Children and Interactive Media

Research Compendium Update

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1.0 Introduction

This is an update of the *Children and Interactive Media: A Compendium of Current Research and Directions for the Future* report to the Markle Foundation from October 2000. In this update, we examine the literature that has been published on the topic between June 2000 and May 2002, focusing on children's in-home use of interactive technologies (see Wartella, O'Keefe, & Scantlin, 2000, for details on our search strategy). In addition, we have organized our review of this literature according to the categories of the original research compendium, including children's use and access to interactive media; cognitive and social outcomes of such interactive media use, health and safety issues, and policy concerns.

In developing the bibliography for this review, we noted that since publication of our original compendium, there have been four books or special issues of journals devoted to this topic (Calvert, Jordan, & Cocking, 2002; *The Future of Children: Children and Computer Technology*; Singer & Singer, 2001; *Zero to Three: Babies, Toddlers, and the Media*, 2001) and an additional set of six research reviews of the literature (Buckingham, 2002; Cordes & Miller, 2000; Subrahmanyam, Greenfield, Kraut, & Gross, 2001; Subrahmanyam, Kraut, Greenfield, & Gross, 2001; Tarpley, 2001; Villani, 2001). Interestingly, however, as we noted in the 2000 report, most of the empirical research to date are studies of the amount of time children spend using interactive media, and studies of the influence of violent content in video games and other interactive media on children's social behavior.

Thus, the topics of inquiry continue to be narrowly focused, and there is still a paucity of research on such issues as the role of interactive media in promoting cognitive growth, the impact of interactive technologies on children's health (e.g., seizures, addiction, and weight gain), and studies of how children interpret advertising in web environments or understand disclosure and other practices to protect their privacy. Indeed, to date little systematic research has been conducted to either legitimize or dispute claims about the impact of interactive media content on children's development, although expression of concern is in the literature (e.g. Cordes & Miller, 2000). Further, few investigations have been conducted that reflect recent advances in interactive technology, including studies on the use and impact of handheld devices, wireless technology, and interactive toys. Explorations on the implications of media convergence (e.g., the manifestations of content across different platforms), accompanied by media

consolidation in the industry itself (e.g., the America Online and Time Warner merger in 2001) have also been conspicuously absent.

The empirical research on children and interactive media has yet to match the myriad of questions posed about its effects. This research, however, has become a thriving area of study as interactive media continue to pervade children's lives and as the technology itself continues to evolve.

2.0 Media Use and Access

Since the 2000 report, both large- and small-scale studies have been published on children's in-home use of interactive media. These studies indicated that ownership of computer-based media has continued to grow. Between 1999 and 2000, computer ownership in American households had grown 2% (from 68%-70%), whereas ownership of video game systems remained relatively stable, with a 1% growth (from 67% to 68%). Online access saw the most significant increase from 1999 to 2000: household dissemination grew 11%, from 41% in 1999 to 52% in 2000 (Woodard & Gridina, 2000). Almost no academic research has emerged on children's use of interactive appliances such as handheld games, interactive toys, and wireless technologies.

The data from the 1997-1998 U.S. Census Bureau's Current Population Survey of U.S. Households (Becker, 2000) showed that 57% of homes with children and adolescents had a computer, and that 60% of children in those households could be classified as regular users (at least 3 days a week). Children most frequently reported using the computer for playing games, followed by school assignments. Internet access was less prevalent than other computer applications: 34% of school-aged children had in-home access to the internet. Among teens, the most cited purpose for going online was for homework, but the data also showed that children's use of the internet for information seeking had declined between 1997 and 1998, while the use of email had grown. Thus, in the home environment, where internet use was propelled by children's preferences, informational use might be giving way to recreational use (Becker, 2000).

Compared with these 1997-1998 Census statistics, recent studies indicate greater media saturation in the home. The most recent national survey, involving 1,235 parents of 2- to 17-year-olds and 416 eight- to sixteen-year-olds, was conducted by the Annenberg Public Policy Center (Woodard & Gridina, 2000). According to the *Media in the Home 2000* survey, American children live in a media-rich environment. In homes with children ages 2-17, 70% owned a computer, 68% owned video games, and 52% had online access. For non-interactive media, 98% of households had at least one television, 97% owned a VCR, 78% had a subscription to basic cable and 31% to premium cable, and 42% subscribed to a daily newspaper. For the first time, online access surpassed newspaper subscriptions. Interactive media had begun to permeate many children's bedrooms: Among 8- to 16-year-olds, 20% had a computer in their bedroom, of which 54% had internet access.

Although television continued to dominate children's time with media, interactive media occupied a significant portion of 2- to 17-year-olds' time. Parents reported that, on average, these children spent 34 minutes a day on a computer, 33 minutes playing video games, and 14 minutes on the internet (Woodard & Gridina, 2000). From this same survey, data on young children's computer use had begun to emerge: According to reports from 145 parents of 2- to 3-year-olds, even these young children spent an average of 17 minutes on the computer, 19 minutes playing video games, and 5 minutes on the internet daily (Jordan & Woodard, 2001). Although data on the time young children spend with interactive media are being collected, the *content* of programs or activities remain overlooked.

Since 2000, we also know more about teenagers' internet use—knowledge that was previously a domain of market research. One small-scale study with 189 middle-class teens (ages 14-19) revealed most teens used the internet for less than an hour a day at home or in school (La Ferle, Edwards, & Lee, 2000). Internet use was less prominent than other media use, namely watching television and listening to the radio. About half of the teens reported spending 1 to 3 hours watching television, and over 3 hours listening to the radio daily. They appeared to use the internet for informational purposes—research, homework, news, and health education—and television and radio for entertainment purposes (La Ferle, Edwards, & Lee, 2000).

In late 2000, the Pew Research Center conducted large-scale studies of Americans' internet use. According to the Pew Internet and American Life Project ($N = 754$; Lernhart, Rainie, Lewis, 2001), 45% of teens ages 12 to 17—which projects to 17 million American youth—used the internet. Of online activities that these teens have done, sending and receiving email was most frequently reported, followed by Web-surfing for fun, visiting entertainment sites, and sending instant messages. Relatively few teens reported having ever looked for health-related information, creating a Web page, and looking for information on a topic that was difficult to talk about. For most teens in this study, the place where they were most likely to use the internet was the home. Three-quarters of teens reported going online at least a couple of times a week, and frequency of use increased with both experience with the internet and with age. Instant messaging (IM) was a popular online activity, with 74% of the sample reporting such use, compared to 44% of adults. Almost 70% of teens used instant messaging at least a couple of times a week, and 45% of online teens reported using IM every time they went online. An important appeal of IM is the ability to stay in touch with friends and relatives who live far away.

General statistics on use and access mask important demographic differences, however. As described in our 2000 report, children's use of and access to interactive media are known to vary according to gender, age, socioeconomic status, and ethnicity. For the most part, the demographic differences found in the 2000 report still exist.

2.1 Gender Differences

Reflecting the focus of the research literature, the 2000 report highlighted gender differences in computer- and video-game play. Game play was the most common computer-based activity, and boys spent more time gaming than did girls. This was partly due to the differential appeal of interactive games to boys and girls: Themes of violence, control, and competition that pervade interactive games do not hold much allure for girls. Girls preferred puzzles, spatial relation, and educational games, whereas boys preferred violent action and sports games.

The current review indicated that the gender difference in gaming has persisted: Boys spent more time (64 minutes a day) playing video games than did girls (30 minutes a day), although there were no gender differences in internet or overall computer use (Woodard & Gridina, 2000). Similar patterns emerged in the 1997-1998 U.S. Census Bureau's Current Population Survey. Overall frequency of computer use was similar regardless of gender. The largest gender differences were in computer-game play, where 75% of boys and 68% of girls reported using games; and in word processing, which 41% of girls and 36% of boys reported doing (Becker, 2000). Thus, beyond the gaming domain, the gender gap in most other computer applications has continued to narrow.

This gender gap in gaming, however, continues to elicit concern among researchers and advocacy organizations. Despite recognition in the early 1990s that girls form a viable market for video games, the industry has yet to fully respond to such a potential. In a 2001 analysis of the top-selling games for each of the six video game consoles and for personal computers (PCs), violence and gender and racial stereotypes pervaded these games. PC games were rated as more girl-friendly than console games, but few girl-friendly games existed overall (Children Now, 2001). In 1998 and 1999, *Barbie*—software focusing on fashion and physical appearance—was the top-selling title for girls (Children Now, 2000). Game makers' concept of marketing games to girls largely consisted of packaging them to appear girl-friendly rather than conceiving content that would actually appeal to girls (Children Now, 2000).

Researchers have long demonstrated that girls' game preferences are distinct from those of boys. Gender differences seemed to emerge at a young age even with regard to preferences for multimedia interfaces (Passig & Levin, 2000). In their evaluation of an interactive storybook, kindergarten girls emphasized the importance of writing, colors, drawings, and the ability to get help from the computer, whereas boys valued control over the computer and movements onscreen. Thus, most educational games were not created with girls' preferences in mind; rather, the traditionally male emphasis on control and navigation are key features of most games and hold more appeal for boys (Passig & Levin, 2000). This could be said not only of educational games, but of interactive games in general. Rather than the competitive games where power is a dominant theme, girls prefer games that offer social interaction, collaboration, challenges, and contain positive female images (Cone, 2001). Girls *are* interested in interactive games, but have yet to become engaged by the market's limited offerings (Children Now, 2000; Girl Scouts of the USA, 2001).

Gender differences were also apparent in internet use. A survey of teens (14- to 19-year-olds) showed that boys and girls seek different information when they go online: Boys were more likely to use the internet for fun, games, find out about music, and shop than were girls; whereas girls used the internet to look for information on colleges and universities and on fashion more often than did boys (La Ferle, Edwards, & Lee, 2000). The Pew project found that although both teen boys and girls used the internet to pursue their interests (e.g., seeking information on hobbies, visiting entertainment Web sites), there were qualitative differences in other uses (Lenhart, Rainie, & Lewis, 2001). Girls emphasized the communicative uses of the Web, using it for email and instant messaging more than boys did, whereas boys performed more activities other than communication and information seeking, such as downloading games and music, trading and selling things, and creating Web pages (Lenhart, Rainie, & Lewis, 2001). These differences may imply gender differences in online interests, or in comfort levels with different online activities. Thus, although the gender disparity in the use of many computer applications has narrowed, gender differences in specific activities may persist.

As with almost all media, most Web sites targeting teens contained content that was gendered, and boys and girls were offered content that was quite different from each other's (Center for Media Education, 2001). The gendered nature of content likely reflects both the true differences, as well as preconceived notions, of girls' and boys' interests. The gender gap in girls' participation in computer technologies

continues to be a source of concern: Compared with boys, girls are not cultivating an interest in technology and computer science or taking advanced classes in high school. If girls—and boys—continue to think of girls as being outsiders in the culture of technology, its implications for women's involvement in technology-oriented careers are troubling (Girls Scouts of the USA, 2001). While women's relative lack of participation in technology and science is worrying, attributing it to interactive games is an oversimplification: There is no reason to expect an interest in interactive games to directly translate to an interest in technology and science, for either boys *or* girls. Rather, an interest in these areas are cultivated though multiple avenues (e.g., parental encouragement), not only through interactive games.

2.2 Age Differences

The literature reviewed in the 2000 report indicated that the patterns of age differences in the amount of video game play varied according to age group: Among young children (ages 2-7), video game play increased with age, whereas among an older age group (9- to 12-year-olds), game play appeared to decrease with age. What was consistent across studies was that younger children preferred and spent more time playing educational games than did older children. Since 2000, few studies have been conducted on children's computer use in general, and on preschoolers' use of interactive media.

According to the 1997-1998 Census Bureau data, older children used the computer more often than did younger children, with those in early adolescence (ages 12-14) being the heaviest users. The youngest age group (6- to 8-year-olds) used the computer less often than did older children, but used it for educational programs and games more often—a finding consistent with previous research (Becker, 2000). More recent studies have confirmed the pattern that older children are heavier users of interactive media—Adolescents spent the most time using the internet, playing video games, and generally using the computer compared with preschoolers and elementary-school age children (Woodard & Gridina, 2000).

Age differences also emerged in children's use of the internet. Almost three-quarters of American teens aged 12-17 go online, whereas 29% of younger children (ages 11 and younger) were internet users (Lenhart, Rainie, & Lewis, 2001). Older teens (ages 15-17) were by far heavier users of the internet than were younger teens (ages 12-14) overall, as well as in specific online activities (email, IM, getting news, researching purchases, visiting chat rooms and Web sites, looking for information, and creating Web pages) except for downloading or playing a game online (Lenhart, Rainie, & Lewis, 2001).

While children's use of interactive technologies at different ages has been a subject of study, researchers are lagging behind in a theoretical, developmental framework that could inform such use. This need was highlighted in the 2000 report, and is still evident today. Some researchers have applied theories previously used to explain television viewing to new media. For instance, authors have used the uses and gratifications theory to examine motivations for internet use: In a survey of pre-teen Dutch children, older children reported using the internet more often for information seeking than did younger children, whereas younger children reported using the internet more often to avoid boredom than did older children (Valkenburg & Soeters, 2001). Overall, attempts at applying theory to the use of interactive media are still poorly conceptualized and lack a developmental perspective.

2.3 Socioeconomic Status and Ethnicity

The 2000 report found a "digital divide" in computer use and access: Large-scale surveys converged on findings that higher income households were more likely to own a computer and have online access than were lower income households, and Caucasian American households were more likely to own a computer than were African American and Hispanic American households. Ownership of a video game system, however, was more prevalent in low-income households than in high-income households. Access to educational content is confounded with socioeconomic status (SES), with almost all educational content available on a computer platform rather than a video game platform. The interplay behind the socioeconomic forces—income, education, and ethnicity—that drive the digital divide is complex.

A review of the current literature revealed that the digital divide has endured. Among high-income households (earning an annual income of more than $75,000), 93% own computers, compared with 77% of middle-income households (earning $30,000-$75,000) and 30% of low-income (earning below $30,000) households. Income was a significant factor in ownership of all media except for video games (Woodard & Gridina, 2000).

Similarly, 1998 Census data indicated that computer access was related not only to income, but also to parent education and ethnicity (Becker, 2000). Most children (91%) in families in which parents had at least a master's degree had a home computer, compared with 16% of those whose parents had not graduated from high school. Even among families with similar income levels and parent education,

African American and Hispanic American children were less likely to have computer or internet access than were other children. Children's access to a home computer was further related to their parents' experiences with a computer at work: Those with both parents who used a computer at work were more likely to have access than those with no parent using a computer at work, even after accounting for SES. Becker (2000) further differentiated between access per se and the quality of access (i.e., whether the computer had five features of functionality—a hard drive, CD ROM drive, printer, modem, and mouse), and found income, education, ethnicity, and parents' work-based experiences with a computer to be strong predictors of quality of access. Thus, the inequalities in access, compounded by inequalities in computer functionality, continue to magnify the digital divide.

SES was associated not only with access, but with activities that children performed on the computer. Parents who had computer experience at work appeared to help children their children with many computer applications. Even within families that had a computer, children's activities varied by SES: More children in higher-SES households reported using the computer for all six activities surveyed compared with those in lower-SES families: school assignments, email, graphics or design, word processing, educational programs, and games than were those from lower-SES homes, with the widest SES gap being in word processing (Becker, 2000). Thus, it appears that SES disparities lay not in the activities performed on the computer, but in levels of use across all activities.

Smaller-scale studies confirmed the disparity in internet use between children of different SES (Borzekowski & Rickert, 2001). More teens from advantaged backgrounds used the internet with higher frequency than did those from disadvantaged backgrounds. Although few students from either advantaged or disadvantaged backgrounds reported being uncomfortable with the internet, more advantaged-students reported being very comfortable with the internet than did disadvantaged students (Borzekowski & Rickert, 2001). Points of access also differed by SES: Youth from higher SES were more likely to have multiple access points to the internet than were lower-SES youth, and almost all (97%) of the higher-SES youth reported accessing the internet from home, compared with half (52%) of the lower-SES youth.

Community effects tended to aggravate family-level SES differences. Children who lived in lower-SES households were also likely to be part of poorer neighborhoods, where they were unlikely to have access to a computer through a neighbor or friend compared to children in higher-SES neighborhoods (Becker,

2000). Increased public and private efforts to provide access through libraries and community technology centers could improve public access to the internet, and be an equalizer among children of different SES (Borzekowski & Rickert, 2001; Shields & Behrman, 2000). Whether these centers would provide age-appropriate activities for children, however, remains in doubt (Shields & Behrman, 2000).

There is speculation that the availability of more affordable equipment that provided online access (e.g., internet appliances and internet-ready computers, handheld devices, digital set-top boxes, and video game systems) raised possibilities of access for low-income families. It is improbable that these appliances would penetrate low-income households, and if they did, they would create disparities of a different kind: The wealthy would have access to computers with premium functionality, whereas the poor would use lower-end hardware with minimal functionality (Shields & Behrman, 2000).

In sum, the digital divide has become more than simply a question of access. There are socio-economic differences in the quality and functionality of the hardware and software, and in children's use of that technology. Future research must examine the Divide with these aspects in mind rather than merely focusing on access or ownership.

3.0 Cognitive Development and Learning

Interactive media are rapidly converging and presenting children with new potentials for learning. In this age of media convergence, platforms are likely to be less important than the activities performed in influencing cognition. Thus, in this update, we examine the relations between interactive media and cognition across various platforms (computer software, video games, the internet). The key frameworks for studying the effects of interactive media on cognitive development and learning were highlighted in the 2000 report. Learning results as a confluence of the affordances of technology, the child's own inclinations and experiences, and the context of use. Drawing from theories of media socialization, we emphasized that learning is social and is grounded in specific socio-cultural situations. Learning is thus founded on interaction. Drawing from both Vygotskian and Piagetian theories, the concepts germane to this notion are (a) situated knowledge, (b) features of computer software as scaffolding for learning, (c) inquiry, (d) dialogue, and (e) framing.

Few published studies have used these concepts to guide analyses, but some have recognized the usefulness of Vyogtsky's Zone of Proximal Development (ZPD) as an approach to designing educational software. The ZPD is the difference between the child's actual level of development and the higher level of potential development that is possible under the guidance of a more competent adult or peer. Interaction and cooperation with others in their environment triggers learning processes in children that would not otherwise develop. Using the ZPD as a guiding principle—wherein collaboration or assistance from a more able member of one's culture is an integral part of learning—Luckin (2001) included the computer system (rather than a person) as a source of collaborative support or scaffolding for the learner. Expanding on the notion of ZPD, Luckin added the concepts Zone of Available Assistance (ZAA) and the Zone of Proximal Adjustment (ZPA) as valuable ideas for the design of educational software. ZAA refers to the quality and quantity of collaborative assistance offered by the system; ZPA pertains to the selection of the appropriate form and amount of assistance for the educational situation. The goal of the software designer, proposed Luckin, is to enable the program to provide high quality and quantity of assistance (i.e., maximize ZAA), and provide the means of targeting the appropriate form and amount of assistance (ZPA) that fits as closely as possible to the learner's Zone of Proximal Development.

In her analysis of the interactions that resulted in learning and the software-design systems that promoted aspects of interaction and collaboration, Luckin (2001) also highlighted the importance of

individual differences in children's (10- and 11-year-olds) interactions with the computer software. Profiles of interaction could be classified along the dimensions of busy-quiet (i.e., number of actions taken), exploration-consolidation (i.e., the extent to which the child's action led her to experience more complex or abstract information), and hopper-persister (i.e., the extent to which the child switched from one type of action to another). There was some evidence that children of different abilities exhibited different interaction profiles, and the profiles were predictive of learning gains. Children also varied in the effectiveness of their collaboration (the number of instances and level of help features used) with the software. Those who used lots of deep support were children of average to high ability and who showed above-average learning gains. Gains were modest to below average for children who used lots of shallow support, little deep support, or little shallow support. Almost half the children belonged in these latter groups, suggesting that children often did not use help available to them and did not assume more challenging activities on their own (Luckin, 2001). Providing them with the means to do so was thus not a sufficient condition for learning.

The importance of considering what the child brings to the interactive experience has often been overlooked in the literature. For instance, whether children (2nd and 5th graders, $N = 127$) implementing strategies or behaviors that facilitate learning (i.e., being process-oriented, such as concentrating on completing the current level and advancing to the next), rather than on the outcome or product of learning (e.g., winning the game), predicted their performance in a video game, *Sonic the Hedgehog 2* (Blumberg, 2000). Children's adoption of process-oriented goals, in addition to their age and gaming experience, interacted to affect video game performance (Blumberg, 2000).

Further, the way in which children frame their experiences with computer technologies arises out of the interplay among the child's intentions, goals, and the affordances of the equipment (Sutherland, Facer, Furlong, & Furlong, 2000). Computers come to be incorporated into an already established social space in the home, and this social context affects children's engagement with new technologies by, for instance, influencing how they perceive the computer's potential and what computing activities (e.g., homework vs. games) were given priority in the household (Sutherland, Facer, Furlong, & Furlong, 2000). Thus, children are active in defining the role of computer technologies in their lives.

Anderson (2001), writing with reference to learning from Web-based courses, emphasized the importance of considering characteristics of both learners and the technology that predict successful Web-based

learning. Important learner characteristics include personality dimensions (ambiguity tolerance, anxiety, field dependence/independence, active/passive learners, and locus of control), learning style (depth of cognitive processing and preferred instructional modality—verbal or imagery), and executive cognitive processes (metacognition, self-regulation in learning, and motivation). Other pertinent factors include prior experience, knowledge, and attitude. These individual characteristics interact with design elements of the Web course (scaffolding, interim feedback) to affect outcomes, which in turn feed back into the learner's attitudes toward and knowledge of the material (Anderson, 2001). Current theoretical models have not yet accommodated the consequences of such reciprocity. This leads us to another major gap in the literature highlighted in the 2000 compendium: the definition of interactivity itself.

In a chapter examining the concept of interactivity, Vorderer (2001) revealed different conceptions stemming from the fields of communication, sociology, and computer science, resulting in some confusion in arriving at a definition of interactivity (Vorderer, 2001). Presently, discussions of interactivity have underscored new technologies' capacity to respond to users, but current theoretical models do not allow for the potential of users interacting with content (Vorderer, 2001).

As others have highlighted, the heart of interaction lies in building knowledge through dialogue (i.e., listening as well as responding), and it is important to know how children are interacting with these media and what they are learning from them in order to ascertain whether these experiences are cognitively enriching (Lerner, Singer, & Wartella, 2001). As some have pointed out, interactive media may be something of a misnomer, for interactivity cannot exist without the user (Vorderer, 2001). In the end, the extent to which interactive technologies enhance or impede cognitive development is a result of the way in which they are used (Tarpley, 2001).

Despite these shortfalls in researchers' understanding of interactive technologies, they have been embraced by many children, parents, and educators with enthusiasm. There are, however, others who challenge the notion that the use of these technologies benefits children at all. In an extensive report on children and computers, the Alliance for Childhood contended that computers could hamper physical, emotional and intellectual development in children (Cordes & Miller, 2000). Computer use, the authors assert, is incompatible with young children's developmental needs. Regarding cognitive development in particular, the Alliance argued that young children learn by being fully engaged—physically and emotionally—in the world around them, and that content delivered through computers are poor

substitutes for these experiences. The authors emphasized that for young children, learning is rooted in hands-on experiences, whereas computer-based learning is based on an information processing or mechanistic model. Moreover, computer use was said to interfere with self-motivation, imagination, creativity, and delay of gratification. Overemphasizing computer use in education creates the risk of rushing children through their childhoods (Cordes & Miller, 2000). There is, however, no evidence to substantiate these claims.

The most recent studies and evaluations of interactive media have added little to our understanding of its influences on children's cognition. Part of the difficulty in studying the effects of interactive media lie in the fact that the technologies themselves are evolving rapidly (Biocca, 2000; Tarpley, 2001). The internet, for instance, has doubled in size every year since 1990, and interactive interfaces, transmission systems, and content will continue to evolve (Biocca, 2000). Currently, we know little beyond what previous research has indicated; namely, that interactive games can have some impact on children's representational skills (see Subrahmanyam, Greenfield, Kraut, & Gross, 2001; and Subrahmanyam, Kraut, Greenfield, & Gross, 2001, for reviews), but we don't know what specific skills might be evoked with interactive-game play. There are glaring gaps in our knowledge of these effects, and a review of recent literature highlights the dearth of empirical studies on how computer use in the home environment affects children's cognitive development. Research that addresses this question needs to encompass multiple methodologies. Small ethnographic studies are needed to examine what children actually do with media, and experimental studies are necessary to evaluate their impact on children's development in both the short and long term (Lerner, Singer, & Wartella, 2001). Also needed is a road map to children's interactive experiences to get at the content that is being promoted for both commercial and entertainment purposes. The Center for Media Education has offered such a road map for teen Web sites (Center for Media Education, 2001a) and more is needed for the variety of experiences that children encounter with interactive media.

4.0 Social Development

Media provide important socialization influences on those who use them. As demonstrated in the 2000 report, the literature suggests that television and interactive media play an important role in children's development.

The 2000 report looked at socialization influences of interactive media in three broad areas: the social context of media use (parental and peer influences), social relationships and identity development, and the effects of violence on social development. While there have been very few new empirical studies examining the social context of interactive media, most of the new data come from looking at how interactive technologies can be used to aid in children's and adolescents' identity development. Violence continues to be a widely studied area of research and of public concern. In the past few years, several new empirical studies and meta-analyses were conducted looking at violent media and its effects on children's development and behavior.

4.1 Social Context & Collaboration

Children use media within a social realm. Peer and parental influences have been examined fully in the last review of literature (see Wartella, O'Keefe, & Scantlin, 2000). What was learned from the literature in the 2000 report and what still holds true is that teenagers are heavier users of the internet and its services than are their parents (Montgomery, 2000; Subrahmanyam, Kraut, Greenfield, & Gross, 2001). Teenagers are also more apt to help their parents with technology than vice versa (Subrahamanyan et al., 2001). In addition, parental attitudes, support, and encouragement influence their children's adaptation to quality interactive materials (Wartella, O'Keefe & Scantlin, 2000).

A positive feature of interactive media within peer interactions is the moments of teaching it affords the users. In a small-scale study of 8- to 16-year-old children, the researcher observed many of the children teaching each other how to interact within the graphical world that was created (Thomas, 2000). Children teaching and helping one another in a cooperative manner can be the first step in an important lesson of collaboration.

4.2 Social Relationships

With the proliferation of new media technologies, many more possibilities exist in the form of communication. No longer do people have to be in the same room or on the telephone with one another to be communicating; now there exists a wealth of new options to share information, chat, or even play games. For example, a scrabble game can be played between two people in the virtual world, without the necessity of a tangible board and two people staring at each other from across a table.

For children and adolescents who are constructing the adults they will become, how do these new interactive technologies bear on their identity formation? Interestingly, there is still fear that the use of the internet will isolate individuals from normal face-to-face social interaction. The initial findings from the *HomeNet* study seemed to suggest that the introduction of the internet led children to become socially isolated, depressed, and lonely (see Wartella, O'Keefe, & Scantlin, 2000 for review). But, in looking closely at the *HomeNet* data, McKenna and Bargh (2000) contend that after two years of being on the internet, children's local social network declined, but their distant social network actually increased over the same two-year period. The cause for this change in social networks is unknown, but the negative impact that the internet was initially charged with seems to be moderated. Follow-up analyses on the same *HomeNet* sample three years later showed that children experienced a decline in depression from the initial findings, and that loneliness was no longer associated with the internet, as it was when the internet was novel to them (Jordan, 2002; Kraut, Kiesler, Boneva, Cummings, Helgeson, & Crawford, 2002).

It is therefore reasonable to hypothesize that the internet may serve different functions for different people (Gross, Juvonen, & Gable, 2002; McKenna & Bargh, 2000). In a study of 130 eleven- to thirteen-year-olds, the authors found that children who reported feeling socially isolated or lonely in school were more likely to communicate online with people they did not know well. Well-adjusted children, on the other hand, used the internet as another means to communicate with their everyday peers (Gross, Juvonen, & Gable, 2002). More research is needed to ascertain whether the lonely children who use the internet as their primary means of communication are making up for the lack of companionship in their off-line lives. Can the internet replace human interaction? The new research suggests that the internet does not necessarily lead to social isolation and loneliness, but that those individuals who experience

those feelings use it for a different purpose compared to those who do not. Future research needs to address the different functions of the internet for different children.

4.2.1 Identity Development in Virtual Environments

Identity formation is an ongoing process that children and adolescents are constantly working through. With new technologies that are offered today, children have the opportunity to explore their identities in different ways. The Pew Internet and American Life Project mentioned earlier in this report found that 24% of teens reported to being a different person when communicating online (Lenhart, Rainie & Lewis, 2001). About half of the teens surveyed said the internet improved their relationship with friends while about a third mentioned that the internet was a place to meet new friends (Lenhart, Rainie & Lewis, 2001).

Some critics would contend that because the internet as well as other "high-tech toys," such as interactive dolls and pets, are very specific in the ways in which they guide children's behavior, the exploration of personal identity and alternate roles are diminished and children's imaginations are limited (Kritt, 2001; Cordes & Miller, 2000). Others would argue that children, and adolescents in particular, use interactive media to try out different aspects of themselves in both helpful and unhelpful ways (see Wartella, O'Keefe, & Scantlin, 2000 for review).

The current research on identity development using multimedia has focused on the ways in which children and adolescents are using the media to their advantage. This is an important first step in understanding its full potential. In the small study mentioned previously, Angela Thomas (2000) looked at how school-aged children were interacting with each other in a graphical world she created. The author found that children were using this world to talk about the ups and downs of their lives. In addition, the children seemed to experiment with the way they represented themselves to others. Participants were able to choose how their character (called an avatar) was depicted on the screen and in writing. By looking at the visual texts as well as the graphical representations of the characters the children created, a representation of each person's identity emerged. Children typically talked about their avatars and wanted them to align with popular culture and fashion. For example, many avatar themes included sports, music, and popular computer games. Also, a trend emerged to spell one's screen

name incorrectly (e.g., Klown for clown) in order to be "cool". It seems reasonable that children are using the technology to play out different ideas of themselves.

In another small observational study ($N = 8$) of how children use technology to explore their identities, Bers and Cassell (2000) designed a program that allowed fourth- and fifth- grade children to author their own stories. Within this program, children were asked to design a sage that would listen to and offer responses to their stories. During observations of these storymaking possibilities, the authors noted that children designed their sage to be someone to whom they would tell their problems. In addition, in developing the characters to tell the stories, the children were playing with different notions of themselves. The characters, in essence, were different formations of their own personality coming through in the form of a story.

In a larger study of 303 elementary, middle, and high school students, children were asked to describe themselves, their favorite character, and their ideal self. The authors found that children of all ages used similar characteristics when describing their ideal self and their favorite video-game character (McDonald & Kim, 2001). The authors contended that these identifications "may have important implications for their emotional well being as well as for the development of their personality" (McDonald & Kim, 2001, p. 254). The causal direction is difficult to ascertain, however: Do children choose to play games in which the characters exemplify their ideal self, or do children define their ideal self based on the characters they see depicted in their favorite games? While it is impossible to answer this question from the current research, prior research on television would seem to suggest that children seek out characters similar to themselves (Harwood, 1999; Hoffner & Cantor, 1991). Based on this finding, we would hypothesize that the former is true: children choose to play games in which the characters exemplify their ideal selves. This issue it is worth further exploration in relation to children's choices of games.

Based on research over the past several years, we know that children and adolescents talk about their lives via the internet (Bers & Cassell, 2000; Thomas, 2000), they are interested in creating "cool" images of their characters (many children added their own graphics, animations, or drawings, to enhance and personalize their avatars; Thomas, 2000), and they also identify with certain characters in interactive games (McDonald & Kim, 2001). Using these avenues provides children with an outlet to express who they are or who they want to become. What is still unknown is how this experimentation aids children in forming their identities, especially the lonely, socially isolated individuals. Do the interactive

technologies take away from important face-to-face interactions or does it provide an additional outlet for children to express themselves? What is clear is that children are able to experiment with different facets of themselves via the new media. Calvert (2002) believes that, "As a society, our challenge is to help young people navigate their real life and their online 'selves' to forge a constructive, unified personal identity" (p. 68).

4.3 Violence and Aggression

Violent media use has been a topic of public concern and of academic research for many years. The previous compendium laid out the theoretical framework for studying violence in the media (for review see Wartella, O'Keefe, & Scantlin, 2000). Are children more affected by the violence portrayed in interactive games because they are more in control of the characters committing the violence?

4.3.1 Research Evidence

In the last few years many new studies have assessed the link between violent interactive media and aggression in children (see Bensley & Van Eenwyk, 2001 for recent review). In addition to the correlational (Buchanan, Gentile, Nelson, Walsh, & Hensel, 2002; Collwell & Payne, 2001; Funk, Buchman & Germann, 2000) and experimental research (Fleming & Rickwood, 2001; Robinson, Wilde, Mavracruz, Hydel, & Varady, 2001), meta-analyses also were conducted (Anderson & Bushman, 2001; Sherry, 2001). Based on the paucity of longitudinal studies looking at violent games, little is known about the long-term implications of playing such games.

As in the 2000 report, more recent correlational studies also found a link between aggressive behavior and violent game-play. A study of 204 twelve- to fourteen-year-old children measured the years of computer-game play, the frequency of play, and the duration of play along with aggression measures. The authors found that aggression was correlated to all the game-play measures, but was more strongly correlated with frequency of play than with duration of play or years of play (Collwell & Payne, 2001). In another study of 364 fourth- and fifth-grade children, preference for violent games was associated with lower scores on the behavioral conduct measure (Funk et al., 2000). The links in both studies was stronger for boys than for girls.

In addition to the physical aggression that was associated with violent video-game play, relational aggression was linked as well (Buchanan et al., 2002). In a study of 219 third-, fourth-, and fifth-graders, the authors found that relationally aggressive children (defined as children who hurt by leaving others out or spreading rumors about another) not only viewed more violent television, but also played more violent games. It seems that violence can have effects not only physically, but emotionally as well.

Self-esteem is also related to violent video game play. Funk et al. (2000) measured self-concept in their sample of 364 fourth and fifth graders by using the Harter Self-Perception Profile that measures scholastic and athletic competence, social acceptance, physical appearance, behavioral conduct, and global self-worth. Boys and girls who preferred violent games had a lower self-evaluation of their own behavior than those who did not like such games (Funk et al., 2000). Collwell & Payne (2001) found that boys who played more frequently had lower global self-esteem than those boys who played less frequently. Self-esteem in their study was assessed using Rosenberg's (1965) 7-item self-esteem scale. While self-esteem was measured in different ways by the two studies, the results are somewhat consistent; those children who both prefer more and play more violent video games have lower concepts of their self-worth, particularly in the realm of their own behavior, than those who do not prefer or do not play as frequently.

Just as the correlational studies have found links between violent content and aggression, so too has experimental studies. Fleming & Rickwood (2001) assessed the relation between violent video games and children's mood. Seventy-one children (8 to 12 years old) either played a violent video game, a non-violent video game, or a paper-and-pencil game. Researchers measured heart rate, self-reported arousal, aggressive mood, positive affect, and general mood. Heart rate and self-reported arousal were not correlated with one another but both were correlated with violent game-play. Those children who played the violent video game reported more arousal and had a higher heart rate than those who played the non-violent video game or the paper-and-pencil game. In addition, general mood was more positive after playing both versions of the video game in comparison to the paper-and-pencil tests. No effects were found for aggressive mood or positive affect. Based on the ethical considerations of having 8 to 12 year old children play a violent game, a mild game was chosen. Perhaps children did not differentiate both versions of the video game because the violence was not great enough. There could be a threshold of violence that exists to "push" children over the edge of acting or feeling aggressive.

In a study aimed to reduce violent media usage, some 8- and 9-year-olds were given a six-month lesson on doing just that (Robinson et al., 2001). Lessons included initially self-monitoring and reporting on their use of media. The children were then challenged to turn off all media for a period of 10 days. After this period, they were encouraged to create a media budget of only 7 hours per week of television, videotapes and video games. Compared with the control group, which did not receive the media-reduction lesson, those children in the experimental group had significant decreases in peer ratings of aggression and observed verbal aggression after reducing their overall media usage, not just specifically violent media. No significant differences were found for observed physical aggression, perceptions of a mean and scary world, or parent reports of aggressive or delinquent behaviors.

Along with the correlational and experimental studies looking at violent content and aggression in children, two major meta-analyses were conducted. Anderson and Bushman (2001) analyzed 33 separate studies of violent video games on children's behavior and found the overall effect size to be positive and significant, $r = .19$: the use of violent games resulted in an increase in aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and a decrease in prosocial behavior (Anderson & Bushman, 2001). Sherry (2001) also conducted a meta-analysis on 25 studies and found the overall effect size between video game play and aggression to be positive and significant, $r = .15$, with a larger effect size for those games containing violence against fantasy and human characters ($r = .15$) in comparison to sports violence ($r = .08$). Both meta analyses have shown an increase in effect size over time between aggression and violent game content (Sherry, 2001; Bushman & Anderson, 2001) suggesting that either the content is getting more violent or the content is affecting the players more or both.

The results are clear: Playing violent video games is positively associated with all types of aggression, including physical, physiological, and relational; and negatively associated with prosocial behavior. While both meta-analyses found comparable effect sizes in the studies analyzed, the conclusions drawn from them were very different. While neither meta-analysis specifically assessed the effect size of television in comparison to interactive games, Sherry (2001) contended that there was only a small effect of video game play on aggression in comparison to that of television (Bensley & Van Eenwyk, 2001). His conclusion was based on converting the overall effect size for interactive games, $r = .15$, into a Cohen's $d = .30$. He mentioned that another study, Paik and Comstock (1994) found the effect of television violence on aggression to be $d = .65$. Anderson & Bushman (2001) on the other hand, warn that violent video games pose a public-health threat to children and it is greater than that of television (Bushman &

Anderson, 2001). What both groups of researchers do agree on is that longitudinal research is needed in this area to assess whether repeated exposure to violent video games increases long-term aggression.

At present, little is known about the long-term effects of playing violent games. Longitudinal designs are needed to investigate whether the violent content in games can affect personality or behavior. Violent content in interactive technologies has important implications for behavior, but that link has not been specifically measured in comparison to television. These findings will have practical implications for game design and parental monitoring and screening, as well as policy repercussions, including regulation (both at the industry and government levels) and possibly a re-examination of the current ratings system.

4.3.2 Policy Initiatives: Rating Systems

In order to protect children from potentially harmful game content, the Entertainment Software Rating Board (ESRB; www.esrb.org) established a ratings system in 1994. There are five age-based rating categories given to games: Early Childhood (EC), Everyone (E or K-A), Teen (T), Mature (M), and Adults Only (AO; for a more specific ratings review see Wartella, O'Keefe, & Scantlin, 2000). These ratings were created with the intent to better inform parents about the content of games before they buy them. The ratings are accompanied by content descriptors that describe the games in more detail. While previously focused on types and levels of violence, the updated content descriptors now include sexual themes, language, and the use of drugs and alcohol. While software companies are not mandated to submit their products to the ESRB, all or most games today do have a rating (Walsh, 2001). That is good news. But, despite this intention to inform, 90% of teenagers surveyed reported that their parents never checked the video game ratings before being allowed to purchase it (Walsh, 2000).

The ESRB has also started to rate online games and websites (called the ESRBi ratings) with an age-based system and content descriptors similar to those for interactive games. In addition, content descriptors for online content include other areas of concern, such as information collection and hate speech. As with games, the ratings for online content are voluntary. Unlike games, however, very few websites (263, at last count) have submitted their content to the ESRB for evaluation.

The findings from the 2000 report have endured. There is a discrepancy between the rating system and parental perceptions of what they would deem appropriate. In a study assessing the validity of the

current rating system for movies, television, and interactive games, parents agreed with the industry ratings if it was rated unsuitable for children (Walsh & Gentile, 2001). But for those media that were rated as suitable for children, parents tended to believe the industry rating was too lenient and that the games warranted additional classification. In particular, games rated as appropriate for adolescents seemed to contain more violence than the parents were comfortable with (Walsh & Gentile, 2001). As an example of this leniency, of 55 video games that were rated "E" for everyone ages six and older, 64% involved intentional violence and 49% depicted death from violence. Of those E-rated video games that had violence, 44% did not mention the violent content in the content descriptor (Thompson & Haninger, 2001). These findings indicate that many E-rated games contain violence and that if violence is not in the content description it does not mean it is violence-free.

While we have come a long way, we still have a way to go. Parents seem to believe the industry ratings are too lenient with respect to the level of violence appropriate for everyone. In a study, 55 parents rated 166 computer games with a green light (product is appropriate for children), yellow light (parents should use caution when allowing their children to use this product), or a red light (product is inappropriate for children; Walsh, 2001). The results indicated that even some products that were rated an "E" for everyone were judged as inappropriate for children ages 3 to 17. More specifically, a product rated a "T" for teen was given a red light by 18% of the parent-raters and a yellow light by 39% of the parent-raters when judging the appropriateness for 13- to 17-year-olds. The authors note that a universal rating system across media platforms such as television, movies, and games would serve to improve the understanding of the system as well as to take away the temptation from the industry to down-rate a product in order to sell more copies.

5.0 Health & Safety

In the 2000 report, this section focused on the positive potential of the internet for accessing medical and health information, concerns about the impact of interactive technologies on children's health (e.g., seizures, addiction, weight gain), and advertising and privacy on the internet. To date, little systematic research has been conducted to either legitimize or question the concerns on interactive media's health impact, although concerns continue to abound (e.g., Cordes & Miller, 2000).

5.1 Online Privacy and COPPA

New studies have emerged out of efforts to regulate the online collection of personal information from children. Since the 2000 report, Congress authorized the Federal Trade Commission (FTC) to implement the Children's Online Privacy Protection Act (COPPA). The Act went into effect on April 21, 2000. As summarized by the Annenberg Public Policy Center (Turow, 2001), COPPA stipulated that Web site operators who collect information from children under 13 must: (a) provide parents with notice of their "information practices;" (b) obtain a parent's consent before they can collect, use, or disclose personal information for children; (c) provide a parent with the means to review the personal information collected from the child; (d) provide a parent with the opportunity to prevent further collection of information as well as the further use of already-collected information; (e) limit collection of personal information for a child's online activities to "information that is reasonably necessary for the activity;" and (f) establish and maintain reasonable procedures to protect the confidentiality, security and integrity of the personal information collected. The FTC also set rules about the placement of links to sites' policy, as well as the content of the policy (Turow, 2001).

Pre-COPPA, a 1998 assessment of recommended Web sites for children (Cai & Gantz, 2000) revealed that of the 166 sites surveyed, over half collected personal information from children; 27% of those that gathered information requested parental permission (but only 3%--three sites—asked written permission), but most of the requests (70%) appeared on a page different from the one where data were being collected. After the FTC released a report about online information collection practices, the researchers found that Web sites provided more disclosure statements, and more sites had disclosed their policy on information use. Disclosure statistics, however, were still low; the Web sites had an average of four statements, but only 14% revealed that they were going to collect personal information or gave ways

to prevent that information from being used. Only a third of Web sites (37%) provided links to their privacy statements. Thus, children were not well protected online. The sites that collected information from children made little effort with disclosure or to seek parental permission (Cai & Gantz, 2000).

With the enactment of COPPA came three in-depth surveys—by the FTC, the Annenberg Public Policy Center (APPC) and the Center for Media Education (CME)—to evaluate Web sites' compliance with the Act. In November 2000, the APPC surveyed 162 popular Web sites that appealed to children to assess their compliance with the new policy (Turow, 2001). Ten percent (17 sites) of the sites did not follow the FTC rule requiring sites that collected information to place a link to their privacy policy on the homepage; the 90% compliance rate was considered high. As for the clarity and prominence of the privacy link, 53% of sites had links that were considered prominent or very prominent, and 19% had links that were not prominent. Although most sites provided information on how the information collected would be used, compliance with other requirements were lower. For instance, almost a third of the sites that shared information with third parties did not tell parents of their right to forbid that sharing. The author also highlighted the difficulty with simply understanding the privacy policies stated on the Web sites; reading the policies to assess their compliance with COPPA was an arduous task, even for trained readers.

With the first anniversary of COPPA, the FTC evaluated 144 sites targeted at children under 13 to evaluate their compliance with the Act (Federal Trade Commission, 2002). The FTC noted the types of personal information the sites collected, the activities offered, whether there was an indication that the site had parental consent mechanisms in place, whether the sites provided links to their privacy policy from the home page and from at least one information collection point, and evaluated the content of the privacy policy itself. Of the 144 sites, 72% collected personal information from children, the most common of which were the child's email address and name, and another person's email address. The FTC staff concluded that most of the sites that collected personal information (84% of sites) appeared to have done so to obtain consent or would otherwise fit under one of the Act's exceptions (e.g., using information for limited purposes and deleting the information). Most websites (89%) that collected information posted privacy policies; 82% linked to the policy from the home page, and 76% did so on at least one page where personal information was collected. Of the sites surveyed, only 47% of those that collected information had parental consent or notification mechanisms; another 18% collected information that could fall under one of the exceptions and would not necessitate parental consent. The remainder (35% of sites) collected too much information to fall under any exceptions. In terms of the

content of the privacy policy itself, the FTC found that most sites (over 90%) complied with rules on the disclosure of the types of information collected and how that information would be used. Compliance with the disclosure of parental rights, however, was poor—only 52% of sites made the appropriate disclosures. Thus, while most websites observed COPPA rules on providing a privacy policy and disclosing how the information collected would be used, other COPPA provisions—particularly those related to parental consent—were followed less faithfully.

The Center for Media Education (CME) conducted a similar evaluation of the success of COPPA (Center for Media Education, 2001b). Studying a sample of 153 top commercial Web sites directed at children under 13, the CME found that COPPA has spurred changes in Web sites' data collection practices. Web sites had limited the amount and type of information (e.g., name, postal address, phone number, age) collected from children, and there was a three-fold increase in the posting of privacy policy information explaining sites' data collection practices. A few sites found innovative solutions (e.g., anonymous registration) that allowed children to interact with site content without revealing personal information. Overall, however, the Center found that many sites were not doing their best to comply with the provisions: Most (66%) did not place links to privacy policies in "clear and prominent" places, and only some sites (38%) obtained parental consent in accordance with key provisions. Further, researchers pointed out that in trying to discourage children under 13 from entering personal information, some sites might inadvertently encourage children to falsify their ages.

In response to the findings from the studies, researchers at the APPC and CME made several recommendations. Those at the APPC (Turow, 2001) suggested the FTC should require Web sites that have to comply with COPPA to display a "K" (for "kids") on the home page in a specific place, so that parents can tell children to only interact with sites that have a "K" on them. Further, the FTC should push for children's Web sites to collaborate in creating a standard format for the required privacy information so that parents can assess sites easily. The CME proposed that Web site operators limit their data collection, provide online activities that do not necessitate personal information from participants, review and make simple changes to their privacy statements and data collection procedures, and reevaluate their age screening methods. Further, policymakers should consider the following: monitor sites' compliance with COPPA and take action against violators; simplify and clarify COPPA and address shortcomings; address how computer security violations may jeopardize children's privacy; and promote the awareness of online privacy issues among teachers (Center for Media Education, 2001b).

6.0 Conclusions

The potentials that interactive media offer to children's development are not well understood. While ongoing research continues to add to this understanding, this update of the literature has revealed continuing gaps in our knowledge that need filling. We know little about very young children's (preschool and younger) use of interactive technologies and the impact of such use, despite the fact that even babies and toddlers spend significant time with these media. Understanding young children's media use is not only necessary to integrate research in a developmental framework; it is also particularly important in light of the American Academy of Pediatrics' recommendation that screen time be discouraged for children under the age of 2.

In terms of content, researchers have to move beyond studying violence to, among other things, educational content (both cognitive and prosocial), and the activities performed and content of messages exchanged online. These questions have to be asked not only of interactive media that have been the focus of research thus far (i.e., video games and computer software, internet), but also of new appliances such as wireless technologies and interactive toys. In other words, researchers should analyze content and interactivity across platforms. This brings forth the problem that interactivity itself—a feature thought to distinguish these electronic media from their predecessors—remains ill defined. Currently, it is used as a "catch-all" word to describe anything from game play to surfing the Web to clicking on the computer mouse. A classification system that examines the various levels and types of interactivity would be a useful—and much needed—foundation in linking specific interactive features to cognitive processing and outcomes.

What has also been apparent is the lack of a theoretical framework that might guide research in this area. Interactive technologies traverse platforms and combine features formerly thought to be unique to one medium—the text in print media, audio and music in radio, audio-visual information in television—with the added complication of user control and input. What is needed is an overarching framework drawing from research in these areas that might inform studies on how children use these media, as well as their effects. Thus, as we gather empirical evidence to answer these research questions, we should also focus on theories that might drive this body of research.

References

Anderson, C. A., & Bushman, B. J. (2001). Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affects, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science, 12,* 353-359.

Anderson, M. D. (2001). Individual characteristics and Web-based courses. In C. R. Wolfe (Ed.), *Learning and teaching on the World Wide Web* (pp. 47-73). San Diego, CA: Academic Press.

Becker, H. J. (2000). Who's wired and who's not: Children's access to and use of computer technology. *The Future of Children, 10,* 44-75.

Bensley, L. & Van Eenwyk, J. (2001). Video games and real-life aggression: Review of the literature. *Journal of Adolescent Health, 29,* 244-257.

Bers, M. U., & Cassell, J. (2000). Children as designers of interactive storytellers: "Let me tell you a story about myself. . ." In K. Dautenhanhn (Ed.), *Human Cognition and Social Agent Technology* (pp. 61-83). Philadelphia, PA: John Benjamins.

Biocca, F. (2000). New media technology and youth: Trends in the evolution of new media. *Journal of Adolescent Health, 27,* 22-29.

Blumberg, F. C. (2000). The effects of children's goals for learning on video game performance. *Journal of Applied Developmental Psychology, 21,* 641-653.

Borzekowski, D. L. G., Rickert, V. I. (2001). Adolescents, the Internet, and health. Issues of access and content. *Journal of Applied Developmental Psychology, 22,* 49-59.

Buchanan, A.M, Gentile, D.A., Nelson, D.A., Walsh, D.A, Hensel, J (2002). What goes in must come out: Children's media violence consumption at home and aggressive behaviors at school. Minneapolis, MN: National Institute on Media and the Family. Retrieved August 2002 from http://www.mediafamily.org.

Buckingham, D. (2002). The electronic generation? Children and new media. In L. A. Lievrouw & S. Livingstone (Eds.), *Handbook of new media: Social shaping and consequences of ICTs* (pp. 77-88). London: Sage.

Cai, X., & Gantz, W. (2000). Online privacy issues associated with web sites for children. *Journal of Broadcasting & Electronic Media, 44,* 197-214.

Calvert, S. (2002). Identity construction on the Internet. In S. L. Calvert, A.B. Jordan, & R.R. Cocking (Eds.), *Children in the Digital Age* (pp. 57-70). Westport, CT: Praeger.

Calvert, S. L., Jordan, A. B., & Cocking, R. R. (Eds.). (2002). *Children in the digital age: Influences of electronic media on development.* Westport, CT: Praeger.

Center for Media Education. (2001a). *Teensites.com: A field guide to the new digital landscape.* Washington, DC: Center for Media Education. Retrieved March 3, 2002, from http://www.cme.org/teenstudy/

index.html

Center for Media Education. (2001b). COPPA—The first year: A survey of sites. Washington, DC: Center for Media Education. Retrieved June 13, 2002, from http://www.cme.org/children/privacy/coppa_rept.pdf

Children Now. (2000). *Girls and gaming: Gender and video game marketing.* New York: Children Now. Retrieved May 7, 2002, from http://www.childrennow.org/media/medianow/mnwinter2001.html

Children Now. (2001). *Fair play? Violence, gender, and race in video games.* New York: Children Now. Retrieved May 15, 2002, from http://www.childrennow.org/media/video-games/2001/

Colwell, J., & Payne, J. (2000). Negative correlates of computer game play in adolescents. *British Journal of Psychology, 91,* 295-310.

Cone, C. (2001). Technically speaking: Girls and computers. In. P. O'Reilly, E. M. Penn & K. deMarrais (Eds.), *Educating young adolescent girls* (pp. 171-187). Mahwah, NJ: Lawrence Erlbaum.

Cordes, C., & Miller, E. (2000). *Fool's gold: A critical look at computers in childhood.* College Park, MD: Alliance for Childhood. Retrieved April 25, 2002, from http://www.allianceforchildhood.net/projects/computers/computers_reports_fools_gold_contents.htm

Federal Trade Commission (April, 2002). Protecting children's privacy under COPPA: A survey on compliance. Retrieved July 2002 from http://www.ftc.gov/os/2002/04/coppasurvey.pdf

Fleming, M. J., & Rickwood, D. J. (2001). Effects of violent versus nonviolent video games on children's arousal, aggressive mood, and positive mood. *Journal of Applied Social Psychology, 31*, 2047-2071.

Funk, J. B., Buchman, D. D., & Germann, J. N. (2000). Preference for violent electronic games, self-concept and gender differences in young children. *American Journal of Orthopsychiatry, 70*, 233-241

The Future of Children: Children and Computer Technology. (2000). Vol 10 (2). Los Altos, CA: The David and Lucille Packard Foundation.

Girl Scouts of the USA. (2001). *The girl difference: Short-circuiting the myth of the technophobic girl*. New York: Girl Scouts of the USA. Retrieved March 9, 2002, from http://www.girlscouts.org/about/ResearchInstitute/reviews/girl_difference.html

Gross, E.F., Juvonen, J., & Gable, S.L. (2002). Internet use and well-being in adolescence. *Journal of Social Issues, 58,* 75-90.

Jordan, A. B. & Woodard, E. H. (2001). Electronic childhood: The availability and use of household media by 2- to 3-year olds. *Zero to Three, 22 (2),* 4-9.

Kraut, R., Kiesler, S., Boneva, B., Cummings, J., Helgeson, V., & Crawford, A. (2002). Internet paradox revisited. *Journal of Social Issues, 58,* 49-74.

Kritt, D. W. (2001). Technology's covert socialization of children: High-tech toys. *Journal of Thought,*

36, 53-61.

La Ferle, C., Edwards, S. M., & Lee, W. N. (2000). Teens' use of traditional media and the Internet. *Journal of Advertising Research, 40,* 55-65.

Lenhart, A., Rainie, L., & Lewis, O. (2001). *Teenage life online: The rise of the instant-message generation and the Internet's impact on friendships and family relationships.* Washington, DC: Pew Internet & American Life Project. Retrieved June 13, 2002, from http://www.pewinternet.org/reports/toc?aspReport=36

Lerner, C., Singer, D. G., & Wartella, E. (2001). Computers, TV, and very young children: What impact on development? *Zero to Three, 22,* 30-33.

Luckin, R. (2001). Designing children's software to ensure productive interactivity through collaboration in the Zone of Proximal Development (ZPD). *Information Technology in Childhood Education Annual, 13,* 57-85.

McDonald, D. G., & Kim, H. (2001). When I die, I feel small: Electronic game characters and the social self. *Journal of Broadcasting & Electronic Media, 45,* 241-258.

McKenna, K.Y., & Bargh, J.A. (2000). Plan 9 from cyberspace. The implications of the Internet for personality and social psychology. *Personality and Social Psychology Review, 4,* 57-75.

Montgomery, K. (2000a). Youth and digital media: A policy research agenda. *Journal of Adolescent Health,* 27, 61-68.

Turow, J. (2001). *Privacy policies on children's websites: Do they play by the rules?* Philadelphia: University of Pennsylvania, The Annenberg Public Policy Center. Retrieved March 10, 2002, from http://www.appcpenn.org/internet/family/privacyreport.pdf

Passig, L. & Levin, D. (2000). Gender preferences for multimedia interfaces. *Journal of Computer Assisted Learning, 16,* 64-71.

Robinson, T. N., Wilde, M. L., Navracruz, L. C., Farish Hydel.K., & Varady, A. (2001). Effects of reducing children's television and video game use on aggressive behavior: A randomized controlled trial. *Archives of Pediatrics & Adolescent Medicine, 155,* 17-23.

Sherry, J. L. (2001). The effects of violent video games on aggression: A meta-analysis. *Human Communication Research, 27,* 409-431.

Shields, M. K., & Behrman, R. (2000). Children and computer technology: Analysis and recommendations. *The Future of Children, 10,* 4-30.

Singer, D. G., & Singer, J. L. (Eds.). (2001). *Handbook of children and the media.* Thousand Oaks, CA: Sage.

Subrahmanyam, K., Greenfield, P., Kraut, R., & Gross, E. (2001). The impact of computer use on children's and adolescents' development. *Journal of Applied Developmental Psychology, 22,* 7-30.

Subrahmanyam, K., Kraut, R. E., Greenfield, P. M., & Gross, E. F. (2000). The impact of home computer use on children's activities and development. *The Future of Children, 10,* 123-144.

Subrahmanyam, K., Kraut, R., Greenfield, P., & Gross, E. (2001). New forms of electronic media: The impact of interactive games and the Internet on cognition, socialization, and behavior. In D. G. Singer & J. L. Singer (Eds.), *Handbook of children and the media* (pp.73-99). Thousand Oaks, CA: Sage.

Sutherland, R., Facer, K., Furlong, R., & Furlong, J. (2000). A new environment for education? The computer in the home. *Computers & Education, 34*, 195-212.

Tarpley, T. (2001). Children, the Internet, and other new technologies. In D. G. Singer & J. L. Singer (Eds.), *Handbook of children and the media* (pp.547-556). Thousand Oaks, CA: Sage.

Thompson, K. M., & Haninger, K. (2001). Violence in E-rated video games. *JAMA, The Journal of the American Medical Association, 286,* 591-598.

Turow, J. (2001). *Privacy policies on children's websites: Do they play by the rules?* Philadelphia: University of Pennsylvania, The Annenberg Public Policy Center. Retrieved March 10, 2002, from http://www.appcpenn.org/internet/family/privacyreport.pdf

Valkenburg, P. M., & Soeters, K. E. (2001). Children's positive and negative experiences with the Internet: An exploratory survey. *Communication Research, 28,* 652-675.

Villani, S (2001). Impact of media on children and adolescents: A 10-year review of the research. *Journal of the American Academy of Child and Adolescent Psychiatry, 40,* 392-401.

Walsh, D.A. (2002). Testimony Submitted to the Committee on Commerce, Science, and Transportation, United States Senate. Retrieved August 2002, from http://www.senate.gov/~commerce/hearings/0321wal1.pdf

Walsh, D. A., & Gentile, D. A. (2001). A validity test of movie, television, and video-game ratings. *Pediatrics, 107,* 1302-1308.

Wartella, E., O'Keefe, B., & Scantlin, R. (2000). *Children and interactive media: A compendium of current research and directions for the future.* Menlo Park, CA: Markle Foundation. Available at http://www.markle.org/news/digital_kids.pdf

Woodard, E. H., & Gridina, N. (2000). *Media in the home 2000: The fifth annual survey of parents and children.* Philadelphia: University of Pennsylvania, The Annenberg Public Policy Center. Retrieved January 19, 2002, from http://www.appcpenn.org/mediainhome/survey/survey7.pdf

Zero to Three: Babies, Toddlers, and the Media. (2001). Vol. 22(2). Danvers, MA: National Center for Infants, Toddlers, and Families.