe. Germany: Westdeutscher Verlag.

In this chapter the authors discuss the influences that extremely violent movies, video films, and video games may exercise on young people's emotional reactions and aggressive behavior. First, the authors give a rough sketch of the tendency to represent violent portrayals in audiovisual products in increasingly graphic and realistic forms. Then, they provide brief research findings on the results of exposure to (TV) films, which contain less extreme forms of violence. On the basis of insights gained from research on the impact of mild portrayals of violence, the authors make an estimate of the possible effects of exposure to extremely violent audiovisual products, a field of research that is still in its infancy. Subsequently the authors discuss a number of popular arguments, which are advanced to take the edge off the thesis that watching violent portrayals can have adverse effects on children. Finally, the authors comment on the role that the government should play in the regulation of the dissemination of violent audiovisual products to juveniles. (PsycINFO)

Van Schie, E.G.M., & Wiegman, O. (1997). Children and videogames: Leisure activities, aggression, social integration, and school performance. Journal of Applied Social Psychology, 27, 1175-1194.

Cross-referenced in Media Use section

Wiegman, O., & van Schie, E.G.M. (1998). Video game playing and its relations with aggressive and prosocial behaviour. British Journal of Social Psychology, 37, 367-378.

In this study of 278 children from the seventh and eighth grade of five elementary schools in Enschede, The Netherlands, the relationship between the amount of time children spent on playing video games and aggressive as well as pro-social behavior was investigated. In addition, the relationship between the preference for aggressive video games and aggressive and pro-social behavior was studied. No significant relationship was found between video game use in general and aggressive behavior, but a significant negative relationship with pro-social behavior was supported. However, separate analyses for boys and girls did not reveal this relationship. More consistent results were found for the preference for aggressive video games: children, especially boys, who preferred aggressive video games were more aggressive and showed less pro-social behavior than those with a low preference for these games. Further analyses showed that children who preferred playing aggressive video games tended to be less intelligent. (Author Abstract)

Content Area: Health & Safety

Bremer, J., & Rauch, P.K. (1998). Children and computers: Risks and benefits. Journal of the American Academy of Child and Adolescent Psychiatry, 37, 559-562.

The increasing popularity of the Internet has created new kinds of risks for the psychological development of children. Chat rooms allow children to interact with people they will never meet and see. The Internet also permits children to be exposed to material, which may be unsuitable for their age. The lack of real-life interactions in chat rooms can be damaging to children's development. On the other hand, computers and the Internet can help children develop social interaction skills and improve their self-esteem. (Author Abstract)

Brown S.J., Lieberman, D.A., Germeny, B.A., Fan, Y.C., Wilson, D.M., & Pasta, D.J. (1997). Educational video game for juvenile diabetes: Results of a controlled trial. Medical Informatics, 22, 77-89.

Packy & Marlon, an interactive video game designed to improve self-care among children and adolescents with diabetes, was evaluated in a six-month randomized controlled trial. In the game, players take the role of animated characters who manage their diabetes by monitoring blood glucose, taking insulin injections, and choosing foods, while setting out to save a diabetes summer camp from marauding rats and mice who have stolen the diabetes supplies. Study participants were patients aged 8 to 16 from two separate diabetes clinics. Each participant received a Super Nintendo video game system at an initial clinic visit and was randomly assigned to receive either *Packy & Marlon* (treatment group, N = 31) or an entertainment video game containing no diabetes-related content (control group, N = 28). Participants were interviewed and a parent filled out a questionnaire at baseline, three months, and six months. The findings in this study indicate that well-designed, educational video games can be effective interventions. There was improvement in the treatment group relative to the control group in terms of diabetes-related self-efficacy ($p = 0.07$), communication with parents about diabetes ($p = 0.025$), and self-care behaviors ($p = 0.003$), and a decrease in unscheduled urgent doctor visits ($p = 0.08$). There were no significant differences between the groups in knowledge about diabetes or in glycated haemoglobin (HbA1c) levels. Since participants in the study were in general well-controlled patients who were receiving excellent medical care, future research is contemplated involving youngsters who are not under good glycaemic control. (PsycINFO & MEDLINE)

Dinubile, N.A. (1993). Youth fitness – problems and solutions. Preventive Medicine, 22, 589-594.

Review of the current data in the area of youth fitness reveals some alarming trends. Children in the United States are fatter, slower, and weaker than their counterparts in other developed nations. In

addition, U.S. children seem to be adopting a sedentary lifestyle at earlier ages. Although there is no easy solution to this problem, there are specific recommendations that can ensure improvement in this area. The cornerstone for any meaningful change must involve programs that seek to increase physical activity both in school and at home. Daily, quality physical education in grades K-12 should be mandated in all states. Parents should be educated regarding the critical importance and the multitude of benefits to be derived from their involvement in fitness-related activities with their children. A healthy balance must be established between sedentary activities, e.g., television and video games, and physical activity. All schools should establish fitness testing programs for children and these should be based on health-fitness parameters rather than on athletic performance variables. To ensure improvements in youth fitness across our nation, other interventions are also necessary. These include appropriate involvement of local communities, state and federal governments, the medical health professions, and the media. Specific strategies are available for each group. (MEDLINE)

Dorman, S. M. (1997). Video and computer games: Effect on children and implications for health education. Journal of School Health, 67, 133-138.

Video and computer-based games have assumed a prominent role in the culture of American children and adolescents. Given the pervasiveness of their influence, it is likely that these games may affect the health and well-being of children. The author examines the effect of video and computer games on the health and education of children. Potential negative health consequences of these games include cardiovascular implications, video game induced seizures, tendinitis, pathological preoccupation with video games, and aggression and pro-social behavior. Although a frequent complaint about video games is that they displace time that children could spend reading or pursuing other educational activities, this complaint has not been supported by research. A more insidious effect of video games on education is children's expectation that all learning must take a gaming approach and be "fun." However, video games can be used positively to promote health and provide information to children. To do this, adults should evaluate the following components of a video game: educational or therapeutic goal, type of game, required level and nature of involvement, information and rules, the role of luck, difficulty, competition, duration, participant age and characteristic, number of players, facilitator's role, setting, and hardware.
(Education Abstracts)

Emes, C.E. (1997). Is Mr. Pac Man eating our children? A review of the effect of video games on children. Canadian Journal of Psychiatry, 42, 409-414.

Cross-referenced in Reviews/Overviews section

Flyan, F., Harding, G.F., Edson, A.S., & Webb, R.M. (1999). Mechanisms of video-game epilepsy. Epilepsia, 40, 28-30.

The authors aim to elucidate the mechanisms underlying video-game epilepsy by comparing the flicker-and spatial-frequency ranges over which photic and pattern stimulation elicited photoparoxysmal responses in two different populations: (a) 25 patients with a history of seizures experienced while playing video games; and (b) 25 age- and medication-matched controls with a history of photosensitive epilepsy, but no history of video-game seizures. METHODS: Abnormality ranges were determined by measuring hotoparoxysmal EEG abnormalities as a function of the flicker frequency of patterned and diffuse intermittent photic stimulation (IPS) and the spatial frequency of patterns on a raster display. RESULTS: There was no significant difference between the groups in respect of the abnormality ranges elicited by patterned or diffuse IPS or by spatial patterns. When the groups were compared at one specific IPS frequency (-50 Hz), however, the flicker frequency of European television displays, the video-game patients were significantly more likely to be sensitive. CONCLUSIONS: The results suggest that video-game seizures are a manifestation of photosensitive

epilepsy. The increased sensitivity of video-game patients to IPS at 50 Hz indicates that display flicker may underlie video-game seizures. The similarity in photic- and pattern-stimulation ranges over which abnormalities are elicited in video-game patients and controls suggests that all patients with photosensitive epilepsy may be predisposed toward video-game-induced seizures. Photosensitivity screening should therefore include assessment by using both IPS at 50 Hz and patterns displayed on a television or monitor with a 50-Hz frame rate. (MEDLINE)

Graf, W.D., Chatrian, G.E., Glass, S.T., & Knauss, T.A. (1994). Video game-related seizures: A report on 10 patients and a review of the literature. Pediatrics, 93, 551-556.

OBJECTIVE. To further describe the features, postulated pathophysiology, treatment, and outcome of seizures occurring while playing or watching video games (video game-related seizures (VGRS)). DESIGN. We evaluated retrospectively 10 patients with VGRS seen by us and reviewed 25 reported cases. RESULTS. The 35 patients ranged in age from 1 to 36 years (mean: 13.2); and 26 subjects (74%) were male. Eight individuals (29%) had prior infrequent nonfebrile seizures, 4 (11%) had febrile convulsions, and 2 (6%) had a family history of epilepsy. VGRS consisted of generalized tonic-clonic seizures in 22 of 35 individuals (63%); absences in 2 (6%); simple partial seizures in 6 (19%); complex partial seizures in 4 (11%); and other manifestations in 4. Neurologic examination and computed tomographic and magnetic resonance imaging scans were normal. Electroencephalograms demonstrated generalized or focal, interictal or ictal epileptic patterns in 11 of 21 patients (52%) and photoparoxysmal responses in 17 of 32 (53%). Eleven of 15 individuals (73%) treated with video game (VG) abstinence alone, 3 of 6 who received anticonvulsants but played VGs, and 7 of 12 treated with combined VG abstinence and anticonvulsants had no further seizures. CONCLUSIONS. We postulate that a special convulsive susceptibility of selected neurons in striate, peristriate, infratemporal, and posterior parietal cortices to particular visual stimuli plays a major role in VGRS. VG abstinence is the treatment of choice of VGRS. Anticonvulsant medication is suggested only for those individuals who continue to play VGs or suffer from seizures triggered by other, unavoidable visual stimuli, or from unprovoked attacks. (MEDLINE)

Griffiths, M. (1997). Video games and clinical practice: Issues, uses and treatments. British Journal of Clinical Psychology, 36, 639-641.

Presents a bibliography on video game use in clinical practice. References are sorted into categories including psychotherapy and behavior management, pain management, cognitive rehabilitation, medical/psychological problems, miscellaneous therapies, and treatment of video game addition. (PsycINFO)

Griffiths, M. (1999). Internet addiction: Fact or fiction? Psychologist, 12, 246-250.

Two questions are posed: Does Internet addiction really exist? And if it does exist, what are people actually addicted to? These questions are explored by examining the core components (i.e., salience, mood modification, tolerance, withdrawal, conflict, relapse) of bona fide addictions and then relating them to excessive Internet use. Taking all the case study and survey evidence together, it can be argued that excessive usage in a majority of cases appears to be purely symptomatic (i.e., the Internet is being used as a tool to engage in other types of rewarding behavior, like being in a relationship.) However, Internet addiction may be prevalent in a significant minority of individuals. (PsycINFO)

Griffiths, M.D., & Hunt, N. (1998). Dependence on computer games by adolescents. Psychological Reports, 82, 475-480.

As computer game playing is a popular activity among adolescents, a questionnaire study was undertaken with 387 adolescents (12 – 16 years of age) to establish their “dependence” using a scale

adapted from the DSM-III-R criteria for pathological gambling. Analysis indicated that one in five adolescents were currently "dependent" upon computer games. Boys played significantly more regularly than girls and were more likely to be classified as "dependent." The earlier children began playing computer games it appeared the more likely they were to be playing at "dependent" levels. These and other results are discussed in relation to research on other gaming dependence. (Author Abstract)

Harrell, J.S., Gansky, S.A., Bradley, C.B., & McMurray, R.G. (1997). Leisure time activities of elementary school children. Nursing Research, 46, 246-253.

Cross-referenced in Media Use section

Henke, L.L. (1999). Children, advertising, and the Internet: An exploratory study. In D.W. Schumann & E. Thorson (Eds.). Advertising and the World Wide Web. Mahwah, NJ: Lawrence Erlbaum Associates.

In a small exploratory study of 23 children ages 9 to 11 years, Henke examined children's perceptions of the persuasive intent of favorite web sites and preferences for web surfing and other activities. Children completed questionnaires that assessed favorite after-school activities and participated in an Internet search session. Several web sites were bookmarked (*Toys R Us*, *Ben & Jerry's*, the Museum of Science, *Foster's Daily Democrat*, and *CNN*) and lists about other sites (e.g., *Batman Forever*, *ESPN*, and *MTV*) were provided to the children. Seventy-four percent of the children named commercial web sites as their favorites, specifically *Toys R Us* and *Ben & Jerry's*, but only 13% said the purpose of their favorite site was to advertise. Interestingly, they thought the purpose of the site was for entertainment. The study suggests that even children 9 – 11 years may not be aware of the commercial intentions of many web sites.

Hertzler, A.A., Young, V.E., Baum, C.M., Lawson, M., & Penn-Marshall, M. (1999). Nutrition and exercise information for children on the Internet. Journal of Family and Consumer Sciences, 91, 100-103.

The authors recently identified and evaluated Internet sites providing nutrition and exercise information for children. Sites were classified by their source (.gov, .org, .edu, and .com), which somewhat identified the authors' credentials and qualifications, and the "last revised" date on the site. The exercise demonstrated that there are a number of reputable sites providing nutrition and exercise information relevant for children (e.g., *FDA Kids Home Page*, *The Kids Food Cyberclub*, and *The Pyramid Tracker*); however, keyword searches will often identify sites that are not useful or relevant. Commercial sites can contain useful information, but the purpose of advertising should not be overlooked when reviewing the content such web sites.

Holden, G., Bearison, D.J., Rode, D.C., Rosenberg, G., & Fishman, M. (1999). Evaluating the effects of a virtual environment (STARBRIGHT World) with hospitalized children. Research on Social Work Practice, 9, 365-382.

The authors pilot tested the impact of STARBRIGHT World (SBW), a virtual environment for seriously ill, hospitalized children. The impact of SBW was assessed with a series of 9 replicated single system designs. Subjects were 9 hospitalized children (ages 9-19 years). The outcomes were children's pain intensity, pain aversiveness, and anxiety. Results were aggregated using meta-analysis. At the individual child level, 6 of 27 contrasts between the two conditions (SBW vs normal pediatric care) reached significance. Overall, there was a trend for the later participants to report greater impact in the SBW condition and this appeared to parallel the increase in the SBW system's functionality. When the results were combined meta-analytically, the combined *p* value was less than .05 for pain intensity and pain aversiveness and slightly greater than .05 for anxiety. This study provided modest

support for the effectiveness of SBW and demonstrates the use of meta-analysis with single system designs. (PsycINFO)

Jenkins, H. (1997). Empowering children in the digital age: Towards a radical media pedagogy. Radical Teacher, 50, 30-35.

Advocates an approach to media education that rejects the abstract notion of the passive innocent child in need of protection from popular culture & the media, & instead, views children as active media consumers who should be educated to make critical content & use decisions. It is noted that children have class, gender, & other identities that are ignored by the universalized notion of the innocent child & that these identities influence their media interactions. New childhood research is cited that demonstrates how children use media creatively & critically & shows the importance of popular culture in their social relationships. It is concluded that media education should be taught as a basic skill throughout the school career & that it should confront issues of class, gender, race, & ethnicity. The application of a radical media pedagogy to the Internet is considered as a positive alternative to the Communications Decency Act. (Sociological Abstracts)

Kasteleijn-Nolst, T.D.G., da Silva, A.M., Ricci, S., Binnie, C.D., Rubboli, G., Tassinari, C.A., & Segers, J.P. (1999). Video-game epilepsy: a European study. Epilepsia, 40, 70-74.

With the introduction of Nintendo video-games on a large scale, reports of children having seizures while playing suggested a possible specific, provocative factor. Although 50% of the photosensitive patients are also sensitive to a 50-Hz television, nonphotosensitive patients with a history of video-game seizures were described as well. The question arises whether this is a mere coincidence, provoked by fatigue and stress, is related to the reaction to the television screen itself, or depends on the movement and color of the pictures of this specific game. A European study was performed in four countries and five sites. All patients were selected because of a history of television, video- or computer-game seizures, with a history of sun-light-, discotheque-, or black and white pattern-evoked seizures, or were already known to be sensitive to intermittent photic stimulation. A total of 387 patients were investigated; 220 (75%) were female and 214 (55%) of those were < 18 years of age. After a routine examination, intermittent photic, pattern, and television stimulation were performed in a standardized way. The patients were investigated with Super Mario World and a standard relatively nonprovocative TV program, both on a 50- and 100-Hz television. Regardless of the distance, Super Mario World proved to be more provocative than the standard program (Wilcoxon, $p < 0.05$). Eighty-five percent showed epileptiform discharges evoked by intermittent photic stimulation. Forty-five percent of patients were 50-Hz television sensitive and 26% were 100-Hz television sensitive. Pattern sensitivity was found in 28% of patients. The patients, referred because of a television, video- or computer-game seizure, were significantly more sensitive to pattern and to the 50-Hz television (chi square, $p < 0.001$). More patients are sensitive when playing Super Mario, compared with the standard program (Wilcoxon, $p = 0.001$) and more sensitive with playing versus viewing ($p = 0.016$). Of the patients who were referred because of seizures in front of the television, or evoked by a video- or computer game, 14% proved not to be photosensitive. Although no difference in age or use of medication was found, twice as many men were found in this nonphotosensitive group. (MEDLINE)

Lehmann, E.D. (1997). Interactive educational simulators in diabetes care. Medical Informatics, 22, 47-76.

Since the Diabetes Control and Complications Trial demonstrated the substantial benefits of tight glycaemic control there has been renewed interest in the application of information technology (IT) based techniques for improving the day-to-day care of patients with diabetes mellitus. Computer-based educational approaches have a great deal of potential for patients use, and may offer a means

of training more health-care professionals to deliver such improved care. In this article the potential role of IT in diabetes education is reviewed, focusing in particular on the application of compartmental models in both computer-based interactive simulators and educational video games. Close attention is devoted to practical applications-available today-for use by patients, their relatives, students and health-care professionals. The novel features and potential benefits of such methodologies are highlighted and some of the limitations of currently available software are discussed. The need for improved graphical user interfaces, and for further efforts to evaluate such programs and demonstrate an educational benefit from their use are identified as hurdles to their more widespread application. The review concludes with a look to the future and the type of modeling features, which should be provided in the next generation of interactive diabetes simulators and educational video games. (MEDLINE)

Lieberman, D.A. (1995). Three studies of an asthma education video game. Report to the NIH: National Institute of Allergy and Infectious Diseases (Grant #R43 AI34821). http://www.clickhealth.com/lieb95/paper.htm

Under a Phase I grant from the National Institute of Allergy and Infectious Diseases, a *Click Health* asthma product, called *Bronkie the Bronchiasaurus* and targeted to young people ages 8 to 14 with asthma, was evaluated in three clinical studies. A media comparison study contrasted playing *Bronkie* for 30 minutes versus watching a 30-minute videotape about asthma. Fourteen youngsters with asthma, ages 8 – 13, were randomly assigned to spend 30 minutes with either the videotape or the interactive game. Those who played the interactive game reported higher enjoyment than those who saw the videotape. Asthma knowledge increased for both groups equivalently, though not significantly. Self-efficacy for asthma self-care, the belief that one can effectively carry out specific asthma self-care tasks, increased for the interactive game group and decreased for the videotape group. This difference in self-efficacy was significant, and was most likely due to the participatory nature of the interactive game, which allowed players to rehearse asthma self-care decisions and skills, and to gain the confidence that they could carry them out.

In a pretest/posttest study, 50 children ages 6 to 16 who had asthma responded to an interview, played *Bronkie* for 40 minutes, and were interviewed again immediately after playing and one month later. The study found immediate and enduring improvements in the youngsters' self-efficacy for asthma self-care and for talking with friends about asthma, communication with parents about asthma, knowledge about asthma care, and knowledge about asthma triggers.

Bronkie was used in a hospital inpatient study. A hospital pediatric ward was equipped with two Super Nintendo stations on rolling carts with a variety of video games, including *Bronkie*. Nurses reported that children played the asthma interactive game often and enthusiastically, usually in pairs and with other children watching. They noted that playing the asthma game increased social interaction among the children and between children and clinicians. Children as young as age 5 and as old as age 18 were avid players. Playing the asthma interactive game seemed to boost asthmatic children's spirits, to help them learn about asthma, and to play an icebreaking role in their relationships with clinicians. Parents also highly approved of the game and wanted to have it at home. (Author Executive Summary)

Lieberman, D.A. (1998). Health education video games for children and adolescents: Theory, design, and research findings. Paper presented at the annual meeting of the International Communication Association, Jerusalem. http://www.clickhealth.com/lieb98/paper.htm

Interactive video games offer unique advantages over conventional methods of health education. Although pamphlets, videos, or health education classes can provide a great deal of didactic content, a compelling video game can expose players to essential content over and over again. Video games provide opportunities to rehearse new skills in a realistic and interactive environment and allow

players to see the consequences of every choice they have made. Furthermore, children's enthusiasm for video game play may facilitate learning of health-related content. This paper discusses the theoretical basis of *Click Health* video game design. The theoretical model suggests that video game play is expected to enhance self-concepts, self-efficacy, knowledge and skills, and communication and social support – mediating factors that can, in turn, lead to improved health behaviors and health outcomes. The author also presents the design strategies in a video game (*Packy & Marlon*) focusing on diabetes self-management and reports findings from a randomized controlled experiment testing the effectiveness of the video game for young people who have this chronic condition. (From Author Introduction)

McComas, J., Pivik, J., & Laflamme, M. (1998). Current uses of virtual reality for children with disabilities. In G. Riva & B.K. Wiederhold (Eds.), Virtual environments in clinical psychology and neuroscience: Methods and techniques in advanced patient-therapist interaction. Studies in health technology and informatics, 58, (pp.161-169). Amsterdam, Netherlands Antilles: IOS Press.

Technological advances, including the use of virtual reality (VR), have contributed enormously to improving the treatment, training, and quality of life of children with disabilities. This chapter describes the advantages of VR for children with disabilities, how VR can minimize the effects of a disability, the role of VR in training and skills enhancement, and how social participation and the child's quality of life may be improved through the use of VR. Examples from published literature and Internet sites are given of current and completed projects that focus on improving the lives of children with disabilities. The research, describing the efficacy of knowledge and skills transfer from a virtual environment to the real world, is examined in relation to children with disabilities. Finally, the current limitations and future directions of VR for children with disabilities are considered. (PsycINFO)

Montgomery, K., & Pasnik, S. (1996). Web of deception: Threats to children from online marketing. Washington, D.C.: Center for Media Education. http://www.cme.org

Advertisers and marketers are targeting the rapidly growing numbers of children online. A variety of new interactive advertising techniques have been developed, and many of them invade children's and their families' privacy. This paper is an outcome of the Center for Media Education' s investigation of online advertising practices. The Center emphasizes the emergence of two types of threats: (1) invasion of children's privacy through solicitation of personal information and tracking of online computer use, and (2) exploitation of vulnerable, young computer users through unfair and deceptive forms of advertising. An example of invasion of privacy includes offering children free gifts or chances to win prizes if they complete online surveys about themselves. Deceptive advertising techniques include the seamless interweaving of online content and advertising. The authors then suggest a number of policy initiatives and safeguards to protect children in this online environment.

National School Boards Foundation (2000). Safe & Smart: Research and guidelines for children's use of the Internet. Alexandria, VA: National School Boards Foundation. http://www.nsbf.org/safe-smart/br-overview.htm

In the fast-moving era of the Internet, school leaders and parents increasingly face a dilemma: Is it possible to protect children from inappropriate content on the Internet without denying them access to engaging and valuable educational content? Can adults set guidelines that strike a balance between safe and smart Internet usage by children? To help parents and school leaders make better decisions, the National School Boards Foundation worked with Grunwald Associates, a leading market research firm specializing in technology, to develop an unprecedented national survey of parents and children. The Dieringer Research Group conducted the survey and tabulated the data for Grunwald Associates. With generous support from the Children's Television Workshop and Microsoft Corporation, we asked parents of children aged two- to 17 a number of questions about the role the

Internet plays in their children's lives. We also asked 601 nine- to 17-year-old children themselves, from the same random sample of 1,735 households, for a reality check on the role of the Internet in their own lives.

The bottom line: Parents and children alike view the Internet as a positive new force in children's lives. Despite recent negative headlines about online violence, pornography, predators and commercialism, parents and children generally are upbeat and favorable about their own Internet experiences. Parents, in fact, are even more positive than children - they believe the Internet is a powerful tool for learning and communicating within families, and they want their children to be on the Internet. And, as parent responses suggest, the Internet can be an equally powerful tool for schools that want to increase family involvement. The data also suggest that schools have an opportunity to help bridge the digital divide between those who have computers and Internet access and those who don't. By the time they are teenagers, nearly three out of four children are online. Moreover, children who use the Internet are more likely to log on at home than at school. In light of the survey findings, school leaders must consider the major roles that parents, families and even peers play in children's use of the Internet. To be most effective, policies and practices should be developed in collaboration with parents. (Author Overview)

Reese, S. (1996). KIDMONEY: Children as big business. TECHNOS Quarterly, 5, 1-7. http://www.technos.net/journal/volume5/4reese.htm

Advertisers consider children to be current and potential consumers. They are perceived as influential, savvy, and discriminating consumers. As children's spending power and influence over their parents grows, marketers are casting their nets wider. The advertising deluge is no longer limited to Saturday morning television, but now has permeated the online environment. Reese discusses advertising practices in two domains: the controversial advertising in the classroom (*Channel One*), and the techniques used in online environments (consumer profiling, "seamlessness" between ads and content). Finally, mechanisms of parental control of online content (e.g., Cyber Patrol, Net Nanny) are addressed.

Ricci, S., & Vigevano, F. (1999). The effect of video-game software in video-game epilepsy. Epilepsia, 40, 31-37.

PURPOSE: The individual role of video-game (VG) programs in VG activation is still unclear. Strict relations between VG seizures and photo- and pattern sensitivity suggest that programs per se may have a role in seizure activation. METHODS: We tested a series of 12 commercially available VG programs in 30 subjects aged 7-28 years; test protocol comprised intermittent photic stimulation (IPS), pattern stimulation, and a game session with 12 programs, each played for 5 min, delivered from a 50-Hz screen. RESULTS: Activation was observed in 17 subjects; marked differences were observed between different games: two programs activated 13 subjects; one program did not provoke activation. High variability between scenes makes it impossible to define mean brightness for the whole program. Activation correlated with "steady maximal brightness" (SMB) within a program; SMB is defined as the brightness in lux of the brightest scene steadily present in a program. SMB varied between 6 and 305 lux in tested programs. Difference in activation between different games was statistically significant ($p < 0.001$). Pattern sensitivity is strictly correlated with the probability of VG activation ($p < 0.001$). CONCLUSIONS: Our study demonstrates a strong variation in activation between different game programs and a strict relation between VG activation and pattern sensitivity. Programs with SMB >100 lux should be regarded as potentially dangerous: programs with SMB <50 lux may be considered relatively safe. (MEDLINE)

Thomas, R., Cahill, J., & Santilli, L. (1997). Using an interactive computer game to increase skill and self-efficacy regarding safer sex negotiation: Field test results. Health Education & Behavior,

24, 71-86.

This article describes the development, field testing, and evaluation of an interactive computer program, "Life Challenge," developed by the New York State Department of Health as a tool for enhancing adolescents' sense of self-efficacy in HIV/AIDS prevention programs. The computer kiosks were field tested in 13 sites serving high-risk adolescents. The program uses a time travel adventure game format to provide information and non-threatening skill practice. Users record and play back their responses as they "negotiate" with their chosen partners. A proof of concept evaluation with analysis of 211 audio responses found that users took negotiating tasks seriously; statistically significant learning gains were achieved on knowledge items and in self-efficacy scores (greatest improvement for those with low baseline self-efficacy levels). Challenges and problems encountered in implementing the project are described, and the potential of using computers for skill practice and educational interventions in health education is explored. (MEDLINE)

Trost, S.G., Pate, R.R., Ward, D.S., Saunders, R., & Riner, W. (1999). Correlates of objectively measured physical activity in preadolescent youth. American Journal of Preventive Medicine, 17, 120-126.

Objective: The purpose of this study was to identify the psychosocial and environmental correlates of objectively measured physical activity behavior in a diverse sample of sixth-grade students. Design: Cross-sectional. Participants and settings: 198 6th-grade students from four public middle schools in Columbia, South Carolina. The study group was 52% female and 55.1% male African-Americans, with a mean age of 11.4 years. Main Outcome Measures: Time spent in moderate physical activity (MPA) and vigorous physical activity (VPA) was assessed using a uniaxial accelerometer. Determinant variables included: age, gender, race/ethnicity (demographic); physical activity self-efficacy, social norms related to physical activity, and beliefs regarding physical activity outcomes (psychosocial); and perceived physical activity habits of parents and peers, involvement in community physical activity organizations, involvement in community-based sports programs, access to fitness/sporting equipment at home, and self-reported hours spent watching television or playing video games (environmental). Results: For boys, physical activity self-efficacy, social norms related to physical activity, and involvement in community physical activity organizations were salient predictors of MPA and VPA. Among girls, only physical activity self-efficacy emerged as a clear predictor of objectivity measured physical activity. Conclusions: These findings are consistent with previous studies using self-reported physical activity and suggest that interventions to increase physical activity in preadolescent youth should endeavor to boost physical activity self-efficacy by offering a wide selection of enjoyable, developmentally-appropriate physical activity options. (MEDLINE)

Trost, S.G., Pate, R.R., Ward, D.S., Saunders, R., & Riner, W. (1999). Determinants of physical activity in active and low-active, sixth grade African-American youth. Journal of School Health, 69, 29-34.

This study compared the determinants of physical activity in active and low-active African-American (AA) sixth grade students (N=108, 57 F, 51 M). Objective assessments of physical activity over a seven-day period were obtained using the CSA 7164 accelerometer. Students were classified as active if they exhibited three or more 20-minuted bouts of moderate to vigorous physical activity over the seven-day period. Relative to low-actives, active boys reported significantly higher levels of self-efficacy, greater involvement in community physical activity organizations, and were significantly more likely to perceive their mother as active. Relative to low-actives, active girls reported significantly higher levels of physical activity self-efficacy, greater positive beliefs regarding physical activity outcomes, and were significantly less likely to watch television or play video games for greater or equal to 3 hours per day. These observations provide preliminary guidance as to the design of physical activity interventions targeted at AA youth. (PsycINFO)

Turow, J. (1999). The Internet and the family: The view from parents. The view from the press (Report Series No. 27). Philadelphia, PA: The Annenberg Public Policy Center. http://www.appcpenn.org

Cross-referenced in Media Use section

Turow, J., & Nir, L. (2000). The Internet and the family 2000: The view from parents. The view from kids (Report Series No. 33). Philadelphia, PA: The Annenberg Public Policy Center. http://www.appcpenn.org

Cross-referenced in Media Use section

Turow, J. (in press). Family boundaries, commercialism, and the Internet: A framework for research. Journal of Applied Developmental Psychology.

This paper presents an *information-boundaries* framework on the family and the Internet with the aim of initiating research on key issues in this area. Drawing from family studies, sociology, and communication, it lays out a model for viewing the family in relation to the Web. Turow addresses a number of important issues, including the family as a "private" domain, the Internet and family boundaries, and methods of filtering or monitoring Internet content. Three features of the Web are identified, all of which make auditing content and enforcing rules about it more difficult for parents than with previous media: (1) the Web is virtually unlimited in nature; (2) there is enormous presence of commercial sites; and (3) the complexity of the technology often results in adults knowing less about it than do their children.

Content Area: Gender Issues & Other Topic Areas

AAUW Educational Foundation (2000). Tech-savvy: Educating girls in the new computer age. Washington, D.C.: AAUW Educational Foundation. http://www.aauw.org/2000/techsavvybd.html

In contemporary culture, the computer is no longer an isolated machine: It is a centerpiece of science, the arts, media, industry, commerce, and civic life. Information technology is transforming every field, and few citizens are unaffected by it. The commission has chosen to use the terms "computers" and "computer technology" to refer to this larger "e-culture" of information and simulation, and has focused its inquiries, discussion, and recommendations on computers and education. The question is no longer whether computers will be in the classroom, but how computers can be used to enhance teaching and learning – ideally, in ways that promote the full involvement by girls and other groups currently underrepresented in many computer-related endeavors. The commission's themes and recommendations, while focused on girls in schools, would, if addressed, improve the quality of the computer culture for all students. Key recommendations include: 1) create a broad range of software that is engaging and interesting to both girls and boys; 2) educate girls to be designers, not just users; 3) prepare tech-savvy teachers; 4) change the public face of computing; and 5) set new standards for gender equity. (From Executive Summary)

Armitage, D. (1993). Where are the girls? Increasing female participation in computer, math, and science education. In D. Carey, R. Carey, J. Willis & D.A. Willis (Eds.), Technology and teacher education annual 1993 (pp. 19-24). Charlottesville, VA: Association for the Advancement of Computing in Education.

Cross-referenced in Media Use/Access section

Ayersman, D.J. (1996). Effects of computer instruction, learning style, gender, and experience on computer anxiety. Computers in the Schools, 12, 15-30.

There are many issues pertaining to computer instruction that remain unresolved. The nature of computer anxiety is such an issue. Although the effects of computer instruction on computer anxiety have been thoroughly researched, there are numerous aspects to this computer anxiety reduction that are still not clearly understood. For example, why haven't learning style groups been found to differentially reduce anxiety? Individual differences affect one's understanding of computer instruction and, because of this, it seems likely that differences based on these learning style groups might occur in computer anxiety reduction. This study investigates this issue while also examining other factors such as the intensity/duration of the treatment, gender, and various computer-related background experiences. (From author introduction)

Badagliacco, J.M. (1990). Gender and race differences in computing attitudes and experience. Social Science Computer Review, 8, 42-63.

A gender and race/ethnicity gap exists, both in computer experience and computer attitudes. The fact that computer-related activities are seen as white and male may influence and discourage women and minorities from making an academic commitment to careers for which high-technology skills are essential. Through these societal perceptions of computers as white and male, and through related instructional biases in our schools, we may be creating a technological underclass. To understand these differences and to help to try to alleviate them, this study was designed to determine how individuals' attitudes toward computing differ, what roles computers play in their lives, and what issues negatively affect their participation and attitudes. A questionnaire was administered to students at a large public urban university. We found that 1) men have more computer experience; 2) men have more favorable attitudes toward computers – women had significantly less favorable attitude scores; 3) persons of different races or ethnicities have differing computer experience – whites had the most years of experience, Hispanics had the fewest years of experience;
4) attitudes toward computing differ by race and ethnicity. Several implications for instruction are drawn from the results. (Author Abstract)

Bamossy, G.J., & Jansen, P.G.W. (1994). Children's apprehension and comprehension: Gender influences on computer literacy and attitude structures toward personal computers. In J.A. Costa (Ed.). Gender issues and consumer behavior (pp. 142-163). Thousand Oaks, CA: SAGE Publications, Inc.

The purpose of the study reported in this chapter was to investigate the similarities and differences between boys and girls in their attitude structures, beliefs, learning skills, and perceived "mental models" of the working structure of personal computers. Measures of computer literacy, attitudes, prior computing experience, and demographics were administered to children from 17 middle schools prior to taking their first formal computer course. Following the 10-week course, experimenters re-administered the attitude and computer literacy tests, and collected data on the student' performance in the course. Boys reported spending significantly more time in the past on the computer than did girls; however, this difference could be accounted for by boys' playing computer games. Both prior to and following the course, girls had significantly higher scores on the fear and negative affect constructs relative to boys, where boys were significantly higher on measures of self-efficacy, positive affect, and beliefs regarding the utilities of computers. The authors suggest that reasonable conclusions include boys have less fear, greater self-confidence, more positive attitudes, and stronger beliefs regarding the uses of computers than do girls prior to ever having formal training, and these differences are likely caused by socialization influences.

Bannert, M., & Arbinger, P.R. (1996). Gender-related differences in exposure to and use of computers: Results of a survey of secondary school students. European Journal of Psychology of Education, 11, 269-282.

A number of empirical studies on the use of computers reveal gender-related differences, with women and girls showing more negative feelings toward modern computer technology. Within the scope of an evaluation study of the pilot project "CULAS" (Computer Assisted Learning in Secondary School in Rhineland-Palatinate) the data of over 1000 students from grades 5 to 10 were analyzed with special focus on gender-related differences. The results of this study provide information on the following aspects: frequency and duration of computer use, computer experiences, computer interests, attitudes toward computers, emotional responses while working with computers, and locus of control. On a whole the results support the assumption of gender-related differences in exposure to and use of computers. However, these findings also indicate that this assumption may not hold true in a general sense, and that future studies must examine gender-related differences with more sophisticated methods. (Author Abstract)

Bernhard, J.K. (1992). Gender-related attitudes and the development of computer skills: A preschool intervention. The Alberta Journal of Educational Research, 38, 177-188.

Computer instructional programs designed to achieve equitable educational outcomes for girls have yielded mixed results. The present intervention involved 59 preschool boys and girls. Within three classrooms, separate girls' and boys' microcomputer groups were formed and matched respectively with girls' and boys' control groups (nature groups). The microcomputer groups received training in open-ended software and were taught basic skills in the LOGO language, over a six-week period. The control groups participated for the same amount of time in a variety of moderately novel, nature-related activities that were designed as gender-neutral. Both groups had female instructors and same-sex pairing. There were two major findings. The first result was that the girls' microcomputer group did not show more positive gender-role attitudes toward computers on the post-test when compared with the girls' control group. Both groups of girls viewed computers as more appropriate for their own gender than on the pretest. The second result was that in spite of equivalent instruction designed to hold the interest of girls, boys completed a significantly greater number of LOGO tasks than girls after the intervention. The question of possible initial advantages of the boys is discussed. Educational interventions with equitable goals face great difficulties in achieving and demonstrating effectiveness. This study suggests that measures of performance should be included in such demonstrations. (Author Abstract)

Bhargava, A., Kirova-Petrova, A., & McNair, S. (1999). Computers, gender bias, and young children. Information Technology in Childhood Education,1999, 263-274.

Cross-referenced in Media Use/Access section

Brown, R.M., Hall, L.R., Holtzer, R., Brown, S.L., & Brown, N.L. (1997). Gender and video game performance. Sex Roles, 36, 793-812.

We investigated potential gender differences in video game (pong) performance in university students. In Experiment 2, men (N=16) performed significantly better than women (N=16). Experiment 2 was similar to the first, but used 14 men and 14 women who were matched carefully on previous video game experience. In spite of the matching, results replicated those of the first experiment. In Experiment 3, we evaluated the effect of an audience (male, female, none) on pong performance in 42 men and 42 women. We also assessed trait competition anxiety (Sport Competition Anxiety Test scores), sex role identification (Bem Sex Role Inventory scores), and video game experience. Both genders showed significantly poorer performance when they played pong in the

presence of a female audience. Overall, males outperformed females as in the first two experiments. Examination of individuals with low, medium, and high levels of sport competition anxiety and video game experience reveals persistent gender differences in performance, seemingly independent of levels of anxiety and experience. In all three experiments, both men and women showed significant improvement in performance over trials. (Author Abstract)

Busch, T. (1995). Gender differences in self-efficacy and attitudes toward computers. Journal of Educational Computing Research, 12, 147-158.

This study aims to investigate gender differences regarding computer attitudes and perceived self-efficacy in the use of computers among 147 college students. At the end of a computer course, the students completed a questionnaire designed to measure self-efficacy, computer anxiety, computer liking, and computer confidence. The results revealed gender differences in perceived self-efficacy regarding completion of complex tasks in both word processing and spreadsheet software. No gender differences were found in computer attitudes or self-efficacy regarding simple computer tasks. Male students had previously had more computer experience in programming and computer games and reported that they had previously had more encouragement from parents and friends. (Author Abstract)

Cassell, J., & Jenkins, H. (1998). Chess for girls? Feminism and computer games. In J. Cassell & H. Jenkins (Eds.), From Barbie to Mortal Kombat: Gender and computer games (pp. 2-45). Cambridge, MA: MIT Press.

The collection of chapters encourages examination of assumptions about gender and interactive games, and proposes different approaches to bridge the digital gender gap. This chapter outlines several basic factors motivating a critical analysis of video games currently in the market, and the desire to design new ones, and explores some of the political contradictions that surround the initiative to create girls' games. The authors introduce the concept of gender and computer game terminology. Can playing interactive games as a youngster lead to differential use of technologies as children grow older or more positive attitudes toward technology? Can game play lead to increased technological literacy and subsequent career opportunities? The implications of girls' and boys' differential use of interactive games are considered.

Colley, A.M., Gale, M.T., & Harris, T.A. (1994). Effects of gender role identity and experience on computer attitude components. Journal of Educational Computing Research, 10, 129-137.

The effects of prior experience and gender stereotyping upon the computer anxiety, confidence and liking of 144 male and female students (undergraduates) who had just commenced their studies at university were examined. Males were found to have lower computer anxiety, higher confidence and greater liking than females. When the effects of prior experience and gender stereotyping were removed however, no significant sex differences on these measures remained. The pattern of associations between experience, gender stereotyping variables and computer attitude measures differed for males and females. Greater experience at home was associated with lower anxiety for both sexes, with higher confidence for males and with greater liking for females. The influence of other family members also differed for the two sexes. The attitudes of both males and females were more positive if they had a brother who used computers, but the influence of father's use was positive for males only, while the influence of mother's use was positive for females only. For females but not males, higher scores on the Masculinity scale of the Bem Sex Role Inventory were associated with more positive computer attitudes. The results demonstrate that importance of experience, particularly in a home context, and of gender stereotyping in determining how males and females perceive computers. (Author Abstract)

Colley, A., Hill, F., Hill, J., & Jones, A. (1995). Gender effects in the stereotyping of those with different kinds of computing experience. Journal of Educational Computing Research, 12, 19-27.

Stereotypes of male and female target figures who had experience of either computer programming, word processing or computer games were investigated. Male and female undergraduate respondents were asked to rate them as portrayed in brief descriptions, on the sixteen personality attributes previously used by Siann, Durndell, Macleod, and Glissov in an investigation of stereotypes of male and female computer science students. As found previously, there was no evidence of negative stereotyping; few differences were found between the male and female target figures, and the pattern of ratings was similar for the three computer uses. The results indicated however, that irrespective of the sex of the target figure, stereotyping of the three uses differed according to the sex of the respondent. Females gave higher ratings on attributes reflecting autonomy and congeniality to the figures with programming experience, while males gave these the lowest ratings on the same attributes. The relationship between this finding, the previous computing experience of the males and possible future implications is discussed. (Author Abstract)

Comber, C., Colley, A., Hargreaves, D.J., & Dorn, L. (1997). The effects of age, gender and computer experience upon computer attitudes. Educational Research, 39, 123-133.

The effects of age, gender, and prior computing experience upon attitudes towards computers were investigated in 278 secondary school pupils drawn from the 11-12 and 15-16 year age groups. Males from both age groups reported greater experience with and more positive attitudes towards computers than females. Younger pupils, both male and female, were found to have greater experience with and more positive attitudes towards computers than older pupils. After controlling for ownership and use of a home computer by means of analyses of covariance, female and male pupils reported similar levels of enjoyment of computers, but age differences in enjoyment and gender and age differences in confidence with computers remained significant. Similar analyses using length of experience as a covariate did not significantly affect gender or age differences. The need to investigate and address the level of confidence of female pupils is briefly discussed. (Author Abstract)

D'Amico, M., Baron, L.J., & Sissons, M.E. (1995). Gender differences in attributions about microcomputer learning in elementary school. Sex Roles, 33, 353.

To investigate whether girls' attributions about computer use were more likely to follow a pattern of learned helplessness, boys' and girls' attributions about a computerized drill-and-practice task and a tutorial program were assessed. Factor analysis of responses on an attribution questionnaire revealed three factors that differed across gender and across task. Multiple regression, using exposure time, group size, attributions, and interactions to predict post-test scores, showed different patterns for boys and girls and between tasks. For the drill-and-practice task, girls benefited from increased exposure time, and attributions to ease of task and ability predicted performance for both boys and girls. For the tutorial task, increased exposure time did not benefit either sex. Girls, however, benefited from working in larger groups, while boys benefited from working in smaller groups. Attributions to luck, as well as perceptions of ability and ease of task, predicted post-test scores. However, for girls, attributions to luck predicted higher scores, while for boys, attributions to luck were negatively correlated with performance. Implications for including appropriate feedback to encourage a mastery approach in computer learning, as well as optimal group size and group composition for positive attributional style and academic success, are discussed. (Author Abstract)

Dietz, T.L. (1998). An examination of violence and gender role portrayals in video games: Implications for gender socialization and aggressive behavior. Sex Roles, 38, 425-442.

Cross-referenced in the Social Development/Aggression section

Fletcher-Flinn, C.M., & Suddendorf, T. (1996). Computer attitudes, gender and exploratory behavior: A developmental study. Journal of Educational Computing Research, 15, 369-392.

Three studies were conducted which examined computer attitudes, and the effect of particular gender views on exploratory behavior. In the first study, preschool children were interviewed about their computer attitudes before and after an interactive storybook session. The results showed a high level of computer awareness, with boys holding more gender-stereotypical views, and experience did not seem to alter these beliefs. Those holding cross-gender beliefs about computers (mainly the girls) were more restrictive in their exploration of the software. In the other two studies (study 2 -12.4 years old; study 3 -15 years), a questionnaire was used to assess computer attitudes among high school students. All held possible views with gender differences of degree but not kind. Few students held gender-stereotypical beliefs, although, there was a consensus that females were less proficient with computers. Unlike the preschoolers, the exploratory behavior of the older students was not related to attitudes. The results suggest that affirmative action programs are working within the high school, but the provision of more female role models is considered to be important in helping to bridge the computer gender gap. Because gender attitudes about technology are formed early, these efforts need to include the very young. (Author Abstract)

Funk, J.B, & Buchman, D.D. (1996). Children's perceptions of gender differences in social approval for playing electronic games. Sex Roles, 35, 219-232.

Cross-referenced in Social Development/Relationship section

Gailey, C.W. (1996). Mediated messages: Gender, class, and cosmos in home video games. In I.E. Sigel (Series Ed.) & P.M. Greenfield & R.R. Cocking (Vol. Eds.), Interacting with video: Vol. 11. Advances in applied developmental psychology (pp. 9-23). Norwood, NJ: Ablex Publishing Corp.

Interactive video games are apt to replicate in their structure the values and activities associated with the dominant ideology. The author asks what values were conveyed in the games (with respect to class, gender, and worldview) and how children as players interpreted the play process and content of the games. A pilot project was conducted involving interviews with a small sample of urban parents and 6-12 yr old children in New York City and Boston. In addition to interviewing and observing the parents and children at play in their homes, in some cases the author played the games with children. Gailey also surveyed two stores renting and selling home video games in two ethnically heterogeneous and mixed-class urban neighborhoods, to see which ones were most popular and to observe the clientele. (PsycINFO)

Goldstein, J. H. (1994). Sex differences in toy play and use of video games. In J.H. Goldstein (Ed.), Toys, play, and child development (pp. 110-129). New York, NY: Cambridge University Press.

Differences in the play behavior of boys and girls, and their different toy preferences, are discussed. Biological and social origins of sex differences in play are considered, with a focus on aggressive play, war toys, and video games. Subjects in the studies discussed were 4-16 year olds. Children and adults view play differently. The role of prior experience, rough and tumble play, toy preference, social effects (isolation and sociability), school performance, cognitive effects, personality and psychopathology, aggression and video games are all considered. (PsycINFO)

Johnson, C.S., & Swoope, K.F. (1987). Boys' and girls' interest in using computers: Implications for the classroom. Arithmetic Teacher, 35, 14-16.

Children who have access to computers from an early age are likely to develop skills and attitudes that give them an advantage over those who lack such experiences. Anecdotal evidence

suggests that computers may be sex-typed as "male" or for boys, thereby discouraging girls' interest in them. The purpose of this study was to determine how children perceive males' and females' interest in using computers. Children (1^{st} – 12^{th} graders) were asked to respond to interest inventories that contained items about computers and two video games (*Star Trek* and *Ms. Pac-Man*), one with masculine appeal and one with feminine appeal. The findings indicated that computers were interesting to both sexes, but both sexes perceived boys to be significantly more interested in computers than girls. Interest in playing the video games was strongly related to the specific content of the game. Both sexes rated boys' interest significantly higher than girls' interest for the *Star Trek* game (a masculine theme), and both sexes rated each group's interest similarly for *Ms. Pac Man* (a more feminine theme). The authors suggest that we must be careful not to reinforce the belief that boys are more interested than girls in computing activities, and need also consider the possible implications of sex-typed themes when selecting software.

Jones, T., & Clarke, V.A. (1995). Diversity as a determinant of attitudes: A possible explanation of the apparent advantage of single-sex settings. Journal of Educational Computing Research, 12, 51-64.

The effects of single-sex educational settings on girls' computing experience and attitudes were investigated. Questionnaire data were collected from a sample of 231 high school girls (aged approximately 15 years) from three single-sex and two co-educational schools in Victoria, Australia. Girls from single-sex settings were found to have more experience with computers, and more positive attitudes toward computers than girls from co-educational settings. However, once the effects of experience with computers were partialled out, there was no effect of educational setting on computing attitudes. Diversity of computing experience was the strongest predictor of high school girls' attitudes toward computers. The findings indicate the importance of designing computing curricula for girls, which emphasize a broad range of computing activities in preference to focusing on skill development in a single area. (Author Abstract)

Levine, T., & Donitsa-Schmidt, S. (1995). Computer experience, gender, and classroom environment in computer-supported writing classes. Journal of Educational Computing Research, 13, 337-357.

This experimental study explores whether, and to what extent, do differences in gender and experience with word processing affect how students perceive their classroom environment in high school writing classes. The study was conducted in 34 classrooms and includes data from 951 students. The experimental group was comprised of 24 writing classes implementing an instructional approach to writing through computer-supported instruction. Ten classes, which did not use computers in their writing classes, served as a control group. The data reveal significant differences in all dimensions of the classroom environment and indicated a more positive perception of the classroom environment is perceived by student with, and without, prior experience in word processing. No such differences were found to exist in the experimental group. The findings revealed that within the two different learning environments, there are differences in the ways boys and girls perceive their classroom environment. Also found are differences between boys and girls in both computer ownership and in the actual use of word processing, with boys having home computers and making more use of word processing outside school. (Author Abstract)

Levine, T., & Gordon, C. (1989). Effect of gender and computer experience on attitudes toward computers. Journal of Educational Computing Research, 5, 69-88.

The purpose of this study was to determine the extent to which gender and prior computer exposure (has a computer at home; participated in a computer course; knows how to work with computers) affect students' attitudes toward computers prior to computer instruction in school. An

attitude questionnaire including cognitive and affective attitude scales was administered to 222 Israeli pupils in grades 8 through 10 who study in schools where computers have not yet been introduced. The results showed that prior computer exposure (in particular, having a computer at home) had a stronger effect on attitudes toward computers than sex. Pupils owning computers were more motivated to become familiar with computers; felt a stronger need for computer in their lives and had more positive affective attitudes toward computers than pupils who don't have computers at home. Sex differences in affective and cognitive attitudes were also observed where boys had significantly more positive affective attitudes toward computers than girls. Boys perceived computers as being more "enjoyable," "special," "important," "friendly," and cheaper" than girls. Furthermore, boys tended to hold more stereotyped attitudes about who is capable of using computers and had more positive attitudes toward the computer as a medium of instruction than girls. (Author Abstract)

Linn, M.C. (1985). Gender equity in computer learning environments. Computers and the Social Sciences, 1, 19-27.

Linn discusses the potential of computer learning environments for fostering cognitive skills, and addresses the gap between the promise and reality of using computers in education and children's performance in the classroom. Differential participation of males and females in computer experiences is documented, citing both content and process factors. Two studies of how males and females respond to computer learning environments are described in terms of the observed sex differences in risk-taking expectations about performance, help seeking, and attributions for success and failure. Future actions to foster equitable outcomes for these environments are suggested. (PsycINFO)

Murray, M., & Kliman, M. (1999, December). Beyond point and click: The search for gender equity in computer games. Eisenhower National Clearinghouse. http://www.enc.org/focus/topics/edtech/articles.

Want to get girls interested in computers? Are "games for girls" the way to go? What does a good educational game look like? These are a few of the questions addressed by Murray and Kliman in an NSF-funded research project. The authors suggest that educators should be concerned about the development and content of computer games, as experiences with these games have the potential to affect girls' experiences with and attitudes toward technology. The article includes a brief discussion of the advent of "girl games" such as *Purple Moon*, *Barbie Fashion Designer*, *Madeline*, and *American Girls Premiere*. "Pink" packaging may initially attract the attention of girls; however, that is not enough to engage them over time. Educationally rich games that appeal to girls as well as boys (e.g., *Logical Journey of the Zoombinis*, *SimTown*, *The Imagination Express Series*) are not based on gender stereotypes. The authors suggest three criteria to consider when choosing computer games: (1) the educational content of the game, (2) the features that make it more or less equitable, and (3) the factors that make it more or less fun and engaging to play.

Nelson, L.J., & Cooper, J. (1997). Gender differences in children's reactions to success and failure with computers. Computers in Human Behavior, 13, 247-267.

This study examined an attributional style explanation for gender differences in computer use and attitudes. A total of 127 Grade 5 subjects filled out questionnaires assessing computer experience. Surprisingly, there were no gender differences in liking for computers. However, consistent with previous research, boys thought that they had more ability with computers, boys used computers more frequently, and more boys had computers at home. Subjects were then randomly assigned to use either a "failure" computer program, a "success" program, or no program. Results showed that boys provided unstable attributions for failure with the computer (e.g., bad disk, lack of effort) more often than girls did, whereas girls provided unstable attributions for success (e.g., easy program, effort) with the computer more often than boys did. Both boys and girls who made stable attributions for success

or unstable attributions for failure were more enthusiastic about using computers in the future, indicating that gender differences in attitudes toward computer use can be explained by gender differences in attributions for performance. The data also suggest that gender differences in relaxation and expectations for improvement were due to gender differences in stability of attributions, frequency of previous computer use, and perceived competence with computers. (Author Abstract)

Shashaani, L. (1994). Gender-differences in computer experience and its influence on computer attitudes. Journal of Educational Computing Research, 11, 347-367.

This study of 902 boys and 828 girls in secondary school shows that gender differences in computer experience has a direct relationship to computer attitudes. The data analysis supports the hypothesis that male students have more computer experience than female students. This experience is measured by the number of computer classes attended, the amount of computer usage, and having access to a home computer. Boys showed more positive attitudes toward computers than girls. The number of classes students attended, and the amount of computer usage was positively related to computer utility. Home computer ownership was not related to computer attitudes. The association between computer attitudes and computer experience was stronger for males than for females. (Author Abstract)

Sneed, C., & Runco, M.A. (1992). The beliefs adults and children hold about television and video games. The Journal of Psychology, 126, 273-284.

In Phase 1 of this study, we asked 23 parents between the ages of 30 and 52 years and 26 children between the ages of 10 and 19 years to list effects of television and video games on children. A questionnaire was developed using the most frequently given responses (e.g., television influences children's aggressive behavior, verbal abilities, or time with friends). In phase 2, this questionnaire was administered to different groups of parents and children and a control group of adults without offspring (N=204) who were asked to rate the influence of each item on the questionnaire. Multivariate analyses of variance indicated that there were similarities and differences among the groups. For example, parents and other adults held similar beliefs about the influence of television, but parents held more positive beliefs about the influence of video games than the other adults. Children held more positive beliefs about the influence of television than parents, but parents and children held similar beliefs about the influence of video games. (Author Abstract)

Subrahmanyam, K. & Greenfield, P.M. (1998). Computer games for girls: What makes them play? In J. Cassell & H. Jenkins (Eds.), From Barbie to Mortal Kombat: Gender and computer games (pp. 46-71). Cambridge, MA: MIT Press.

In this chapter, authors address the problem of girl appeal in game software. Into a market that had long been dominated by male consumers sprung "Barbie Fashion Designer" in November 1996. Produced and developed by Mattel Media for girls 6 and older, it sold more than 500,000 copies in its first two months of sales. Authors are not sure if it should be classified as a game, but the significance of "Barbie Fashion Designer" is that it is the first piece of entertainment software to garner a mass market with girls. Authors analyze why and how the "Barbie Fashion Designer" CD-ROM succeeded with young girls, where so many others failed before it. To develop an account of game features that girls find appealing, we draw from recent research on computer and video games, research on children's play and television preferences, and research by software developers. The authors hope is that this analysis will illuminate for parents, educators, researchers, and software developers general principles for girl appeal in computer software. (PsycINFO)

Ware, M.C., & Stuck, M.F. (1985). Sex-role messages vis-à-vis microcomputer use: A look at the pictures. Sex Roles, 13, 205-213.

This study explored the pictoral representation of men, women, boys, and girls in popular computer magazines through content analysis. Issues of three mass market computer magazines (total pages = 2,637) were analyzed to determine numbers of men, women, boys, and girls illustrated; roles in which they were portrayed; and whether they were shown using the computer actively, standing by while others used the computer, or rejecting the computer. Many stereotypic portrayals were found: Men appeared in illustrations almost twice as often as women; women were over-represented as clerical workers and sex objects, while men were over-represented as managers, experts, and repair technicians. Women were shown significantly more often in a passive role vis-à-vis computers. In mixed-sex illustrations, men were most often shown in the position of authority. Only women were shown rejecting the computer or portrayed as sex objects. Also included are observations regarding the effects of stereotypic portrayals on women/girls and suggestions for further research. (Author Abstract)

Williams, S.W., & Ogletree, S.M. (1992). Preschool children's computer interest and competence: Effects of sex and gender role. Early Childhood Research Quarterly, 7, 135-143.

This investigates sex differences in computer interest and competence in preschool children and the relationship of these variables to gender role concepts. Eighty-two children from a university-affiliated day care center and a nearby Head Start program were individually administered the Sex Role Learning Index (SERLI) as well as a brief computer background questionnaire. Computer-related behaviors were assessed in the preschool setting via three matching games (dinosaurs, shapes, and number). Computer competence was assessed by number of completed trials for each game. Computer interest was measured through children's level of participation in three categories of computer-related behavior-"proximity," "observation," and "working" – as indicated through analyses of selected videotaped computer sessions. For the combined computer competence score, older children completed more trials than younger children. Age and sex main effects were found on the child-figures section of the sex role preference (SRP) scale of the SERLI, with boys and older children indicating a stronger preference for their own sex role. For boys, the computer competence score was related to own sex role discrimination (SRD), and older children scored higher on the SRD scale than younger children. University children were more likely to indicate prior exposure to a computer. Male children viewed the computer as male oriented while female children viewed it as female oriented.