Rachel Barr
Deborah Nichols Linebarger
Editors

Media Exposure During Infancy and Early Childhood

The Effects of Content and Context on Learning and Development

Foreword by Aletha C. Huston

Springer

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Foreword

This book is dedicated to John C. Wright, my late husband and research partner, who was a pioneer in understanding the cognitive and social processes involved in children's learning from media, primarily from television. Television reached most American homes during the 1950s. In 1950, about 10 % of homes had a set; by 1960, the number was close to 90 %, a rate of dissemination that seemed extraordinary at the time though it pales in comparison to the spread of smartphones and the Internet.

The introduction of each new medium in the twentieth century elicited a storm of apocalyptic predictions about its harmful effects as well as wildly optimistic hopes for its capacity to enrich the lives of viewers. The research that followed typically demonstrated that both are true, depending on the content and features of programming as well as the characteristics of the viewer and his or her environment. As John once paraphrased Marshall McLuhan's idea that the medium is the message: "The message is the message."

Two questions dominated television research in the 1950s and 1960s. (a) What are the effects of the medium itself? (b) How does television violence affect aggressive behavior? Both were concerned primarily with negative influences of TV. The first question was typically answered with fairly simple correlational studies, a trend that unfortunately continued well beyond the time when more nuanced and sophisticated investigations had made it clear that viewing television per se does not have simple effects on children. The second question gained momentum because of the high rates of violence in fictional programming, including programming for children, and because television news was broadcasting footage of graphic violence in the war in Vietnam and in urban riots in many major American cities. In response to these concerns, the US Surgeon General appointed an Advisory Committee on Television and Social Behavior, which in turn requested that the National Institute of Mental Health fund a program of research on the topic.

Research on potential positive influences of television emerged in the late 1960s. With a grant from the NIMH initiative on TV and Social Behavior, Lynette Friedrich and I launched a series of investigations. Although we included violent programs in the first study, we were more interested in the potential of TV to teach prosocial

behavior. We chose Mr. Rogers' Neighborhood because it had a clear basis in developmental theory and presented a range of positive behavior including helping, sharing, task persistence, cooperation, and delay of gratification.

Around the same time, Sesame Street began production with the explicit goal of reaching children in minority families and those living in poverty. Although the idea of educating young children with television seems obvious now, many were skeptical that such programming could reach beyond an elite audience of children with well-educated parents. Hence, the funding for the first 2 years included two large-scale evaluations of impact on the target audience. A strong tradition of both formative and summative evaluations of Sesame Street and other educational programs ensued.

In the 1970s and 1980s, research on the processes by which young children learned television content, both positive and negative, arose in the fields of communication and child development. With the advent of cartoons and other programs specifically directed to young children, both parents and researchers became concerned about commercialism and advertising to young children. Action for Children's Television, an advocacy group headed by Peggy Charren, pressed for restrictions on such advertising. As a result, an important body of research provided information about developmental differences in children's processing including their ability to comprehend the purposes of advertising and their susceptibility to persuasion by favorite television personalities and characters.

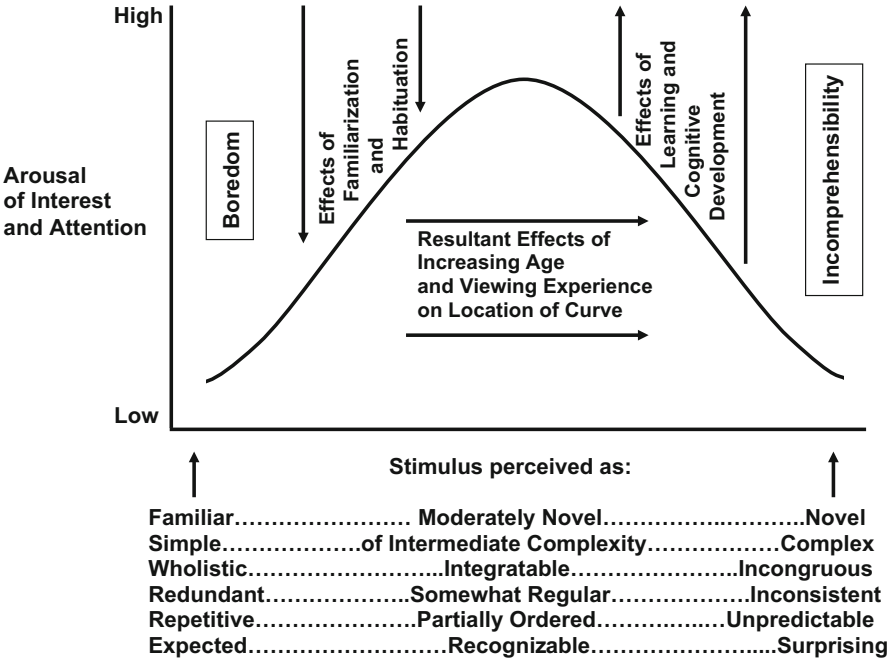
In the late 1970s, John Wright and I created the Center for Research on the Influences of Television on Children (CRITC) at the University of Kansas, which John directed for many years, to carry out research that brought together his expertise in cognitive development and mine in social development. One major theme was understanding how TV formal production features (e.g., action, pace, special effects) and content affected attention, comprehension, and social behavior. We did laboratory studies of children's attention to and learning from programs selected or edited to contain particular combinations of form and content, and we also conducted some longitudinal studies of children's home viewing experiences.

Around the same time, at the University of Massachusetts, Dan Anderson conducted seminal studies of the relations of comprehension to attention and launched a large investigation of children's home viewing. Ultimately, we collaborated to follow up the Kansas and Massachusetts home viewing samples when they were adolescents, showing that preschool viewing of educational programs predicted some aspects of school achievement. For a review of late twentieth century media research, see Huston and Wright (1997).

Many of the themes of the earlier work are evident in the contents of this volume. First, although it seems obvious that theories of cognitive and social development apply to and can be tested by studies of media, the research on media has often been segregated from developmental psychology and early education. The authors in this volume apply concepts of learning and social development to media in ways that inform both basic and applied science. They extend analyses of content and production features to understand the messages presented to children. They make good use of experiments disaggregating the components of media stimuli (both form and content) to test their effects on learning. In various chapters, the authors investigate

children's understanding of the connotations and conventions of TV, their understanding of fiction-reality distinctions, and, echoing the advertising research on character appeal, their parasocial relationships with characters.

A second theme of the earlier work was a clear developmental perspective with a focus on both micro and macro levels. At the macro level, children's capacity for learning from media changes over time as their cognitive capabilities grow, but also as a function of their experience with particular media. But, change also occurs at the micro level. At any point in time, attention and comprehension are greatest when stimuli are moderately complex and novel; interest is diminished when content is either too easy or too hard. As illustrated in Wright's "traveling lens model," for example, changes with time and experience occur such that content that is moderately difficult becomes easier and less interesting, and content that was too difficult attracts more attention and interest. By definition, a developmental perspective requires that the match between the media content and the child's level be considered in understanding children's learning—a pervasive assumption in this volume.



Still another theme was that learning from media is active. Many observers argued that learning from television was by definition passive because it offered one-way communication from screen to child with little or no opportunity for children to interact with or affect the content. We and other early investigators contended that such learning could be and often was active because children attend selectively, exert

mental effort, and use their existing knowledge to interpret television content (Huston & Wright, 1989). As technology has changed, no one questions the idea that a child can be "active" in learning, but there are still issues of when and how children transfer that learning to other contexts. The newer work also allows a better understanding of the biological processes underlying children's interactions with media.

Still another thread of the early work was context, particularly the context of viewing at home. The home viewing diaries collected in Massachusetts and Kansas produced information about co-viewing of different types of programs with parents and siblings, and the videotapes of viewing collected in Massachusetts offered an in-depth understanding of viewing in a natural context. The current work on co-viewing and parent-child interaction reported in this volume advances our understanding of how media are integrated into family life. Possible impacts on parent-child relationships are ever more urgent with new media. For example, anecdotes abound about parents being absorbed by their phones while children sit passively (or perhaps play on their own devices).

The papers in this book have their roots in themes from early research, but the newer work goes well beyond TV because there is a proliferation of media platforms. Researchers can now investigate interactivity and a much wider range of content and form including carefully planned games for children (and perhaps those not so carefully planned). Although young children still spend a great deal of time with television, many of them also play games on phones and tablets. At the same time, the range of programming and games has grown on both television and other media, with many more claims by manufacturers that content is beneficial to children.

The age groups targeted by media (and presumably affected by them) have shifted to include infants and toddlers, a trend that is reflected in the research in this volume. When Sesame Street was introduced, it was aimed at 4-year-olds, an age group that seemed very young at the time. Despite warnings from the American Pediatric Association, viewing data over the years have made it clear that very young children are exposed to a great deal of television, often because older family members are viewing, and programming for infants and toddlers on both TV and other platforms has followed, creating new questions for research.

Screen media now allow children to engage in various forms of social interaction with fictional characters and real people. The papers in this volume document children's "parasocial" relationships to media characters as well as Skype interactions with parents and other important adults who are far from home. This line of research has only begun to answer interesting questions about how such mediated interactions are perceived by children and how they affect other aspects of social relationships.

Finally, the contributions of practitioners, educators, and media professionals to this volume follow in a strong tradition of interactions among research, media policy, and practice. The research on violence, advertising, and prosocial television has been used in policy proposals with varying degrees of success over the years. Although research was not the only influence on the 1990 Children's Television Act, the legislation would probably not have happened without it. Perhaps more relevant to this volume, many of the best children's television shows have used research to plan their content and to evaluate their successes. Building in the

thoughts of practitioners for each chapter strengthens the likely contribution of this work to design and evaluation of new media as well as old.

In summary, the papers in this book build on themes of earlier work while presenting a range of important advances in understanding the multiple roles of screen media in the lives of children. Although the technological changes in media are occurring at a rapid rate, always raising new questions and issues, much of the knowledge generated in this research deals with lasting and important questions of children's development. It draws on a strong tradition of past work to make major interesting and new contributions to the field.

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Preface

The New Blooming, Buzzing Confusion: Introduction to Media Exposure During Infancy and Early Childhood

> The baby, assailed by eyes, ears, nose, skin, and entrails at once, feels it all as **one great blooming, buzzing confusion** (p. 488; William James, 1890)

William James's conception of the infant captured the prevailing view that the infant's world is dominated by sensations that lack order and assail themselves on the infant as if, as Locke argued in 1689, the infant is a "white paper [tabula rasa] void of all characters, without any ideas" (Book II, Chap. I, 2). This view has dominated developmental psychology even into the late twentieth century: infants were thought to be born knowing little of their larger world and, over time and with experience, must organize the buzzing confusion. This phrase, while not unique to the study of media and subsequent effects on infants (e.g., Anderson & Hanson, 2010), was the impetus for this book. Infants are not born into a world of confusion; instead, they are sophisticated learners with functional memory systems (for review see Rovee-Collier, Hayne, & Colombo, 2001; Saffran, Aslin, & Newport, 1996) who develop gradually and systematically across the first few years of life. As we sat in Rachel's garden creating a prospectus for this book, our goals were twofold. First, we wanted to encourage scholars who study media and young children to present complex and scientifically rich descriptions of their own research programs by focusing on how very young children might learn from media and the ways in which the content of said media and the context surrounding exposure interact to influence how and whether learning occurs. Second, we wanted leading industry experts, content creators, journalists, and policymakers to read these scholarly chapters and discuss the relevance and application of this research for their own practice. In all, we wanted the research and its translation into practice to present a more nuanced and balanced view of babies and screen media that reflects a rigorous application of developmental science to how, whether, and why infants learn from screen media.

Current Media Landscape

Since 1997, there has been an unprecedented surge in media content produced for young children coupled with the advent and rapid mass production of touchscreen tablets and mobile phones. In just the 2 years between 2011 and 2013, the use of mobile devices skyrocketed: use by children under 2 increased from 10 to 38 % whereas use by children 2–4 years old increased 39 to 80 %. But a more recent study conducted in France (Cristia & Seidl, 2015) estimated that 58 % of 5–24-month-olds had used a touchscreen device. Smartphones comprise the most frequently used touchscreen device (51 % of children have used this device at least once) although tablets are close behind (44 %; Rideout, 2013). Estimates of daily usage also vary. Recent studies one in the USA (Rideout, 2013) and one in France (Crista & Seidl, 2015) indicate that about 20 % of infants and toddlers use a touchscreen-enabled device each day. Two studies with more racially and socioeconomically diverse samples, one in the USA (Kabali et al., 2015) and one in Northern Ireland (Ahearne, Dilworth, Rollings, Livingstone, & Murray, 2016), indicate a much higher estimate, approximately 70 %. While it is important to note that the way these data have been collected also varied over time (see Barr, Danziger, Hilliard, Andolina, & Ruskis, 2010; Certain & Kahn, 2002), it is quite clear that children's exposure to screen media is shifting across platforms. Unlike any other point in time, young children are exposed to media content via multiple devices in multiple locations and in multiple formats, potentially leading to a new blooming, buzzing confusion. This technology explosion is shifting the use of screen media from a centrally located television set in the family's living room to anywhere and everywhere a child might be. From the family car to the local restaurant, while visiting the doctor's office and when riding on public transportation, exposure to media content is inescapable. As researchers and industry leaders, it is challenging to keep pace with such rapid proliferation in order to generate basic evidence about its effects as well as guidance on just what families and educators can or should do.

Moral Panics About Children's Time Spent with Media

As each new wave of technology takes hold, different facets of the population express varying opinions about the role that such technology should play in young children's lives ranging from trepidation about the perils to extreme optimism about the promise of the technology (Chap. 1). McLuhan (1964) wrote that "each new technology creates an environment that is itself regarded as corrupt and degrading" (p. ix). The promise lies in the ability of media to widely and rapidly increase children's access to information and education (Mielke, 1994). At the same time, others have voiced concerns that early use places young children's developing attentional system at risk for concurrent and later developmental problems while simultaneously disrupting sleep and displacing important childhood experiences. Throughout

the book, how parents and early educators are responding to these profound changes to the media landscape is discussed. The context in which media exposure occurs is more relevant and important than ever before.

Historically, child media research has focused on relations between outcomes and the total amount of media exposure a child has (see Anderson, Huston, Schmitt, Linebarger, & Wright, 2001 for a discussion). This narrow focus on amount of exposure has constrained our ability to interpret both the short-term and long-term impact of media on early socio-cognitive development and slowed the accumulation of knowledge about which child when exposed to what content and under what circumstances experiences particular outcomes. As the field matured, there was a shift from total effects to an examination of the differential impact of media content. Multiple studies document that high-quality and well-designed educational media help young children learn the content featured in that media. For instance, in a longitudinal study following children from age 5 to age 15, researchers determined that young children who spent more hours viewing Sesame Street evidenced higher grades, more leisure book reading, and stronger academic self-concepts in adolescence whereas young children who spent more hours viewing Mr. Rogers had higher creativity scores and reported greater participation in creative extracurricular activities (e.g., drama, art; Anderson et al., 2001).

At present, there is a dizzying array of content options available for young children. The Apple app store contains well over 80,000 applications tagged as educational (Apple, 2015). Unlike the development of traditional television content (both educational and entertainment), the speed with which new technologies are created has led to an equally rapid explosion and deployment of content for these technologies. As a consequence of the academic research process, we know very little about how this new content delivered via new technologies is developed, whether it is developmentally appropriate, and, perhaps most importantly, whether and how it is effective for learning. To deal with the lag between technology and research, Zosh and colleagues (Chap. 17) have proposed ways to identify app-based content as truly educational by using basic learning science research.

Welcome to the New Blooming, Buzzing Confusion

This book was born from an invitation by Springer to consider submitting an edited volume that investigated the consequences of early media use; and so began our own blooming buzzing confusion. We met the challenge by inviting many of the top academics in the field to author chapters on the perils and promise of early media exposure firmly embedded within a developmental science perspective. As we considered their potential research topics, we simultaneously identified key industry leaders and child advocates who could comment on the implications of the research for their own practice. Consequently, this book moves the research debate from the early focus on cause/effect relations dominated by total exposure and even total exposure broken into content categories to models where multiple and interacting

factors of the child, the content, and context in which exposure occurs are considered (Barr & Linebarger, 2010; Guernsey, 2012). Through careful consideration of the potential interactions between and among the content and context of early media exposure, we will address under what conditions this new blooming buzzing confusion can be deciphered by young children including how they come to make sense of it. These issues are timely and relevant not only to academics but also to parents, early educators, and policymakers who are making key decisions about their children's access to, use of, and potential learning from media.

The book is structured to present information from different perspectives. Each research chapter provides state-of-the-art research about the content and context of media exposure during early childhood. Known leaders of industry and parenting advocacy groups and think tanks were then asked to write a commentary chapter to provide insight into how the research is or could be translated into practice. These research and practice chapters are designed to be read together. By highlighting both research and practice, we have been able to review and identify factors that might realize the promise of technology while simultaneously reducing or mitigating the potential risks for very young children.

We identified several crosscutting themes across the chapters and commentaries. These themes demonstrate how research that incorporates greater complexity and sophistication across questions, methods, and theories enhances our understanding via simultaneously considering the multiple and interacting effects of individual child characteristics, content type, and the context in which exposure occurs. These themes include:

1. *Cognitive constraints on the child*. Throughout the book we will closely consider how the age of the child influences learning. We consider attentional and cognitive constraints on processing information from screens during early childhood (Chaps. 3 and 5) and how these factors influence children's ability to learn in media settings. We discuss the relevance of developmental science principles in understanding not only how children learn from technology but in the design of media content and consideration of the context of learning as well.
2. *Importance of the delivery of content*. The delivery of media content will be discussed from multiple perspectives, with consideration of preschool television content (Chaps. 7 and 8), the development of characters (Chaps. 9 and 10), and the development of touchscreen apps (Chaps. 3, 4, 17, and 18). We discuss the importance of character development, the careful design of the educational and prosocial content, and the need to develop and implement age-appropriate curriculum and leveling. We also discuss how it may be possible to use features of new media to more effectively level content to capitalize on technology but we will also need to carefully consider how to focus the learning without overwhelming young learners with extraneous information.
3. *Importance of the context*. Co-viewing is now extended to co-using and joint media engagement. More than ever before it is important to consider how learning from media occurs in the context of other social partners. We focus on impacts of parental mediation and scaffolding during media exposure (Chaps. 11–15).

4. *Shift to newer media devices*—There has been a rapid adoption across socioeconomic status of touchscreen-enabled phones and tablets and a vast array of software in the form of applications (apps) has been developed to deliver content on these devices. These new devices are mobile making them available in multiple locations. These devices are interactive both due to the touchscreen-enabled functionality and the connectivity with other devices in order to engage in activities like videochat. These dramatic changes in technology have increased the contingency and interactivity of content available to young children. We will expand upon the recent dramatic shift to mobile and interactive technology (Chaps. 1, 2, 13, 17, and 18). We integrate the extensive findings obtained from the study of children's exposure to television to the more recent findings with this new digital media. We also discuss the challenges of the new media.
5. *Parenting and educational implications of early media exposure*. Throughout the book we consider the educational ramifications of new media content and devices and the role that parents and early educators will need to play in order to maximize child outcomes. This will be considered from the Science of Learning perspective (Chap. 17), in the early education environment (Chaps. 1–4 and 6), and from the parenting perspective (Chaps. 11–16).

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Contents

About the Editors

Rachel Barr, Ph.D. is Associate Professor of Psychology at Georgetown University and Director of the Georgetown Early Learning Project. Dr. Barr received her Ph.D. from the University of Otago, New Zealand. She is primarily interested in how children bridge the gap between what they learn from media and how they apply that information in the real world. She has written frequently about the transfer deficit which is the consistent finding that infants and toddlers learn less from television and touchscreens than from face-to-face interactions due to memory constraints and also how the transfer deficit can be ameliorated by including repetition, additional language cues, and appropriate use of television features to enhance learning. She has also examined how parents can facilitate learning from both touchscreens and television. Finally, she has provided developmental expertise while working with media developers, and she has collaborated on a project that has used media content as part of an early intervention parenting program for incarcerated teen fathers.

Deborah Nichols Linebarger, Ph.D. is Associate Professor of Human Development and Director of the Children's Media Lab at Purdue University. Dr. Linebarger received her Ph.D. from the University of Texas, Austin. She is primarily interested in the interface between children's cognitive development (i.e., learning, language and early literacy skills, executive function) and educational media and how and whether these relations vary by important demographic and social indicators including poverty status, culturally and linguistically diverse populations, age, and location of residence (e.g., rural or urban). To examine this interface, she conducts descriptive work to detail media access and use patterns and relations among these patterns and child development; micro-level experimental work to detect the features used in media that direct attention and contribute to content comprehension; and macro-level intervention work that combines the knowledge gained through both descriptive and basic research and applies it in various real-world contexts. In the latter capacity, she has extensive experience evaluating the efficacy of various media products and media interventions (i.e., 22 different products and

interventions evaluated across 52 different studies) using theoretically and empirically rigorous research methods and evaluation techniques. Recent projects and consultancies include Sesame Workshop, PBS Kids/CPB, Between the Lions, WGBH public TV, Sprout, LeapFrog, Disney, Nickelodeon, the World Bank, and members of Congress.

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Deborah Nichols Linebarger is an Associate Professor at Purdue University. Her research examines the interface between children's cognitive development and educational media and how and whether these relations vary by important demographic, social, and contextual factors (e.g., poverty status, diverse populations, co-use of media, stimulus attributes).

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Chapter 1
The "New" Technology Environment: The Role of Content and Context on Learning and Development from Mobile Media

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For decades we have seen the wave-like reaction to new media technology. First the increased panic that whatever new device of the time—whether it is radio, TV, movies, DVDs, or computers—will have a negative effect on our youth; then a plateau as children use these devices, regardless of recommendations from policy organizations, teachers, or parents; and finally a decrease in concern and a sense of actual acceptance as that device becomes part of everyday culture and another device enters the market to restart the wave. Coinciding with this wave of panic is a wave of excitement and opportunity driven by those who see the novel opportunities of each device to expand our everyday experiences. Wartella and her colleagues have addressed this ongoing historical trend in children's media technology over the decades (Wartella & Jennings, 2000; Wartella & Reeves, 1985; Wartella & Robb, 2007). In this chapter we update this discussion with a focus on newer mobile media and the impact it has on young children today. Rather than focusing solely on the effects of the device itself, we build on the historical literature by expanding our focus on two specific factors: the content provided on new mobile media devices and the context in which these devices are used.

1.1 Historical Trends

Historically, the concerns about media technology have focused on the specific device (e.g., television, video games, movies, etc.; Wartella & Jennings, 2000), when in reality the content was driving the concern (e.g., violence). With older children and youth, there is evidence that exposure to violent content in TV

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programming, video games, and even music lyrics can have negative effects on development (Bushman & Huesmann, 2006). Over the decades, we have minimized the concern associated with the devices by improving the content. For example, *Sesame Street* and *Mister Rogers' Neighborhood* calmed much of the worry related to children and TV viewing with their educational curricula and demonstrated success as teaching programs (Ball & Bogatz, 1970; Friedrich & Stein, 1973).

In the late 1990s, however, a change in the target audience of TV programming and DVDs resulted in new concerns regarding media and child development (Wartella & Robb, 2007). With a vast increase in infant-directed content (e.g., *Baby Einstein*) in the late 1990s, the American Academy of Pediatrics (1999) originally recommended that parents refrain from allowing children under 2 from watching screen media out of fear that parents would rely on these products too heavily and that important caregiver–child interactions would be displaced. Despite this recommendation, parents were allowing their young children to view screen media. Reports in 2002 indicated that 83 % of young children used screen media in a typical day, and 74 % of those under 2 had watched TV (Rideout, Vandewater, & Wartella, 2003); by 2005, children under 6 were spending nearly 2 h per day with screen media (Rideout & Hamel, 2006).

In part, the concern over infant-directed programming arose from the claims by many companies that their products were educational when in fact little if any research had been conducted to determine the validity of these claims. In the years since these DVDs were created, a series of content analyses have been conducted to assess the presence of educational concepts within the content of the programs. One small-scale content analysis (Garrison & Christakis, 2005) examining educational media found that 76 videos on Amazon.com's top 100 best-selling list for babies ages 2 and under made educational claims. Many videos for young children also claimed that they encouraged parent–child interaction. Similarly, the titles and claims of many computer programs for young children suggested or directly stated that they were educational and would have positive educational effects on children (Garrison & Christakis, 2005). Unfortunately, this study did not assess the actual content by watching or playing the games, instead relying on the best-selling list and company reviews as the main indicator of content. A second content analysis, conducted in 2007 and 2008, of 57 DVDs targeting infants and toddlers between the ages of 0 and 3 years found that educational claims were prominent on baby DVDs (Fenstermacher et al., 2010). This study went further and determined that often times the claims in the title, packaging, and promotional materials overstated the content of the DVD (see also Chap. 7, Linebarger, Brey, Fenstermacher & Barr, 2016; and Chap. 8, Santomero, 2016).

In addition to studying the specific content that was being marketed and sold to parents of young children, researchers responded to concerns by examining whether infants and toddlers were learning from content presented in video form. Anderson and Pempek (2005) provided an excellent review of the literature to date, suggesting that young children struggle to learn from one-directional TV or DVD screen content and coined the term the "video deficit." Other scholars continued to explore this controversy to determine whether infants and toddlers could learn from "baby media" (e.g., DeLoache et al., 2010; Richert, Robb, Fender, & Wartella, 2010;

Robb, Richert, & Wartella, 2010; Vandewater, 2011), generally finding mixed results from commercially available products. Some researchers looked at more basic factors of content, such as character familiarity (Krcmar, 2010; Lauricella, Gola, & Calvert, 2011), to determine if altering content features influenced young children's learning from screen media. While there was some consideration for the context of infant media, such as time spent watching TV in childcare centers (e.g., Tandon, Zhou, Lozano, & Christakis, 2011) or the role of parent–child interactions during media use (e.g., Barr, Zack, Muentener, & Garcia, 2008; Fidler, Zack, & Barr, 2010), the focus with infant-directed media research was primarily on the effects of the content on very young viewers' learning.

1.2 Mobile Media Trends

More recently, there has been a boom in digital media technology used by young children that differs vastly from the technology of the past. In 2007, Apple introduced the first iPhone, and just 3 years later the first iPad was released, providing the world with a new type of mobile technology driven by the touchscreen. This technological advancement incidentally also created a more developmentally appropriate medium for young children as they could now manipulate and control these devices more easily without the help of an adult (Geist, 2012). New mobile technology saw the same wave-like reaction from parents, press, and policymakers as seen historically. Concerns spiked that these devices would negatively affect young children's development, and new policy statements were released cautioning parents about potential negative effects (e.g., AAP 2011, 2013). Simultaneously, educators and school systems immediately bought into the hype that mobile technology could revolutionize the education system, spending millions of dollars investing in new technology for their students (e.g., Garner, 2015; Paczkowski, 2013).

With the influx of new devices, two key policy statements have provided recommendations for parents and educators to handle this new media environment. While the American Academy of Pediatrics (1999, 2011, 2013) traditionally recommended no screen time for children under 2 years old and limited screen time for older children, the organization's most recent recommendations in 2015 recognized that strict screen time limits are no longer plausible in today's media-saturated world (AAP, 2015). The AAP (2015) even acknowledged the potential benefits of high quality educational content, such as *Sesame Street*, for children's learning and development, as long as screen time occurs in moderation and with caregiver guidance. Additionally, the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center (2012) released a joint position statement supporting developmentally appropriate and intentional use of technology in early childhood education. The NAEYC/Fred Rogers Center (2012) statement emphasizes the importance of using technology to support, not substitute, learning, suggesting educators should create a balance of traditional and digital activities in their centers and classrooms. Further, as with the AAP (2015) recommendations,

NAEYC/Fred Rogers Center (2012) emphasizes the need for quality social interactions around technology to support young children's learning.

Despite these policy recommendations, we are still in the nascent years of understanding how these technologies influence children's learning and development. However, unlike prior work that has primarily focused on the devices themselves, today there is more of a focus on what Lisa Guernsey (2007) describes as the three C's—the child, the content, and the context. Recognition of the importance of taking these three factors into account when understanding how media technology affects young children has led to the development of new research and theoretical models, such as Valkenburg and Peter's (2013) Differential Susceptibility to Media Effects Model that focuses on the differential effects media has on young children's learning and development.

Given that the AAP (2015) and NAEYC/Fred Rogers Center (2012) recommendations provide suggestions on how to choose and use media to support young children's learning and development, it is critical to understand what types of content are available and how parents and educators are constructing digital media contexts for young children. As such, the remainder of this chapter focuses on new media technology with regard to the content that young children are engaging with and the context in which these interactions occur.

1.3 New Media Content

The advent of mobile touchscreen technology has led to a very different type of media use. While television remains the most prominent media technology used by young children, time spent with smartphones and tablets is increasing dramatically as family ownership of these devices reaches new highs (Rideout, 2013). Importantly, while some content is being moved from traditional television or computer games to touchscreen devices, we are also seeing an increase in novel content that is being created specifically for mobile touchscreen devices. An important distinction between traditional media content and the new mobile touchscreen content is the opportunity for increased user-influenced interactivity and user-created content, something that was impossible with TV content. Most research examining new technology has been conducted on electronic books (e-books); however, new studies are being conducted to examine the content and quality of children's apps and to understand the way children create and develop their own content on touchscreen devices.

1.3.1 E-Books

Decades of traditional children's storybooks have led to the relatively seamless transition to children's e-books that can be read on computers or handheld devices. The earliest versions of e-books were created for desktop computers, played via

CD-ROM technology, and ranged considerably in their interactive features (De Jong & Bus, 2003; James, 1999). Most research has focused on the effects of e-books on story comprehension, vocabulary, and phonological skills. An early study by Ricci and Beal (2002) showed kindergarten children had better story comprehension and recall from interactive e-book CD-ROMs with audiovisual and interactive features compared to children who only had audio narration without any visuals. Similarly, Chera and Wood (2003) demonstrated that exposure to voice-narrated e-books increased 4-year-old children's phonological awareness compared to a control group. More recently, Gong and Levy (2009) found that word highlighting in e-books could enhance preschool children's print and letter concepts. These types of interactive components also seem to enhance children's motivation and engagement (Ciampa, 2012, 2014; Colombo & Landoni, 2014; Gong & Levy, 2009; James, 1999; Lauricella, Calvert, & Barr, 2014).

Other studies have determined that e-books can be particularly beneficial for children from special populations. Verhallen and Bus (2010) found that the very foundation of an e-book providing multimedia pictures instead of static images, as in the case with traditional books, could help increase second-language learners' vocabulary skills. Another study showed that low- and middle-income students who used e-books with dictionaries or e-books in the "read and play" mode outperformed their peers in the "read only" condition on word meaning and recognition as well as phonological awareness (Korat & Shamir, 2007). Shamir and colleagues (Shamir, Korat, & Fellah, 2012; Shamir & Shlafer, 2011) also showed interactive e-books could be especially useful in increasing vocabulary, print concepts, and phonological awareness for children with learning disabilities. Taken together, these studies suggest the importance of interactivity as opposed to simply reading a book on an electronic device.

However, other studies contrast these findings and demonstrate that interactive features either had negative effects (e.g., De Jong & Bus, 2002; Kozminsky & Asher-Sadon, 2013), no impact (De Jong & Bus, 2004; Willoughby, Evans, & Nowak, 2015), or mixed effects (Doty, Popplewell, & Byers, 2001) on children's learning. In an early study, De Jong and Bus (2002) demonstrated that the interactive features of e-books, such as hotspots, games, pictures, and interactive texts, may negatively influence children's understanding of the storyline. Similarly, Kozminsky and Asher-Sadon (2013) found kindergarten children who were read to from a traditional book by an adult had significantly higher literacy outcomes compared to their peers who listened to and played with an e-book.

Multiple studies with young children have found no effect of e-books. Willoughby and colleagues (2015) found no discernible differences in phonological awareness for 4-year-old children who were exposed to repeated readings of ABC e-books compared to children who were exposed to repeated readings of traditional ABC storybooks. De Jong and Bus (2004) showed that kindergarteners who read an e-book independently had similar story comprehension and retelling abilities as students who worked with adults, despite the e-book having hotspots. Finally, Doty and colleagues (2001) found that second-grade children who read an e-book on

CD-ROM showed increased story comprehension compared to students who read a printed book, but no differences were found for retelling the story.

When trying to interpret the mixed effects of interactivity and new mobile technology, we must acknowledge that "interactivity" can be defined, measured, and assessed in a multitude of ways. With each individual study examining specific features of interactivity, it is not surprising that current results are not yet consistent or streamlined. A second limitation with some of the interactivity research is a function of the stimuli used to test "interactivity." Specifically, many of the studies that find positive effects of e-books used researcher-created e-books, where the interactive components are intentionally aligned with the story content and skills being assessed, as opposed to commercially available content, which may lack such intentionality (Salmon, 2013).

An extension of interactivity research is now exploring how haptic technology can be added to e-books as a way to increase young children's interactivity with the reading experience. Haptics provide tactile vibration feedback, providing a more multisensory reading experience above and beyond audiovisual cues. While few have investigated the effect that haptic technology has on young children's learning (Alam, Rahman, & El Saddik, 2013), companies such as Disney Research are in the process of developing haptic displays for children (Kim, Israr, & Poupyrev, 2013). Only one exploratory study investigating the application of haptics to children's e-books has been conducted, and the authors found that while younger children (3- to 5-year-olds) enjoyed the addition of haptics more than older children (6- to 8-year-olds), parents felt that younger children were more distracted by the haptics (Cingel, Blackwell, Connell, & Piper, 2015). As such, the tension between engagement and distraction around enhanced e-books will likely continue as the technology advances.

In sum, new mobile technology does offer children an opportunity to interact with and manipulate some or all of the content on the device, but the effects of these interactive features require continued research. Factors like child age and previous exposure to traditional storybooks, e-books, and touchscreen technology may play an important role in the overall effects associated with these types of experiences. Additionally, defining and measuring "interactivity" is increasingly challenging as interactive features and opportunities continue to develop and change. Research has begun to assess certain aspects of interactivity, such as hotspots and haptic technology, but just as there is a long list of formal features used in video presentations (e.g., cuts, zooms, pans, etc.), the list of interactive features that need to be studied and understood is far from complete. Finally, the relationship between the developmental abilities, experience, and the interactive technology must be understood in context. Specifically, this relationship should be investigated with commercially available content and in the places where children are using these devices (e.g., home, school, and even in transit), both with and without parent involvement, to better reflect the realities of children's engagment with these new technoolgies.