EVALUATING PRESCHOOLERS' COMPREHENSION OF EDUCATIONAL TELEVISION: THE ROLE OF VIEWER CHARACTERISTICS, STIMULI FEATURES, AND CONTEXTUAL EXPECTATIONS

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Evaluating Preschoolers' Comprehension of Educational Television:

The Role of Viewer Characteristics, Stimuli Features, and Contextual Expectations

Dedication

For my best friend, and the love of my life, my husband John.

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ABSTRACT

EVALUATING PRESCHOOLERS' COMPREHENSION OF EDUCATIONAL TELEVISION: THE ROLE OF VIEWER CHARACTERISTICS, STIMULI FEATURES, AND CONTEXTUAL EXPECTATIONS

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This study represents the first experimental investigation to simultaneously evaluate the impact of three key areas of a child's television viewing experience - individual differences (story schema), the stimulus (narrative type), and the environment (perceived demand characteristics). Guided by the capacity model (Fisch, 2000, 2004), preschoolers' comprehension of an educational television program was evaluated in a 2 (story schema: low, high) x 2 (perceived demand characteristics: fun (low), learning (high)) x 2 (narrative type: participatory cues absent, participatory cues present) between-subjects fully crossed factorial experiment. Comprehension was operationalized as both narrative (i.e. central, incidental, and inferential comprehension) and educational content comprehension. A total of 172 preschoolers (102 females) participated in the study (Mean $_{Age}$ = 4.2 years). Children were randomly assigned to one of four conditions created by crossing the perceived demand characteristic manipulation with the narrative type manipulation. Story schema level was assigned through a median-split procedure based on story schema scores. In addition to program comprehension, data was collected

on expressive vocabulary, story schema skills, program familiarity, and engagement with and attention to stimuli.

Advanced story schema supported narrative comprehension, and this reduction in narrative processing demands translated to educational content comprehension. Children's television programmers are advised to design educational television content which conforms to a prototypical story structure while integrating educational content within the narrative. Additionally, while children seemed able to devote greater attention to content when asked to "watch to learn", they appeared to struggle with how to differentially distribute this attention, resulting in minimally enhanced inferential processing and no additional benefits to educational content comprehension. Finally, the inclusion of participatory cues in children's television programming was not sufficient to support comprehension. Rather, it seems that *engagement* with participatory cues is necessary to support comprehension – particularly for children with low story schema and children viewing "for fun". When integrating the findings for perceived demand characteristics and narrative type, children's television programmers are advised to use participatory cues strategically to highlight educational content.

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Background

Television & Children

Since its inception, television's impact on youngsters has been met with concerns. These concerns have fueled over fifty years of research on the role that the flickering box plays in the lives of children and has been the impetus for much of the media policy and legislation in the United States. While some concerns have been debunked in the literature (Wartella, 1995), others remain important venues for continued research and legislation. There is a compelling body of research which has linked children's exposure to violent television content with subsequent aggressive behavior (Huesmann, Moise-Titus, Podolski, & Eron, 2003; Murray, 2007; Paik & Comstock, 1994). Similarly, there is a growing body of literature that has implicated exposure to sexualized media content with adolescents' sexual behavior (Bleakley, Hennessy, Fishbein, & Jordan, 2008; J. D. Brown et al., 2005; R. L. Collins et al., 2004) and teenage pregnancy (Chandra et al., 2008). The Institute of Medicine (2006) has cited television food advertising as a likely contributor to less healthful diets and negative diet-related health outcomes and risks, while exposure to thin models in the mass media has been shown to elicit body dissatisfaction among females (Groesz, Levine, & Murnen, 2002) and may be related to disordered eating (Harrison & Hefner, 2006).

Implicit in these concerns and others like it is the notion that children can and do learn from television. And while the negative lessons of television deserve the close attention they receive by researchers and policy makers, if we subscribe to the notion that television can teach, then it stands to reason that television can offer its young viewers positive lessons as well (Fisch, 2004). This contention is widely supported in the literature with researchers making the critical point that when television programs are "designed with research-based knowledge of how children use and understand television and when they are designed to incorporate systematic academic or social curricula, children benefit"(Schmidt & Anderson, 2007, p. 79). In other words, content is key.

Educational television for children secured its place in history with the arrival of *Sesame Street* in 1969. At its time revolutionary, *Sesame Street* was developed with the explicit goal to advance the school readiness of 3 to 5 year old children – with a special emphasis on children from low income and minority backgrounds (Palmer & Fisch, 2001). Moreover, *Sesame Street* was the first children's television series to employ empirical research as an integral part of its production. Often referred to as the CTW model (Children's Television Workshop (CTW), the former name of the production company that created *Sesame Street*; Mielke, 1990), this "arranged marriage" of educational advisors, researchers, and television producers all acting as equal partners to create effective educational programming worked (Cooney, 2001). *Sesame Street* is the most researched television series in history with over 1,000 studies examining its power to teach (Fisch & Truglio, 2001). The longest-ranging evidence for its impact comes from longitudinal data in which researchers found that preschool children who watched educational television programs, particularly *Sesame Street*, spent more time reading and engaged in educational activities (Wright, Huston, Murphy et al., 2001; Wright, Huston, Scantlin, & Kotler, 2001). These effects remained even after the effects of various mediating variables were statistically removed. Further, follow-up longitudinal research found that the positive associations between viewing *Sesame Street* as a youngster and school achievement carried into adolescence (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001).

At the same time that *Sesame Street* was emerging on the children's television landscape, child-directed programming on broadcast television was being replaced by adult programming (Jordan, 1996). The lack of quality and quantity in children's programming, coupled with proof that educational television was not an oxymoron (i.e. *Sesame Street*, see also Anderson, 1998), led the public and advocacy groups to put pressure on the Federal Communications Commission (FCC) to regulate children's television. As a result, several key pieces of legislation emerged to help support the availability and growth of educational television for children.

In the 1970s, legislative efforts were minimal with the FCC issuing guidelines for broadcasters to make a "meaningful effort" to provide a "reasonable amount" of educational programming for children with the caveat that noncompliance would result in stricter rules (Jordan, 1996). Unfortunately, broadcasters did little to meet these guidelines and the educational television landscape saw little change. While the FCC did move forward with its plans for subsequent regulation, pressure from networks and producers as well as First Amendment issues led to deregulation, as opposed to regulation efforts (Linebarger & Wainwright, 2007). With this deregulation came a significant decrease in the network broadcasting of children's educational programming (Jordan, 1996).

Rather than admit defeat, advocates continued to fight for the regulation of educational television for children. Working with congressional leaders, these advocates were ultimately instrumental in creating and enacting the Children's Television Act

(CTA) of 1990. This act required the FCC, in its review of each television broadcast license renewal application, to “consider the extent to which the licensee…has served the educational and informational needs of children through the licensee’s overall programming, including programming specifically designed to serve such needs.” Educational and informational television was defined as content that would “further the educational and informational needs of children 16 years of age and under in any respect, including children’s intellectual/cognitive or social/emotional needs” (Jordan, 2004, p. 105). Unfortunately, this act did not clearly specify what broadcasters had to do and led to both various levels of compliance and confusion among parents and child advocates.

In 1996, the FCC adopted a more stringent approach to clarify the Children’s Television Act of 1990 (Federal Communications Commission, 1996). The new processing guidelines, informally known as the Three-Hour Rule, specified that broadcasters air a minimum of three hours of educational/informational programming each week. This “core” programming was defined as regularly scheduled weekly programming, airing between 7:00 AM and 10:00 PM of at least 30 minutes in length, in which the main goal was to educate and inform children. The FCC mandated that this programming be identified as educational and informational when aired. This federal mandate reflected two key assumptions about television: that educational television is beneficial to children and that broadcast television is national resource that should be used to serve the public interest (i.e. the child audience; see Jordan, 2004). Content analytic work has revealed that these processing guidelines have been fairly effective with most broadcast stations choosing to air the minimum of three hours of educational programming per week (77% of which was shown to meet the benchmarks of “moderately” or “highly” educational) in order to qualify for expedited license review (Jordan, 2000). Recent research has demonstrated that the educational programming environment has not changed much. Wilson, Kunkel, & Drogos (2008) reported that 76% of a current sample of E/I programs met benchmarks for “moderately” or “highly” educational programming although the percentage of moderately educational programming increased (57 to 63%) while the percentage of highly educational programming decreased (20 to 13%). Thus, although legislative forces have helped ensure that educational television programming remains a constant on the broadcast television lineup, the quality of that programming has room for improvement.

To date, we know that television can have a positive impact on children. This is implicit in the legislative policies regarding educational television and is supported in the extant literature. Using developmental theory coupled with entertaining formats and educational objectives, researchers have demonstrated global television impacts on children’s school readiness skills (e.g. *Sesame Street*, Wright, Huston, Murphy et al., 2001), literacy skills (e.g. *Between the Lions*, Linebarger, Kosanic, Greenwood, & Doku, 2004), mathematics skills (e.g. *Cyberchase*, Fisch, 2003) , problem-solving skills (e.g. *Blue's Clue*s, Bryant et al., 1999), science skills (e.g. *Bill Nye the Science Guy*, Rockman et al, 1996), and prosocial behavior (e.g. *Mister Rogers' Neighborhood*, Friedrich & Stein, 1973). Considering that nearly all children (99%) living in the United States live in a home with at least one television (Roberts & Foehr, 2008), and that children aged 2 through 18 reportedly watch between two and three hours of television daily (Roberts & Foehr, 2008), the potential for educational television is vast. Unlike other media forms or educational materials that may be limited by socioeconomic circumstances, broadcast educational television has the unique ability to reach all segments of society – including those typically underserved segments of the population. It seems then that our responsibility is not to simply ask whether or not television will impact children (we know it will) but rather to determine those practices that can help ensure that the educational television children view meets its goals.

The focus of this study is on educational television designed for preschool-aged children. In the past decade, we have witnessed dramatic growth in the educational television landscape for preschoolers. This growth is attributable to the FCC's Three-Hour Rule as well as (1) to the growth in cable channels resulting in programming for every conceivable niche including preschoolers (e.g. *PBS Kids Sprout, Noggin*), (2) a surge of research on the importance of early childhood development, (3) and a realization by television producers that preschool television can make money (Collins, McDowell, & Tynan, 1997 in Piotrowski, 2006). These forces have converged to create a crowded television landscape for preschoolers, a landscape which parents see as including advances in educational quality (Rideout & Hamel, 2006). This crowded landscape, coupled by recent estimates which suggest that 74% of preschoolers watch at least one hour of television per day (Rideout & Hamel, 2006), highlights the need for research on ways to support the educational outcomes that preschoolers can experience when viewing educational television.

Children's Learning from Television: A Theoretical Approach

In order for us to understand those practices that contribute to effective educational television, we first must understand how children learn from television. Most discussions of learning center on the kinds of learning experiences that lead to transfer, or the ability to extend what has been learned in one context to new contexts (Byrnes, 1996). As with other educational tools, one of the goals of educational television is to support such transfer. And while research has demonstrated transfer effects (Bryant et al., 1999; Friedrich & Stein, 1973; e.g. Huesmann, 1986; Linebarger & Piotrowski, 2008), the findings on educational television and transfer are generally inconsistent (Fisch, Kirkorian, & Anderson, 2005).

In research on effective learning experiences, Bransford & colleagues (Bransford, Brown, & Cocking, 1999) suggest that there are three factors that influence successful transfer: (1) the degree of mastery of the original content, (2) the mental representation of the original content, and (3) the transfer situation. Rather than count television out, researchers (e.g. Fisch et al., 2005; Singley & Anderson, 1989) argue that the absence of consistent transfer effects from television is likely indicative of a child's poor mastery of the original content rather than demonstrative of the medium's inability to support such transfer. Thus, finding ways to support children's initial learning or comprehension of the educational content in a television program is an important goal.

Despite the importance of ensuring that children comprehend the educational content in an educational television program (as comprehension is a prerequisite for transfer; Haskell, 1999; Singley & Anderson, 1989), Fisch (2000) posits that we know little about how this learning process occurs. He argues that by understanding the interplay between viewer characteristics and program characteristics during the learning process, educational television producers may be able to maximize comprehension of the material among its target audience. In response to the dearth of theoretical approaches available to explain how viewers extract and comprehend educational content, Fisch

(2000, 2004) presented a systematic model of comprehension (referred to as the capacity model) with its roots in information processing research. Central to the model is the idea that working memory is limited and, if content is to be processed effectively; the demands of the viewing task cannot exceed the resources available in the working memory. Work by Lang (2000) supports this contention with adult audiences; when demands of processing a television program exceed the capacity of working memory, comprehension is impaired.

The capacity model focuses on children's allocation of cognitive resources during television viewing, with specific attention to the degree to which working memory resources are allocated to comprehension of narrative versus embedded educational content. Fisch (2000) defines narrative content as content which presents the story in the program whereas educational content is the underlying educational concept or message which the program is intended to convey. For example, in an episode of the children's television program *The Magic School Bus* titled "Gets Planted", a character (Phoebe) has been charged with growing a vine for her school's production of Jack and the Beanstalk. During this narrative, we see that Phoebe is having trouble growing the vine so she asks for help. With the help of her teacher (Ms. Frizzle), her friends, and the Magic School Bus, Phoebe learns about photosynthesis (the educational content embedded within the narrative of the show) and is ultimately able to use her knowledge to grow a vine for the school play.

In the capacity model, demands for cognitive resources are said to come from three basic elements: (1) processing the narrative storyline, (2) processing the educational content, and (3) the distance between the two (i.e. the degree to which the educational content is integral or tangential to the narrative). When the educational content is tangential to the narrative, the model posits that the two parallel comprehension processes compete for limited resources in the working memory, resulting in impaired comprehension of the educational content. However, when the educational content is integral to the narrative, comprehension processes are said to become complementary and comprehension of the educational content will likely be strengthened. The capacity model further predicts that factors that allow for more efficient processing of either the narrative or educational content will reduce the demands associated with processing that type of information, and subsequently increase comprehension.

While the presence of narrative content is self-evident in the many educational television programs that employ stories and characters, Fisch (2004) argues that all televised presentations of educational content include some form of narrative. As the processes used in comprehending print-based narratives have been shown analogous to the processes of comprehending television narratives (e.g. Kendeou et al., 2005; Neuman, 1992), we know much more about narrative processing than educational content processing. Measures of narrative comprehension of television have been adapted from the print-based literature with researchers measuring both relevant and irrelevant content comprehension (W.A. Collins, 1983).

Relevant content comprehension is generally defined as comprehension of information that is either explicitly presented in the program (i.e. central content comprehension) or is implied by events shown on screen (i.e. inferential content comprehension). Irrelevant content comprehension involves comprehension of content that is nonessential to plot understanding (i.e. incidental content comprehension; W. A.

Collins, Wellman, Keniston, & Westby, 1978). Inferential processing is considered to be a more sophisticated cognitive skill than central content processing (W. A. Collins et al., 1978). In line with research that suggests that successful narrative processing involves top down processing or hierarchical organization (Thorndyke & Yekovich, 1979), incidental content comprehension in the face of weak central and/or inferential content comprehension suggests that the narrative was incorrectly processed.

Narrative content comprehension is presumed to occur in working memory, thus placing demands on limited resources (Fisch, 2004). However, print-based research as well as research with television narratives has illustrated that there are various viewer (e.g. prior knowledge, story schema, knowledge of formal features) and programmatic (e.g. story complexity, temporal organization, inclusion of advanced organizers) factors that can impact comprehension and, presumably, the processing demands related to this comprehension (Fisch, 2004).

Educational content is content that has been purposefully included in the television narrative to support academic or prosocial skills of viewers (Fisch, 2004). Compared to the large knowledge base related to narrative processing (e.g. W.A. Collins, 1983; W. A. Collins et al., 1978; Meadowcroft & Reeves, 1989; Newcomb & Collins, 1979), we know much less about how children process the educational content embedded within a television program (Fisch, 2000, 2004). However, as with narrative processing, it is likely that there are both viewer (e.g. interest in content, prior knowledge of content) and stimuli (e.g. explicitness of content, presentation clarity, advance organizers) characteristics that contribute to educational content processing and its related draw on working memory resources (Fisch, 2000, 2004).

Although the allocation of working memory resources to narrative and educational processing is a function of the demands of each, the capacity model does specify several broad governing principles that help determine the differential allocation of resources (Fisch, 2000, 2004). Fisch (2000, 2004) argues that because television is primarily an entertainment medium with its more accessible surface content consisting of the narrative (e.g. the story of needing to grow a vine for the Jack and the Beanstalk production), the model posits narrative dominance (i.e. priority is given to comprehension of narrative over educational content). In light of the narrative dominance principle, it stands to reason that the amount of cognitive resources available to process educational content is a function of the amount of resources not already committed to processing the narrative. Thus, high demands for processing narrative leave fewer resources available for educational content, whereas low demands of narrative leave more resources available. The third principle posits that viewers can choose to allocate resources differentially among the processing of narrative and educational content, although the processing of narrative can never entirely be abandoned in favor of educational content (in light of the principle of narrative dominance).

The components of the model, in conjunction with the governing principles, lend themselves to five ways in which the comprehension of educational television content can be increased (Fisch, 2000, p. 82): (a) by increasing the total amount of working memory resources to understanding the television program as a whole (akin to Salomon, 1984 and the theory of amount of invested mental effort), (b) by reducing the demands of processing the narrative so that more resources are available to process the educational content, (c) by reducing the demands of the educational content so that fewer resources are needed, (d) by minimizing the distance between narrative and educational content in the program so that content complements rather than competes (i.e. ensuring that the educational content plays an integral role in the narrative, as opposed to an extraneous role), and (e) via viewers' voluntary allocation of a greater proportion of working memory resources to the processing of educational content. Each of these tenets gives rise to numerous empirical predictions regarding the conditions under which comprehension of educational content will be strongest, as well as related practical implications for the design of effective educational programming. Guided by the tenets of the capacity model, this research study investigated how preschool children's comprehension of narrative and educational television content is affected when (1) total working memory resources are increased, (2) when narrative processing demands are reduced, and (3) when viewers' voluntary allocation of working memory resources to content are increased via participatory cues designed to encourage engagement with the content.

Increasing Total Working Memory Resources

The capacity model predicts that an overall increase in working memory resources devoted to understanding the television program as a whole will lead to greater comprehension of educational content. This prediction is akin to Gavriel Salomon's theory of Amount of Invested Mental Effort (AIME; 1983b; 1984) which argues that comprehension of print and audiovisual media is dependent upon the viewer's AIME (Fisch (2004) considers this concept synonymous with working memory). Salomon (1983b, 1984) argues that when viewers expend greater AIME, they process televised information more deeply and, as a result, comprehension is enhanced. Salomon's theory posits that the benefits of increased AIME will not impact factual recall (i.e. central content comprehension) because such recall relies on rather shallow or surface level processing (see also Beentjes & van der Voort, 1993; Cennamo, 1993). Rather, Salomon (1983b, 1984) argues that the benefits of increased AIME will impact inferential learning (i.e. inferential content comprehension) because such learning requires deeper processing.

Contrary to automatic processing which is seen as controlled by the stimulus and/or situation, AIME is a controlled, voluntary, and intentional expenditure of mental effort (Salomon & Leigh, 1984), representing "the number of nonautomatic mental elaborations applied to a unit of material" (Salomon, 1984, p. 648). A child has a "pool" of available mental effort that can be allocated to tasks while the employment of non-automatic processes demands effort and therefore taps that "pool" (Salomon & Leigh, 1984). By allocating a greater overall portion of one's "pool" of resources to television viewing, there are more resources available to process television content. The obvious question then is how do we encourage viewers to increase the total pool of working memory resources when viewing educational television? In Salomon's research (1983b, 1984) with school-aged children, he found that perceptions of the medium (i.e. perceived demand characteristics; PDC) impacted how much AIME children invested when viewing. Specifically, Salomon (1983b, 1984) found that children perceived television to be an "easy" medium whereas print was a "hard" medium – and thus invested greater AIME when confronted with print-based media as compared to televised media. In other words, he found that children are "relatively effortless televiewers", performing below their real levels of ability (Salomon, 1983b, p. 194).

Salomon's research on PDC and AIME prompted several additional studies investigating whether the PDC of a medium could be manipulated. Early research by Kunkel (Kunkel, 1981 in Salomon, 1983a) suggested that the branding of a television program could impact older children's perceptions of the program, the effort expended during viewing, and the amount of information learned. Kunkel asked students to self-report the AIME they invest when consuming public and commercial television. As expected, he found that students reported expending more AIME when viewing programs aired on public television. These students were then randomly assigned to one of two viewing conditions. The first group viewed a program that they believed was designed for PBS, while the second group viewed the same program believed to be designed for commercial TV. The students in the PBS viewing group learned more and reported investing more effort in processing the program compared to their peers in the commercial TV group, lending support to Salomon's argument (Kunkel, 1981 in Salomon, 1983a).

In 1983, Krendl & Watkins attempted to alter PDC of television via viewing instructions. The researchers were interested in understanding how fifth graders' comprehension of a television narrative (defined as simple and higher-level comprehension) would be impacted by the perceived demands of the stimulus as well as whether the viewing scenario encouraged active or passive viewing. In order to manipulate the PDC of the medium, half of the viewers were told that the program was intended to teach them something and they should try to learn something from it in order to answer questions after viewing. Additionally, they were instructed to look for important parts and to try to remember them. The remaining children were told that the program was intended to be shown on commercial television and entertain children their age. These students were told that the researchers wanted to learn how the program compared to other programs they watched at home and whether they thought other children would like it. Relevant results showed that children in the educational instructions condition outperformed their entertainment instructions counterparts on tests of higher level (or inferential) processing. As expected, there were no differences between these groups on simple recall (i.e. central content comprehension).

Similar to the manipulation used by Krendl & Watkins (1983), Salomon & Leigh (1984) were interested in directly testing whether AIME was a medium-dominated or individually controlled concept. Although previous research by Salomon & colleagues (Salomon & Cohen, 1978) supported an individually-controlled argument, other researchers (e.g. Singer, 1980) suggested that the inherent nature of television (e.g. quick pace, pictorial nature, crowdedness) inhibited effortful processing thus forcing viewers to rely on automatic processes. Salomon & Leigh (1984) argued that if one was able to experimentally induce increased effort expenditure and learning by manipulating children's preconceptions of the AIME necessary, then there would be support for AIME as an individually-controlled concept. There were two manipulations used in the research: stimulus type (television versus print) and perceived demand characteristics. In addition to investigating their hypothesis that increased PDC would increase AIME and learning, the researchers hypothesized that the increases would be greater for television than for print. Learning was measured via central and inferential content recall and the PDC manipulation occurred via instructions. Sixth graders were assigned to one of two conditions. Those assigned to the low PDC condition were instructed to watch or read the story for fun while those in the high PDC condition were instructed to watch or read the story "to see how much you can learn from it" (Salomon & Leigh, 1984, p. 131). Results illustrated a main effect of PDC on AIME such that children in the high PDC groups reported expending more effort than their peers in the low PDC group. Results also showed that while the PDC manipulation did not impact story recall (i.e. central content comprehension), the manipulation did impact inference-making scores (i.e. inferential content comprehension) such that children in the high PDC, TV viewing condition outperformed children in the low PDC, TV viewing condition. Unexpectedly, the researchers also found that heightened PDC depressed inferential learning in the print group[1]. The researchers concluded that the "context of expectations" did influence sixth-graders' experience with television, with heightened PDC leading to increased AIME and improved inferential comprehension.

In an effort to expand the literature to a younger age range as well as a broader range of modalities, Field & Anderson (1985) conducted an experiment with five and nine year old children to evaluate how instructions impacted comprehension of television segments that emphasized either visual, auditory, or audiovisual information. Children viewed a 35-minute television segment which consisted of six short segments (2 presenting central content visually; 2 presenting central content aurally, and 2 presenting central content via both audio and visual modalities (visual/verbal redundancy)).

[1] While not tested in the reported study, the researchers did offer a potential explanation for the inferential finding in the print group as it relates to PDC. Specifically, they suggested that inferential learning from a medium perceived to be highly demanding (print), coupled with a stressful situation (i.e. the pressure to learn from the story), may depress the performance of children with poor perceived efficacy and thus depress the means of the entire group (Salomon & Leigh, 1984).

Children were assigned to one of two instructions conditions. Those children assigned to the instructed group received instructions "to watch carefully and remember as much as possible of the television stories" and were told they would be tested after viewing (p. 94). The children in the non-instructed condition were not informed of the testing, and were asked to watch for enjoyment. Visual orientation was assessed during viewing, and a battery of questions were administered postviewing to assess receptive vocabulary skills, perceived effort and efficacy regarding the television stimuli, and free and cued recall to assess central content comprehension. Results showed that children in the instruction condition attended to the visual stimuli more than children in the non-instruction condition. There was no effect of instruction for attention to auditory or audiovisual segments. Similar patterns occurred for comprehension. Only visual stories elicited significantly improved comprehension performance under instruction. Children in the instruction condition also reported significantly more effort in trying to understand the stimuli than non-instructed children. In all cases, there was no evidence for differential benefit of instructions by age. Although Field & Anderson (1985) concluded that the results illustrated that the benefits of formal learning instructions appear to only benefit recall of central information when presented visually, the fact that the comprehension assessments measured only central content comprehension suggests that they may have missed some of the benefits of the instructions. Recall that Salomon (1983b, 1984) argued that the benefit of increased AIME is expected to impact inferential content processing, not necessarily surface level comprehension (i.e. central content comprehension) because such surface level processing is likely the minimum comprehension that will occur when viewing a television program. It seems that it would be erroneous to conclude that this research does not support Salomon's model. Rather, it seem that these findings are in line with Salomon's predictions, and that additional research is necessary to determine if learning instructions (by altering the PDC and subsequent AIME) do support inferential comprehension skills in younger children. Moreover, Field & Anderson's (1985) research illustrates that young children can modify their mental-effort investment during viewing.

Following Field & Anderson's work with preschoolers, researchers (Reiser, Williamson, & Suzuki, 1988) conducted a study to evaluate how instructional coviewing of *Sesame Street* (i.e. when adult coviewer asks child viewer questions about stimuli content during viewing) could support preschool children's learning of the educational content. The authors hypothesized that by asking questions about the educational content during viewing, children would perceive the stimulus as being more demanding, and thus exert greater effort in extracting information from the program (Reiser et al., 1988). Their hypotheses were confirmed with preschoolers in the instructional viewing condition outperforming their peers in the simple coviewing condition (i.e. adult coviewer views with child, no questions) on tests measuring recall of the educational content in the program. Although Salomon does not directly discuss recall of embedded educational content in stimuli, Fisch's capacity model (2000, 2004) posits narrative dominance such that the narrative will be processed prior to the educational content. By increasing the total pool of resources, there will be greater resources left over to process the educational content. However, like inferential comprehension of narratives, educational content is seen as requiring deeper processing (Fisch, 2004) and it is the deeper processing where Salomon predicts AIME will make a difference. Thus, one can reasonably argue that Reiser et al.'s (1988) findings corroborate Salomon's predictions and provide additional evidence that even young children can modify their mental-effort investment based on the task demands associated with the viewing (in this case, based on the task demands associated with coviewers' engagement).

Most recently, research similar to Field & Anderson's (1985) was conducted with older children (10 and 11 year olds). Gunter, Furnham, & Griffiths (2000) were interested in understanding how recall of news content (central content comprehension only) differed by presentation (i.e. television, audio-only, print), reading proficiency, and post-viewing test expectations. As Salomon's model would predict, Gunter et al.'s (2000) research found no evidence for a main effect of test expectations. Children who expected a memory test post-viewing did not exhibit significantly more recall than those who did not expect a test.

Summarily, the research to date would suggest that the perceived demand characteristics of a medium can be successfully manipulated via previewing instructions, and that heightened PDC can successfully increase the AIME. Furthermore, as predicted by Salomon's model, increased mental effort has been shown to impact deeper levels of processing (i.e. inferential content comprehension as well as the comprehension of educational content embedded within a stimulus). The research has shown that these findings are not necessarily limited to older children but rather seem to translate to children as young as three. That being said, the research with younger audiences is not conclusive. Field & Anderson (1985) did not include measurement of inferential content comprehension, so we can only infer that an effect would be present for heightened PDC if it had been measured. Similarly, Reiser et al. (1988) used an edited stimulus and did not measure narrative comprehension. Thus, the available research does not offer a complete test of the predictions made by Fisch's capacity model (2000, 2004) in terms of increasing total working memory resources. The present study takes this next step by evaluating how increased AIME, as induced by manipulating PDC, impacts preschoolers'[2] narrative (central, inferential, incidental) and educational content comprehension. Based on the findings related to Salomon's model, as well as predictions of Fisch's cognitive capacity model (2000, 2004), it is expected that manipulating PDC will not lead to differential impacts on central or incidental content (i.e. null hypotheses). However, PDC manipulations are expected to impact inferential content comprehension and educational content comprehension.

H1. *Preschool-aged children viewing to learn (PDC-LEARN) will demonstrate greater comprehension of inferential content than their peers viewing for fun (PDC-FUN).*

H2. *Preschool-aged children viewing to learn (PDC-LEARN) will demonstrate greater comprehension of educational content than their peers viewing for fun (PDC-FUN).*

Reducing Narrative Processing Demands

The capacity model predicts that when narrative processing demands are reduced, more cognitive resources are available for processing and comprehending the educational

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[2] It is often assumed that mental capacity increases with age (in fact, M space has been argued to increase one unit for every 2 years of age from age 3 through 15; Pascual-Leone, 1970). Dempster (1981) argues that it is not a growth in capacity that is experienced over time but rather a decrease in the capacity needed to execute mental transformations. That being said, Dempster (1981) does acknowledge that a growth of capacity is more plausible between the ages of 3 through 6 than any other time. Assuming that the growth rate posited by the theory of constructive operators (Pascual-Leone, 1970) is an accurate, then limiting the sample to children between the ages 3 years, 0 months old and 5 years, 1 month old should help ensure that working memory is constrained in the sample.

content within an educational television program. Narrative processing has received much attention in the print-based literature (e.g. Best, Floyd, & McNamara, 2008; Gerrig, 1993; Kremer, Lynch, Kendeou, Butler, & van den Broek, 2002; McCabe & Peterson, 1991; McCabe & Rollins, 1994; Trabasso & Stein, 1997), and as a result, a considerable amount of information regarding how processing can be both taxed and reduced is known. Empirical research has illustrated that television viewers engage in many of the same processes used in reading, and thus argue that the findings in print-based literature translate to television viewing (Kendeou, Bohn-Gettler, White, & Van Den Broek, 2008; Kremer et al., 2002; Linebarger & Piotrowski, 2009; Neuman, 1995). Schema research is one area of research that has successfully translated from the print domain to the television domain. Schemas, defined as an organized representation of a body of knowledge derived from past experiences (Mandler, 1979), are said to contain slots for expected information and serve to aid comprehension (Schank & Abelson, 1977). The knowledge structures represent "concept abstractions or prototypes which describe the main features of a typical case" (Meadowcroft, 1986, p. 71). There are many types of schema, each schema associated with a specific type of processing. For narrative processing, story schema guides comprehension during encoding and acts as a retrieval mechanism during recall (Fisch, 2000; Mandler & Johnson, 1977; Thorndyke & Yekovich, 1979). Story schema is defined as "memory structures which consist of clusters of knowledge about stories and how they are typically structured and the ability to use this knowledge in processing stories" (Meadowcroft, 1986, p. 7) and is argued to play an important role in the processing of both print-based and televised narratives (Luke, 1987).

Story schema is a developmentally associated construct (Applebee, 1977; Riley, Freer, Lorch, & Milich, 2007) which develops from exposure to prototypically structured narratives (Mandler & Johnson, 1977; Stein & Glenn, 1979). The narrative structure, or story grammar, is the set of rules that identify important elements in a story as well as the manner in which these rules are logically ordered and related to one another (Buss, Yussen, Mathews II, Miller, & Rembold, 1983; Fitzgerald, 1989). Children learn the basic structure of stories and how events are related through exposure to stories that conform to the prototypical story grammar (Mandler & Johnson, 1977; Stein & Glenn, 1979). With time, story schemas accommodate new information (such as frequent exceptions in story structure) and become significantly more complex (Thorndyke & Yekovich, 1979). Children use their developing story schemas to aid in processing stories or in creating their own new stories.

Processing narratives involves using one's story schema to guide attention to aid in encoding and comprehension as well as act as a retrieval mechanism during recall by presenting information hierarchically (Buss et al., 1983; Fisch, 2000; Hudson & Shapiro, 1991; Lang, 2000; Low & Durkin, 1998; Mandler & Johnson, 1977; Meadowcroft, 1986; Meadowcroft & Reeves, 1989). Information central to a story is at the top of the hierarchy whereas relatively unimportant information is clustered at the bottom. Story schema serves to organize content through a process of instantiation (i.e. matching incoming information to schema elements; Meadowcroft, 1986; Thorndyke & Yekovich, 1979). Incoming story information is encoded based on a schematic organization allowing the individual to understand the story with minimum processing because the schematic structures organized the content into a coherent framework. Via the hierarchical storage of the story information in memory, story schema decreases effort associated with recall such that central content is recalled better than incidental content (Thorndyke & Yekovich, 1979; see also "the levels effect" in Meadowcroft, 1986). In other words, story schema facilitates story comprehension by reducing the effort associated with encoding and recalling the story content.

Much of the research related to the benefits of a well-developed story schema has been evaluated within the contexts of the print tradition. Research has shown children with well-developed story schema tend to be better readers (Fitzgerald, 1984; McClure, Mason, & Williams, 1983; Rahman & Bisanz, 1986); are more likely to produce organized story writing (Fitzgerald & Teasley, 1986); and are better able to comprehend and recall text-based narratives (Buss et al., 1983; Mandler & Johnson, 1977; Nezworski, Stein, & Trabasso, 1982; Thorndyke, 1977). Research has shown that children as young as four are sensitive to the structural features of narrative (van den Broek, Lorch, & Thurlow, 1996) and can employ their developing story schema to aid in describing and recalling picture-based narratives (Poulsen, Kintsch, & Kintsch, 1979). And yet while most scholars agree that television viewing is at least partly schema driven (Anderson & Lorch, 1983; Bordeaux & Lange, 1991; Lee & Huston, 2003; Lorch, Bellack, & Augsbach, 1987; Luke, 1987; Salomon, 1983a; Wright et al., 1984), research on the role that story schema plays in television viewing is limited.

Although some early research attributed narrative television processing differences to age (W. A. Collins, 1970), most research looking at how children process television narratives has invoked the notion of a story schema to some extent. Because story schema is a developmentally associated construct, most studies have used age as a proxy for story schema (Meadowcroft, 1986). Collins and colleagues (W. A. Collins, 1970; W.A. Collins, 1983; W. A. Collins et al., 1978; W. A. Collins & Wellman, 1982) initiated much of the early work on children's comprehension of television narratives. This early research focused on the role of age in narrative processing, and suggested that young children have cognitive deficiencies when processing television narratives (W. A. Collins et al., 1978). These early findings, however, should be cautiously interpreted as later research demonstrated that even young children have knowledge of narrative structure and logical relations and that the stimuli used in the initial research was much too complex for their cognitive abilities (see Low & Durkin, 1998 for a discussion).

Early research by Newcomb & Collins (1979) paved the way for additional research looking at the role that story schema plays in comprehension. In their research, they were interested in understanding whether previous age-related findings (i.e. W. A. Collins et al., 1978) represented an "absolute incapacity" for processing narrative information or whether it partly reflected young children's unfamiliarity with the types of roles, characters, and settings typically found in entertainment television programs (Newcomb & Collins, 1979). Using two broad variables, socioeconomic status and ethnic-group membership, Newcomb & Collins (1979) reasoned that children socialized in certain socioeconomic or ethnic subcultures may comprehend television plots that feature characters and settings similar to their own backgrounds better because they would be able to readily assimilate information into their existing schemas for social cues, events, and relationships among them. Using a fully crossed experimental design, factors were grade level (second, fifth, and eighth), socioeconomic status (working class and middle class) and ethnicity (Caucasian and African American). A total of 578 children were randomly assigned within sex and grade level to one of two experiments. In Study 1, children viewed an edited commercial network comedy featuring a Caucasian middle-class family while in Study 2 children viewed a program featuring an African American working class family. After viewing, participants completed a comprehension assessment which measured central, inferential, and incidental content comprehension. Results showed that comprehension of the programs varied as a function of the child's life experiences. In Study 1, middle-SES second graders viewing the middle-class family show scored higher than lower-SES second graders. In Study 2, lower-SES second graders viewing the working-class family show comprehended more content than their middle-class counterparts. There were no SES effects for other grade levels and no consistent ethnicity effects at any age. Newcomb & Collins (1979) interpreted these findings as an indication that children do use their world experience when processing narratives and that, because young children have a more limited and less varied range of social experiences compared to their older peers, they are less able to comprehend a wider range of social portrayals. They noted that younger children's difficulties in comprehending narratives may be less pronounced when the stimuli information is congruent with children's prior social experiences. While not directly focusing on story schemas, Newcomb & Collins (1979) offered an important contribution by illustrating that young children do employ schemas (in this case social schemas) when processing televised narratives.

Collins and Wellman (1982) provided additional evidence that children employ schemas when processing narratives. Arguing that viewers have scripts for different types of programs, Collins & Wellman (1982) suggested that children who have internal scripts that accurately characterize what actors in a narrative do, think, and feel will be better able to comprehend both explicit and implicit events. They also argued that because younger children have fewer and less varied social circumstances, they likely have fewer and more limited scripts than older children who would be able to recognize and encode departures from scripts. Based on these suppositions, Collins & Wellman (1982) hypothesized that younger viewers would be less likely to recall events that are uncommon, or relatively idiosyncratic, to the plot of the program (i.e. events that did not follow a stereotypical script expectation). Additionally, younger viewers' recall inaccuracies were hypothesized to reflect what they would expect to happen based on their scripts while older viewers' inaccuracies would reflect misunderstanding or confusion about program events. The study involved 252 children across three grades (2^{nd}, 5^{th}, and 8^{th} grade). Children in the study viewed a crime drama and then completed a recall and recognition measure. The recall assessment measured retrieval of common knowledge (knowledge about policemen, acts of murder) and program-specific knowledge (knowledge that some of the non-uniformed characters in the program were policeman; knowledge that the murder at the beginning of the program occurred because the victim surprised the villain during a theft) while the recognition assessment measured recall of central and inferential content. The findings supported the authors' hypotheses. While proportions of children who included common-knowledge content in plot retellings were similar across age, significantly lower proportions of second graders included program-specific knowledge in their retelling of the plot. Young children more often made errors in comprehending the stimuli and, in a higher proportion of instances, filled in gaps in their knowledge with stereotypes of common action sequences. The authors concluded that the findings fit the argument that young children are particularly likely to recall aspects of narratives that conform to their existing social scripts or schemas (W. A. Collins & Wellman, 1982).

With research by Collins & colleagues suggesting that young children bring schemas to the narrative viewing experience which impact narrative comprehension, coupled by research suggesting that narratives have a story grammar and that exposure to prototypical narrative grammars can support the development of a story schema (Mandler & Johnson, 1977; Stein & Glenn, 1979), Meadowcroft took the important next step of evaluating how children's *story* schema impacted attention and comprehension of a television narrative. The researchers (Meadowcroft, 1986; Meadowcroft & Reeves, 1989) hypothesized that story schema development would be positively associated with (1) reduced allocation of effort in attention to television stories, (2) allocation of more attention to central than incidental story content, and (3) better memory for central than for incidental story content. It was also hypothesized that children with well-developed story schemas would allocate attention differently to a television story structured like a story compared to a program with no underlying story structure (Meadowcroft & Reeves, 1989, p. 357).

A factorial design requiring two separate testing sessions was implemented to address study hypotheses. The factors were story schema development (high versus low), story content (central versus incidental), and story structure (structured or no structure). Schema development and story structure were between-subjects factors while story content was a within-subjects factor. A total of forty children between the ages of 5 and 8 participated in the study. During the first session, children completed assessments to measure their story schema with mean scores used to assign them to either the low or high story schema group. During the second session, children were randomly assigned to either the story structure or nonstory structure condition. As children watched, their attention was measured via a secondary task reaction time. After watching, children completed an assessment measuring recognition of central and incidental content.

Findings for allocation efficiency confirmed the first hypothesis. Children in the high story schema group allocated less attention to processing television stories than children in the low story schema group. The difference between groups was particularly evident in the nonstory-structure condition. Findings for strategic allocation rejected the second hypothesis. All children allocated more attention to central than incidental content with this effect strongest in the story-structure condition. In terms of allocation flexibility, the hypothesis was supported for attention allocated to central content. Children in the high story schema group allocated more attention to central content in the story-structure condition than in the nonstory-structure condition and the pattern was reversed for children in the low story schema group. Consistent with hypothesis 3, story schema was associated with increased memory of central story content. Recognition scores for incidental content were stable across schema groups (M = 93% for high schema; M = 87% for low schema). The results illustrate that story schema influences children's processing of television narratives by offering strategies for attending to and remembering narratives (Meadowcroft & Reeves, 1989).

Meadowcroft & Reeves' (1989) research made important inroads into our understanding of how children process television narratives, however, the research can be extended into three areas: children's age, inferential comprehension, and educational content comprehension. Meadowcroft & Reeves' (1989) research studied children as young as five. Newer research by Ilgaz & Aksu-Koc (2005) suggests that children's story skills emerge even earlier in life with children as young as three demonstrating emerging story skills. Studying how story schema skills translate into comprehension abilities with preschool-aged children will expand our understanding of story schema and television processing. Our understanding on the role of story schema and inferential processing of television content can also be expanded. Meadowcroft & Reeves' (1989) research illustrated that a child's story schema can help increase the efficiency of narrative processing but does not address how story schema can aid in the processing of inferential content. As inferential comprehension has consistently been argued to reflect deeper processing (e.g. W. A. Collins, 1979; Kendeou et al., 2008; Salomon, 1983b), from an information processing perspective, it would seem that possessing a strong schema would increase the efficiency of processing the central story content allowing more cognitive resources for processing inferential processing. Finally, as it was not the focus of their research, Meadowcroft & Reeves' (1989) study did not address the role of story schema on educational content comprehension. Fisch's capacity model (2000, 2004) predicts that children with a strong story schema should demonstrate superior educational content comprehension when compared to peers with weaker story schema abilities because the narrative processing demands of the stimuli are less and thus viewers can devote more of their cognitive resources to the educational content. The present study tests this prediction. While story schema is not expected to differentially support incidental content comprehension (i.e. null hypothesis), the following hypotheses regarding the relationship between story schema and central, inferential, and educational content comprehension are posited:

H3. *Preschool-aged children with high story schema will demonstrate greater central content comprehension than their low story schema peers.*

H4. *Preschool-aged children with high story schema children will demonstrate greater inferential content comprehension than their low story schema peers.*

H5. *Preschool-aged children with high story schema children will demonstrate greater educational content comprehension than their low story schema peers.*

Increasing Allocation of Working Memory Resources to Stimuli Content

The capacity model predicts that viewers' voluntary allocation of working memory resources to educational content will lead to greater comprehension of that content. Implicit in this prediction is the notion that, rather than engaging in a seemingly passive experience (e.g. Winn, 1985), children can and do actively engage with the medium by using the formal features of the medium to guide their attention as well as by engaging in a variety of inferential activities while viewing (Anderson & Lorch, 1983; Huston & Wright, 1989; see also Kirkorian, Wartella, & Anderson, 2008; Lee & Huston, 2003). In the past decade, there has been a growing body of research investigating how educational television producers can capitalize on the active viewing of their audience. Guided by developmental theorist Vygotsky and his research on the role that more capable peers can play in scaffolding children's learning (i.e. zone of proximal development; Vygotsky, 1978)[3] as well as Salomon's research on the role perceived demand characteristics can play on mental effort investment (Salomon, 1984), a new

[3] The zone of proximal development (Berk & Winsler, 1995) is defined as the difference between a child's actual development as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.

formal feature in children's television has emerged – participatory cues. Programs that utilize participatory cues break the "fourth-wall" by asking children to respond to queries and building in pauses to allow the children time to respond to these queries (Anderson et al., 2000). These participatory cues have been shown to result in overt interaction between the viewer and the character. While not truly interactive, these participatory cues simulate interactivity and are argued to provide the viewer with an opportunity to rehearse important programmatic content either in a motoric or linguistic way (Calvert & Goodman, 1999; Calvert, Strong, Jacobs, & Conger, 2007). Though Vygotsky himself was not alive to witness this medium, Vygotsky's research on child development suggests that this rehearsal of content via participatory cues may encourage self-directed speech (Berk & Winsler, 1995) which is argued to be an important activity intrinsic to metacognitive understanding and linked to cognitive outcomes (Zakin, 2007). Although participatory cues have not yet been experimentally evaluated in terms of the role they play in educational television content, the research to date would suggest that effective use of participatory cues will result in interactions with the educational content (see Anderson et al., 2000). These interactions are expected to encourage viewers to voluntarily allocate working memory resources to the educational content and subsequently support educational content comprehension.

Although the formal inclusion of participatory cues in children's television is a rather new formal feature, television has been recognized as eliciting interaction from its viewers for some time. Formative and summative research on *Square One TV* (a television series dedicating to supporting mathematics and problem solving skills for children aged 8 to 12) consistently revealed that viewers participated in the program in some way (Hall, Miller, & Fisch, 1990). The participation typically took one of two forms: (1) participation while viewing such as calling out solutions to problems or (2) post-viewing participation such as showing mathematical tricks from the series to friends (Fisch & McCann, 1993). The first type of participation, participation while viewing, illustrated that certain segments of the program (e.g. *Mathnet*, *Mathman*, and game shows) were able to encourage viewers to play along while viewing. Although segments that exhibited this "play-along-ability" were not empirically compared to other segments that did not elicit participation while viewing, Fisch & McCann (1993, p. 105) found that there were four common characteristics across segments with high play-along-ability. Segments were appealing which encouraged children to attend to them, characters and viewers solved problems that were clearly defined, viewers were provided with sufficient time to respond before on-screen characters supplied the correct answer, and segments were designed so that viewers could make educated guesses if they were not sure about the answer. Fisch (2004) explains that problems were presented with a defined set of options from which the viewer could choose rather than relying on open-ended questions.

Square One TV was not designed with the explicit intent to elicit audience participation. Rather, it was designed to support mathematical and problem-solving skills while promoting a positive attitude towards mathematics (Fisch & McCann, 1993). An experimental (pretest/posttest, control v treatment) summative evaluation with fifth graders revealed that the program achieved its goals with exposure to thirty episodes over eight weeks translating into increased problem-solving, mathematical skills, and attitudes towards mathematics (Hall et al., 1990). This same evaluation revealed that 22 of 24 viewers reported participating with the program in some way. While it would be inappropriate to conclude a clear role of viewer participation as it relates to child outcomes, it seems fair to conclude that children were able to learn from the program while participating with it.

In 1996, *Blue's Clues* joined the educational television lineup for preschoolers. Unlike other children's television shows, *Blue's Clues* explicitly relied on interaction from the audience. In fact, from its inception, the show identified four specific elements to incorporate in each episode to meet its mission (in Anderson et al., 2000): (1) a thinking skills curriculum relevant to a preschooler's daily life, (2) *active audience participation* to encourage ownership and mastery over the content presented, (3) positive reinforcement and a sense of cognitive competence as motivation for accomplishment, and (4) a model of prosocial messages. Anderson et al. (2000) explain that "play to learn!" was the philosophy that inspired the creation of the show.

The show, designed to support preschoolers' thinking skills, centers around an animated puppy (Blue) and her friend (Steve). In each episode, Steve invites the viewer into the animated world and sets up the theme for the day. Blue wants to play Blue's Clues to figure out the problem that is set up. Blue's Clues is a game in which Blue leaves her paw print on three objects (i.e. clues) and the viewer is invited to make an inference about the solution. While following the clues, obstacles in the form of educational games are encountered. The viewers are invited to participate in each of the educational games, which increase in difficulty to provide content developmentally appropriate for children 2 through 5 years of age (program description adapted from Anderson et al., 2000, p. 181). Viewer participation plays a key role in the program. Preschoolers are seen as both an audience and an integral part of the show who, through active participation via participatory cues, have the opportunity to engage in a literal and concrete experience with the educational content (Anderson et al., 2000).

Blue's Clues has undergone a series of formative and summative studies. The formative research for this program was extensive with each aspect of every episode tested three distinct times to ensure maximum effectiveness (Anderson et al., 2000). The show also underwent extensive summative evaluation. While active participation was never formally evaluated in an experimental setting (i.e. participatory cues present versus participatory cues absent), it has played a role in much of the summative research and offers researchers insight as to how the participatory cues may be working.

A large scale longitudinal study with 120 preschoolers was conducted to evaluate whether *Blue's Clues* met its curriculum goals. Of the 120 children who participated, 64 were regular viewers of the program whereas 56 were unable to view the program because they did not receive Nickelodeon (the station it airs on) in their homes or childcare facilities. The resulting design was a 2 x 9 mixed factorial. Viewing condition (viewers, nonviewers) was a between-subjects factor while time of assessment (9 time points across 2 years) was a repeated-measures factor. Dependent measures included viewing level, attention while viewing, character appeal, information acquisition, and self esteem. Results illustrated that *Blue's Clues* viewers attended to *Blue's Clues* stimuli at significantly higher rates than their peers did to other, similar curriculum-based programming; appeal ratings by viewers of *Blue's Clues* were quite high; viewers felt quite positive about their abilities to help Steve solve everyday problems; and finally, viewers statistically outperformed their non-viewing counterparts on program-specific information acquisition as well as on standardized tests assessing flexible thinking, pattern perception, creative thinking, and problem-solving (Bryant et al., 1999)[4]. In other words, *Blue's Clues* was found to meet the majority of its curriculum goals with preschoolers while using a format that explicitly relied on audience participation.

Research conducted by Crawley & colleagues (Crawley, Anderson, Wilder, Williams, & Santomero, 1999) offered additional information as to how the program met its educational goals. *Blue's Clues* had a unique airing strategy such that the same episode was repeatedly aired for five consecutive days. In addition to a body of research that illustrated that preschoolers enjoy repetition (see Taylor, 2006 for a review), the producers and consultants felt that repetition would provide viewers, particularly young viewers, with time to fully master the problems present within the stimuli. Crawley et al. (1999), in anticipation of the telecast strategy, conducted a formal experiment of the effects of episode repetition. Children aged three through five viewed an episode of *Blue's Clues* one or five times, or alternatively viewed a comparison program one time. In addition to coding children's attention and behavior during viewing, children completed assessments measuring educational and entertainment comprehension as well as far transfer skills. Results illustrated that while attention to entertainment content remained relatively stable with repetition, attention to educational content was somewhat higher initially before dropping to the same levels as entertainment content. Audience participation greatly increased with repetition, with a particular increase during educational content. Results also illustrated that, while one viewing was enough for

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[4] For program specific acquisition, children were tested on their understanding and retention of knowledge about the concepts conveyed in particular *Blue's Clues* episodes (see Bryant et al., 1999 for list of measured skills). The assessments were designed such that both viewers and non-viewers could complete all required tasks.

children to learn a substantial amount of content (compared to the comparison group), children in the repetitive viewing condition demonstrated superior performance on the comprehension assessments. The researchers interpreted these results as suggesting that during the first few viewings, children are closely attending to the educational content because it is cognitively demanding, explaining the lower level of overt audience participation (because such overt participation would require additional cognitive resources). Once the content was learned, additional cognitive resources are available to interact with the content. Considering that one of the goals of including participatory cues within the program was to increase the perceived demand characteristics of the content in an effort to get viewers to invest more mental effort, (Crawley et al., 1999; see also Salomon, 1983b), these findings make sense.

Just as *Blue's Clues'* unique telecast strategy stimulated research on the role of repetition for viewing attention, behavior, and subsequent comprehension, *Blue's Clues'* unique incorporation of formal participatory cues stimulated additional research as well. Crawley and colleagues (2002) conducted two studies to determine how experience with the program impacted viewing of the show and viewing of an alternative program. In Study 1, the viewing behavior of experienced and inexperienced *Blue's Clues* viewers was compared during the viewing of a new episode of *Blue's Clues.* Variables of particular interest included attention to entertainment versus educational content, attention to series-typical versus series-unique content, and related interactions with the content. Results illustrated that experienced viewers looked less than inexperienced viewers; all children attended to educational content more than entertainment content; and experienced viewers paid greater attention to series-unique content (when compared to series-typical content) while inexperienced viewers made no such distinction. Experienced viewers were also shown to overtly interact with the program more than inexperienced viewers, particularly during series-typical content and to outperform inexperienced viewers on comprehension of series-typical content.

Because experienced viewers were shown to interact more overall, a second study sought to evaluate whether experienced viewers had learned a new viewing style that could translate to a different stimuli which also included participatory cues. Experienced and inexperienced viewers of *Blue's Clues* viewed an episode of *Big Bag* (episode had not been telecast at time of study). Viewing behavior and comprehension of the content was assessed. Results showed that patterns of looking were identical across groups as was comprehension performance. However, interestingly, the researchers found that *Blue's Clues* experienced viewers interacted more with *Big Bag* than did inexperienced viewers, suggesting that watching *Blue's Clues* altered the way children watch other television programs (Crawley et al., 2002).

Taken as a whole, the research on *Blue's Clues* has several implications for research regarding participatory cues in children's programming. It suggests that the participatory cues invite mental effort allocation, particularly when used in conjunction with educational content. It suggests that children can learn educational content from a program that uses participatory cues to highlight such content. And, it suggests that children will overtly interact with participatory cues and that the quality of this interaction may be indicative of content mastery. What remains to be learned, however, is whether participatory cues support comprehension to a greater extent than stimuli without participatory cues. Research by Calvert and colleagues (Calvert et al., 2007) took the first step in addressing this question.

Calvert et al. (2007) were interested in evaluating how differential levels of program interactivity, as well as individual difference variables (gender and ethnicity), impacted character identification, participation, and related learning outcomes with Hispanic and Caucasian preschoolers. Positing that participatory cues in children's television programming approximates interactivity, the researchers were interested in how this approximate interactivity would compare to more traditional interactivity as well as to stimuli without any participatory cues. The researchers modified an existing television program to create study stimuli to test hypotheses. Specifically, an episode of *Dora the Explorer* (titled "Sticky Tape") was selected to represent programming with embedded participatory cues.

Dora the Explorer, like *Blue's Clues,* explicitly includes participatory cues throughout the program. Developed to support Spanish language skills, math and visual skills, music skills, and physical coordination, in each episode viewers are invited to help Dora (a seven-year old Latina girl) and her friends solve a problem. On their journey to solve the problem, Dora and her sidekick Boots (a humorous monkey) encounter obstacles – in the form of educational problems – that require the assistance of the viewers. The participatory cues occur during both educational and entertainment segments, the requests are appealing to children (see Linebarger & Kosanic, 2001), the problems are clearly defined with sufficient time provided to the viewer before an on-screen response is supplied, and the participatory segments are designed so that viewers can make educated guesses

Using the Sticky Tape episode, Calvert & colleagues (2007) created four experimental conditions: control, observation, participation, and interaction. The original episode was used for the participation condition. Children assigned to the participation condition viewed with an adult coviewer who participated at Dora's request. To make the stimuli for the control and observation conditions, the participatory cues were deleted from the episode while leaving the remaining narrative intact. In the observation condition, the child viewed beside the adult while in the control condition the child viewed with the adult in the back of the room (to control for modeling effects for looking at screen). In the interaction condition, the program paused at nine targeted program points where Dora asked the viewer to participate. The child had to use a computer mouse and make correct decisions for the program to continue.

Each participant viewed one randomly selected manipulation, and then completed questions assessing prior exposure to the program, perceived similarity to the main character, program interest, recall of story content, and divergent processing skills. Results showed that, as expected, girls perceived themselves more like Dora than boys and were more likely to want to be like Dora. Unexpectedly, Caucasian children perceived themselves as more similar than Hispanic children. Children in the interaction and control conditions were found to be more motivated than children in the observation condition, while children in the observation condition were found to be the most attentive. Results related to content comprehension illustrated that there were no significant differences by condition on tests assessing recall of central content comprehension. However, an interesting pattern of results emerged when looking at active engagement. As expected, children in the participation and interaction condition were significantly more engaged with the stimuli content than children in the observation or control condition. Children in the participation condition were also significantly more engaged than children in the interaction condition. Regression analyses revealed that children who were more engaged, as measured by physically or verbally acting on the content, were more likely to understand the central content (Calvert et al., 2007). Rather than suggest that overt engagement is indicative content mastery (e.g. Crawley et al., 1999), this research suggests that engagement can lead to content mastery.

The research by Calvert et al. (2007) contributed to the extant literature by offering an initial experimental analysis of the role that participatory cues play in preschool-aged children's recall of central narrative content within a children's television program. However, the participation condition confounded participatory cues with coviewing behavior, so it unclear as to whether the same effect would have been present had the coviewer not interacted with the stimuli. Further, the research does not specifically inform us as to the role participatory cues play in children's recall of incidental, inferential, or educational content. Extrapolating from research on *Blue's Clues* with preschoolers (see Anderson et al., 2000), in conjunction with predictions of the capacity model, it seems likely that programs with built-in participatory cues during educational content presentations provide preschool-aged viewers with the opportunity to voluntarily allocate a greater portion of working memory to the educational content. Such allocation, as predicted by the capacity model, should result in improved comprehension of the educational content. Although narrative dominance would posit that children will not abandon processing the narrative in favor of educational content, it is possible that deeper inferential processing will be abandoned in favor of the educational content. Alternatively, the engagement that results from the participatory cues may support inferential content comprehension. Similarly, while it seems likely that the presence of participatory cues will highlight essential content, thus leading to decreased recall of incidental content, it is possible that engagement with the program via the participatory cues will heighten the attention children pay to the entire stimulus resulting in heightened incidental content recall. As such, the following hypotheses and research questions are posited in the present study:

H6. *Preschool-aged children viewing a television program with participatory cues (Participatory Narrative) will demonstrate greater central content comprehension than their peers viewing a television program without participatory cues (Non-Participatory Narrative).*

RQ1. *How will preschool-aged children viewing a television program with participatory cues (Participatory Narrative) differ from their peers viewing a television program without participatory cues (Non-Participatory Narrative) on incidental content comprehension?*

RQ2. *How will preschool-aged children viewing a television program with participatory cues (Participatory Narrative) differ from their peers viewing a television program without participatory cues (Non-Participatory Narrative) on inferential content comprehension?*

H7. *Preschool-aged children viewing a television program with participatory cues (Participatory Narrative) will demonstrate greater educational content comprehension than their peers viewing a television program without participatory cues (Non-Participatory Narrative).*

Viewer Characteristics, Contextual Expectations and Stimuli Features

Guided by the capacity model (Fisch, 2000, 2004), the present study evaluates how three distinct variables (perceived demand characteristics, story schema, narrative type) impacts preschoolers' comprehension of narrative and educational content in a children's television program. Each of these factors has, to some extent, been previously evaluated in television comprehension research. However, the previous research has not looked at the relative contribution that the factors make to both types of comprehension. The research is unique in that it is extracting and analyzing a variable of interest from three of the most important aspects of a child's viewing experience: the child, the stimulus, and the environment. Researchers agree that what the child brings to the viewing experience is as important as the stimulus itself (e.g. Anderson & Lorch, 1983) and the environment in which the viewing occurs (e.g. Jordan, 2005). By evaluating how story schema (an individual difference variable), perceived demand characteristics (an environmental variable), and narrative type (a stimulus variable) impact comprehension of narrative and educational content via a factorial experiment, the research is able to capture relationships previously neglected and offer a greater understanding as to whether these variables moderate one another's functions.

To date, there is no research on how these specific variables interact to impact educational television comprehension. One can see that there are several places where one variable may moderate the effect of another; however the pattern of this moderation is unclear. As such, research questions have been posited for each possible interaction.

The first possible interactions relate to the relationship between story schema and perceived demand characteristics. The empirical literature does suggest that a child's ability level (including story schema) and efficacy with a particular medium can impact the cognitive resources they devote to a task (Cennamo, 1993; Salomon, 1983b). However, these studies do not inform us as to how ability level will moderate the impact of manipulated demand characteristics. While heightened demand characteristics are not predicted to impact central or incidental content comprehension, the possible relationship between demand characteristics and story schema on inferential and educational content comprehension is less clear. It is possible that the variables will not interact to impact either outcome. It seems equally likely that children in the low story schema group will benefit from heightened demand characteristics more than their high story schema peers, or alternatively, that high story schema children will be best able to capitalize on the effects of heighted demand characteristics.

RQ3. *Do perceived demand characteristics (PDC-FUN versus PDC-LEARN) moderate the impact of story schema on inferential comprehension with preschool-aged children?*

RQ4. *Do perceived demand characteristics (PDC-FUN versus PDC-LEARN) moderate the impact of story schema on educational content comprehension with preschool-aged children*?

There are several similar predictions for the relationship between story schema and narrative type. The main effects hypotheses posit that high story schema and participatory narratives will support central and educational content comprehension. How these variables will interact on this comprehension is unclear. It is possible that the variables do not interact on these outcomes. It is also possible that children with low story schema will benefit more from the inclusion of participatory cues than their high story schema peers or, it may be that high story schema children are better able to use the participatory cues to support their central and educational content comprehension. While it is unlikely that the factors would interact to impact incidental content comprehension, it is unclear how these factors would impact inferential content comprehension.

RQ5. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of story schema on central content comprehension with preschool-aged children?*

RQ6. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of story schema on inferential comprehension with preschool-aged children?*

RQ7. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of story schema on educational content comprehension with preschool-aged children?*

The last two-way interaction that the factorial design permits tested is that between perceived demand characteristics and narrative type. Although researchers have suggested that the inclusion of participatory cues can serve to increase the perceived demand characteristics of a program (Crawley et al., 1999), it is unclear as to how these variables may interact. No interactions between demand characteristics and narrative type are expected on central or incidental content comprehension. As both factors are expected to impact educational content comprehension, it is possible that they may interact. It may be that participatory narratives are more beneficial in conditions where demand characteristics are low, or it may be that the presence of participatory cues in an environment with heightened demand characteristics lends itself to superior educational content comprehension. As the role of participatory cues on inferential comprehension is unknown, it is unclear whether and how these variables will interact.

RQ8. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of perceived demand characteristics (PDC-FUN versus PDC-LEARN) on inferential comprehension with preschool-aged children?*

RQ9. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of perceived demand characteristics (PDC-FUN versus PDC-LEARN) on educational content comprehension with preschool-aged children?*

The complete factorial design used in this study also allows a test of how all three variables interact to impact each of the comprehension outcomes. As with the two-way interactions, the literature to date does not lend itself to particular hypotheses regarding the relationship. A research question is offered.

RQ10. *Are the relationships across any two variables moderated by the presence of a third variable for any of the comprehension outcomes measured in this study?*

Methods

Research Design

This study utilized a 2 (story schema: low, high) x 2 (perceived demand characteristics: fun (low), learning (high)) x 2 (narrative type: non-participatory narrative (cues absent), participatory narrative (cues present)) between-subjects fully crossed factorial experiment. The fully crossed factorial design was selected because it yields unconfounded statistical tests of all main effects and interactions and allows smaller sample sizes than would otherwise be needed (Shadish, Cook, & Campbell, 2001).

Participants

Power Analysis. In order to determine appropriate sample size for this study, a power analysis was conducted. Although no studies report effect sizes for the relationship between the variables of interest and both narrative and educational content comprehension, effect sizes were calculated for the main effects of each of the independent variables on narrative comprehension using procedures described by Cohen (1988). Research on the impact of increased AIME (via enhanced PCD by previewing instructions) on narrative comprehension has demonstrated what Cohen (1988) would consider a medium effect size (i.e. Field & Anderson, 1985, Cohen's *d* ranged between .09 (small effect) and .99 (large effect); Salomon & Leigh, 1984, Cohen's $f^2 = .26$ (medium effect)). Research on the role that active program engagement (as a result of participatory cues) plays on narrative comprehension has also demonstrated a medium effect size (i.e. Calvert et al., 2007, Cohen's $f^2 = .13$). Research on the impact that story schema has on central content comprehension has demonstrated a large effect size (i.e. Meadowcroft & Reeves, 1989, Cohen's $d = .90$). Extrapolating from these effect sizes, estimating a medium effect size (i.e. Cohen's f = .25, Cohen, 1988) for this study is reasonable. When conducting a 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) ANOVA model with a desired power of .90, a medium effect size (f) of .25, and a desired alpha level of .05, a total of 171 participants equally distributed across eight cells was needed (Faul, Erdfelder, Lang, & Buchner, 2007).

Study Sample[5]. Because some attrition was anticipated, participants were oversampled. Children were recruited from nineteen childcare centers in and around the Philadelphia area. In accordance with the Institutional Review Board at the University of Pennsylvania, childcare centers were required to provide written consent indicating participation agreement while parents were required to provide written consent for their children to participate as well as provide written consent to record their child's viewing of the experimental stimulus. Participating classrooms were compensated $100 each in the form of gift certificates to an educational supply store. Participating children received a child's book and sticker as compensation. Parents who completed a parent survey were compensated $20 in the form of a Visa gift card.

A total of 209 consent forms were returned. Seventeen children were dropped from analyses because of incomplete data due to child absence. Of the remaining 192 children with complete data, 20 were dropped from final analyses because they were

[5] In addition to the final study sample, fourteen children participate in a pilot study designed to evaluate study procedures. Eleven children completed both the pretest and posttest assessments of the pilot study. The three children that did not complete both assessments had withdrawn from the childcare center prior to completing posttest assessments. Of the eleven children, seven were female. The average age at pretest was 4.38 years (SD = .60). Consent and compensation procedures were identical to that of the full study.

determined to be either too old or too young to participate. In order to be included in the final sample, children were required to be between 3 years, 0 months old and 5 years, 1 month old on the date of pretest. As such, data from 172 children were included in study analyses. This age criterion was based upon previous research on the development of children's narrative skills (Ilgaz & Aksu-Koc, 2005) and children's working memory capacity (Dempster, 1981).

Of the 172 children, females represented 59.3% (n = 102) of the sample. The average age of the children in the sample was 4.20 (SD = .50) with no significant differences in age by gender (F (1,171) = .421, p = .52; Mean $_{\text{males}}$ = 4.24, SD = .50; Mean $_{\text{females}}$ = 4.19, SD = .50). Random assignment resulted in nearly equal group size. Eight-five children (35 males) were assigned to the PDC FUN condition while 87 children (35 males) were assigned to the PDC LEARN condition. Neither gender (χ^2(1, N = 172) = .016, p = .899) nor age (F (1,171) = .680, p = .411) were significantly different across these two randomly assigned conditions. Eighty-six children were assigned to the Non-Participatory Narrative condition (38 males) while the remaining 86 children (32 males) were assigned to the Participatory Narrative condition. While gender (χ^2(1, N = 172) = ..867, p = .352) did not significantly differ by condition, age was found to unexpectedly differ by condition such that children in the Non-Participatory Narrative condition were older (Mean $_{\text{No Cues}}$ = 4.33 SD = .48) than their Participatory Narrative peers (Mean $_{\text{Cues}}$ = 4.17, SD = .50), F (1,171) = 4.36, $p < .05$). At the conclusion of the study, children were assigned to the low or high story schema condition based on their performance on the story schema assessment. Eighty-four children were assigned to the low story schema condition while 88 children were assigned to the high story schema condition. Age was marginally significant for story schema such children in the low story schema condition (Mean $_{LSS}$ = 4.13, SD = .53) were slightly younger than their higher schema peers (Mean $_{HSS}$ = 4.27, SD = .46), F (1,171) = 3.37, p = .07. Because story schema is a developmentally associated measure, some difference in age was expected. There was no difference by gender on the story schema condition, χ^2(1, N = 172) = 2.234, p = .135. When looking at the fully crossed conditions using a (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) factorial analysis of variance, there were no significant differences by age on any of the condition interactions (See Table 1). Similarly, when looking at the distribution of gender by the fully crossed conditions (resulting in eight cells), there were no significant differences by gender (χ^2(7, N = 172) = 4.88, p = .674). See Table 2 for sample size by the three crossed conditions.

Table 1. *Factorial Analysis of Variance Data on Children's Age by Condition*

Variable	***df***	**MS**	***F***
SS	1	.747	3.026^{+}
NT	1	1.001	4.055*
PDC	1	.186	.755
SS x NT	1	.108	.439
SS x PDC	1	.067	.273
NT x PDC	1	.074	.300
SS x NT x PDC	1	.037	.148
Error	164	.247	

Note. SS = Story Schema; NT = Narrative Type (Participatory Narrative; Non-Participatory Narrative); PDC = Perceived Demand Characteristics
**p < .01, *p < .05, ^{+}p < .10

Table 2. *Sample Size by Condition*

Story Schema	PDC	Narrative Type		Totals
		Non-Participatory Narrative	Participatory Narrative	
Low Story Schema	PDC Fun	11% (19)	12% (21)	**23% (40)**
	PDC Learn	12% (21)	13% (23)	**26% (44)**
	Total	**23% (40)**	**26% (44)**	**49% (84)**
High Story Schema	PDC Fun	13% (23)	13% (22)	**26% (45)**
	PDC Learn	13% (23)	12% (20)	**25% (43)**
	Total	**27% (46)**	**24% (42)**	**51% (88)**
			Total Sample Size	**172**

Note. PDC = Perceived Demand Characteristics; Values in parentheses represent total number of children assigned to condition.

Demographic information regarding the participating children and their families was gathered via parent surveys. Of the 172 participating children, 159 parent surveys were returned (92% return rate). Four parents reported that their child had a special need that could interfere with learning (an additional 3 families provided no response to the question). Of those responding to the question of child race (n = 154 parents), more than half of the children were identified as African American (n = 85) followed by approximately 30% of the children identified as White (n = 46), with the remaining children identified as either multiple races (n = 15), Other Race (n = 5), Asian (n =2), or Native American (n =1). Eighteen families (of 150 reporting) identified their children as of Hispanic, Latino, or Spanish origin.

Slightly over 60% of the responding parents (n = 97) reported having a high school diploma, some college, or a vocational or trade school degree. Nearly 25% (n = 38) reported holding a Bachelor's degree and slightly over 10% reported holding a

Master's Degree or higher (n = 16). The remaining respondents (1.4%, n = 2) reported less than a high school diploma. One hundred and eleven respondents (out of 156 respondents) reported that there was a second caregiver in the child's life that helped support the child. This caregiver was most often a parent. Similar to the responding parent, the majority (75%, n = 84) of individuals serving as the other caregiver to children had a high school diploma, some college, or a vocational or trade school degree. Nearly 14% (n = 15) held a Bachelor's degree and 5% (n = 6) held a Master's degree or higher. The remaining other caregivers (5%, n = 7) held less than a high school diploma.

Based on 157 responses, family size averaged 4.08 members, ranging from 2 to 8 persons. Annual gross income for 2008 (based on 129 responses) ranged from $500.00 to $160,000, with a median income of $40,000.00. As an indicator of socioeconomic status of the study sample, family size and income were used to generate an income-to-needs ratio. The income-to-needs ratio reflects absolute income as a proportion of the official poverty line for a family of a particular size in 2008. Therefore, a family with income exactly at the poverty line is at 100% of poverty and has an income to needs ratio of 1.00. In this sample, the mean income to needs ratio for families providing sufficient information (n = 128) was 2.49, ranging from .02 to 7.95. Applying definitions utilized by the NICHD study of early child care (Pierce, 1998) to the income-to-needs data, 18.9% of children in this study were living in poverty (income-to-needs < 1.0) with an additional 32.3% of children living in near-poverty (income-to-needs of 1.0 to 1.99).

There were no significant differences by condition for any of the reported demographic variables. See Table 3 for demographic information by condition, as well significance tests by condition.

Table 3. *Demographic Information by Condition*

Variable	Story Schema: Low				Story Schema: High				Total or Mean (SD)	SS	PDC	NT
	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues		χ^2 (df) or F (df)	χ^2 (df) or F (df)	χ^2 (df) or F (df)
Child Gender										2.23 (1)	.016 (1)	.887 (1)
Male	8	10	12	9	10	7	8	6	70			
Female	11	11	9	14	13	15	15	14	102			
Child Age	4.22 (.56)	4.04 (.56)	4.35 (.46)	4.13 (.52)	4.32 (.50)	4.29 (.44)	4.42 (.45)	4.24 (.47)	4.25 (.50)	3.28^{+} (1,170)	4.36* (1,170)	.68 (1,170)
Child Disability										1.25 (1)[a]	.001 (1)[a]	.011 (1)[a]
No	18	17	19	17	21	19	22	19	152			
Yes	0	1	1	1	1	0	0	0	4			
Not Reported	*1*	*3*	*1*	*5*	*1*	*3*	*1*	*1*	*16*			
Child Race										2.26 (2)	1.12 (2)	2.26 (2)
White	6	3	6	4	12	5	3	7	46			
African American	9	15	10	12	7	9	13	10	85			
Native American	0	0	0	1	0	0	0	0	23			
Asian	0	0	0	1	0	1	0	0				

Variable	Story Schema: Low				Story Schema: High				Total or Mean (SD)	SS	PDC	NT
	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues		χ^2 (df) or F (df)	χ^2 (df) or F (df)	χ^2 (df) or F (df)
Native Hawaiian	0	0	0	0	0	0	0	0				
Multiple Races	2	0	4	1	2	2	3	1				
Other	1	0	0	0	1	2	0	1				
Not Reported	*1*	*3*	*1*	*4*	*1*	*3*	*4*	*1*	*18*			
Child Ethnicity										4.91* (1)	.015 (1)	.004 (1)
Not Latino	15	17	18	16	17	15	17	17	132			
Latino	0	1	1	2	4	4	4	2	18			
Not Reported	*4*	*3*	*2*	*5*	*2*	*3*	*2*	*1*	*22*			
Parent Education (Respondent)										1.66 (3)	1.38 (3)	2.40 (3)
Less than 8th Grade	1	0	0	0	0	0	0	0				
8th Grade	0	0	0	0	0	0	0	0	36			
Some high school	1	0	0	0	0	0	0	0				
High School /GED	3	2	6	4	4	4	8	3				
Some College	3	8	6	5	5	4	6	5	42			

Variable	Story Schema: Low				Story Schema: High				Total or Mean (SD)	SS	PDC	NT
	PDC Fun No Cues	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**	**PDC Fun No Cues**	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**		**χ^2 (df) or F (df)**	**χ^2 (df) or F (df)**	**χ^2 (df) or F (df)**
Vocational / Trade	3	2	2	5	4	2	2	1	21			
Bachelor's Degree	4	7	3	3	5	5	5	6				
Master's Degree	1	0	3	0	3	1	1	3	54			
Ph.D, M.D., J.D.	1	0	0	1	1	1	0	0				
Not Reported	*2*	*2*	*1*	*5*	*1*	*5*	*1*	*2*	*19*			
Employment Status of Respondent										5.84 (3)[a]	4.08 (3)[a]	.222 (3)[a]
Full Time	15	17	17	13	16	12	15	15	120			
Part Time	0	1	1	0	1	3	1	1				
Self-employed	0	0	0	1	0	0	0	0	11			
Homemaker	0	0	0	0	2	0	0	0				
Student	1	1	1	0	1	1	1	0				
Disabled	0	0	0	0	0	0	0	0	17			
Unemployed	1	0	1	4	0	0	3	2				
Multiple Categories	1	0	0	1	2	3	2	1	10			

Variable	Story Schema: Low				Story Schema: High				Total or Mean (SD)	SS	PDC	NT
	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues		χ^2 (df) or F (df)	χ^2 (df) or F (df)	χ^2 (df) or F (df)
Not Reported	1	2	1	4	1	3	1	1	14			
Marital Status of Respondent										.592 (2)	2.54 (2)	.592 (2)
Married	7	5	4	7	11	8	6	10	70			
Living as Married	2	0	6	1	1	0	1	1				
Divorced	2	1	0	0	3	2	0	0				
Separated	1	1	2	2	0	1	0	0	16			
Widowed	0	0	0	0	0	0	1	0				
Never Married / Single	6	12	8	8	7	8	13	8	70			
Not Reported	*1*	*2*	*1*	*5*	*1*	*3*	*2*	*1*	*16*			
Other Caregiver Education										1.57 (4)	2.95 (4)	5.62 (4)
No Schooling	0	0	0	0	1	0	0	0				
Less than 8th Grade	0	0	0	0	0	0	0	0	49			
8th Grade	0	0	0	0	0	0	0	0				
Some high schl	1	0	3	0	0	1	0	1				

Variable	Story Schema: Low				Story Schema: High				Total or Mean (SD)	SS	PDC	NT
	PDC Fun No Cues	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**	**PDC Fun No Cues**	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**		**χ^2 (df)** or **F (df)**	**χ^2 (df)** or **F (df)**	**χ^2 (df)** or **F (df)**
High School/ GED	7	4	5	4	9	3	6	4				
Some College	4	3	4	4	4	6	1	5	31			
Vocational / Trade	0	0	2	2	1	2	2	2	11			
Bachelor's Degree	1	2	1	1	2	1	3	4				
Master's Degree	0	1	0	1	1	1	0	1	21			
Ph.D, M.D., J.D.	1	0	0	0	0	0	0	0				
Not Applicable	*4*	*7*	*5*	*6*	*4*	*5*	*10*	*2*	43			
Not Reported	*1*	*4*	*1*	*5*	*1*	*3*	*1*	*1*	*17*			
Other Caregiver Education Employment Status										1.70 (4)[a]	1.41 (4)[a]	1.79 (4)[a]
Full Time	10	8	13	10	13	10	7	14	85			
Part Time	2	1	0	1	0	1	2	0				
Self-employed	1	1	1	1	2	1	1	2	17			
Homemaker	0	0	0	0	0	0	0	0				
Student	0	0	0	0	0	0	0	0	11			
Disabled	0	0	0	1	0	0	0	0				

Variable	Story Schema: Low				Story Schema: High					SS	PDC	NT
	PDC Fun **No Cues**	**PDC Fun** **Cues**	**PDC Learn** **No Cues**	**PDC Learn** **Cues**	**PDC Fun** **No Cues**	**PDC Fun** **Cues**	**PDC Learn** **No Cues**	**PDC Learn** **Cues**	**Total** or **Mean (SD)**	χ^2 **(df)** or **F (df)**	χ^2 **(df)** or **F (df)**	χ^2 **(df)** or **F (df)**
Unemployed	1	1	1	0	3	1	2	1				
Multiple Categories	0	0	0	0	0	1	0	0	1			
Not Applicable	*4*	*7*	*5*	*6*	*4*	*5*	*10*	*2*	43			
Not Reported	1	3	1	4	1	3	1	1	15			
Income-to-Needs										.024 (1,126)	.271 (.603)	.692 (1,126)
Reported	2.59 (2.23)	2.27 (1.77)	2.36 (1.31)	2.66 (1.67)	2.70 (2.16)	2.75 (2.03)	1.78 (1.06)	2.83 (1.71)	2.50 (1.77)			
Not Reported	*2*	*5*	*6*	*8*	*6*	*7*	*7*	*3*	*44*			

Note. SS = Story Schema (Low, High); PDC = Perceived Demand Characteristics (Fun, Learn); NT = Narrative Type (Non-Participatory Narrative (No Cues), Participatory Narrative (Cues))

***p* < .01, **p* < .05, ^{+}p < .10

[a] Cells have expected count less than 5 violating assumption of Pearson χ^2 statistic, review frequency data to view patterns.

Procedures

After obtaining approval from the Institutional Review Board at the University of Pennsylvania, a small pilot study was conducted to evaluate study procedures. The results of the pilot study revealed that research assistants were able to enact study procedures with little difficulty. Children did not appear to suffer from fatigue suggesting that the assessment lengths were appropriate and the assessments required only minor corrections.

Once the pilot study was completed, the full study commenced. The research design required two testing sessions. Prior to the testing sessions, all children were randomly assigned to one of four viewing conditions created by crossing the perceived demand characteristic manipulation with the narrative type manipulation. All testing was conducted within available spaces in the children's schools (e.g. empty classrooms, recreation rooms, lunch room). After field work was concluded, story schema assignment was determined using a median-split procedure with the children's story schema scores. Because the story schema assessment incorporated television viewing followed by questions about the program, there was some concern that the perceived demand characteristic manipulation for the experimental stimuli would fail because all children would anticipate questions post-viewing. In an effort to decrease this expectation, posttesting was required to occur 7 and 10 days after pretest (Median = 7 days after pretest, Mean = 9.12 days, SD = 3.9; some exceptions were made due to temporary student absence). There were no significant differences by condition in terms of length of time between pretest and posttest (utilized Mann-Whitney test (*U)* and Kruskal -Wallis test (*H)* due to deviations from normality; story schema group: *U*

=3464.5, *p* = .453; perceived demand characteristics: *U* =3240.0, *p* = .138; narrative type: *U* =3460.0, *p* = .440; fully crossed groups resulting in 8 cells: *H* = 9.174(7), *p* = .24).

During the first testing session, children completed assessments to evaluate expressive vocabulary, program familiarity, knowledge of educational content in the experimental stimulus, and story schema skills[6]. During the second session, participants received their respective viewing instructions and viewed their respective stimuli. Prior to viewing, children assigned to the PDC-FUN condition were told "today you are going to watch an episode of *Dora the Explorer* just for fun. While you are watching, I'll be sitting here doing my homework". Children in the PDC-LEARN condition received instructions intended to heighten the perceived demand characteristics of the medium and thus increase the total amount of working memory invested during the viewing. Adapted from Field & Anderson (1985), children in the PDC-LEARN condition were told "Today you are going to watch an episode of Dora the Explorer. I want you to watch really carefully and try to remember as much as you can about the TV show. After you are done watching, I'm going to ask you some questions about the show. Okay? Remember, I want you to watch really carefully and try to remember as much as you can. After you are done watching I'm going to ask you questions about what you watched. While you are watching, I'll be sitting here doing my homework." Children assigned to the participatory narrative condition viewed an unedited episode of *Dora the Explorer* while children in the non-participatory narrative condition viewed the same stimuli, with all

[6] Session 1 assessments were administered in the order listed here.

participatory cues deleted. Both versions of the stimuli have been used successfully in previous research (Calvert et al., 2007).

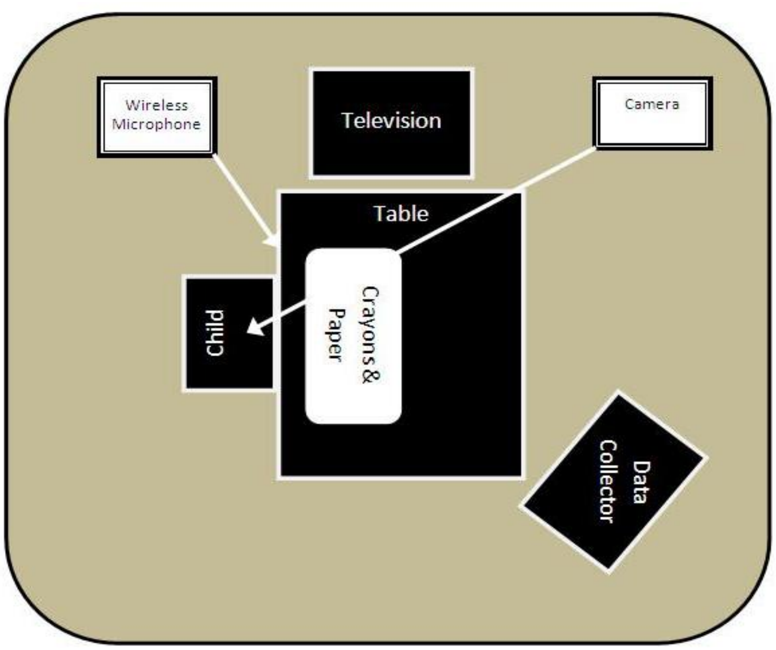
Because research has shown that children have different viewing experiences when viewing with another child (e.g. Wright et al., 1984), viewing was completed individually with only the researcher present with the child. The researcher was ostensibly "doing homework" in order to avoid biased attention to the stimuli as a result of adult attention to the stimuli (see Calvert et al., 2007). Crayons and paper were available as a distracter task during the viewing. If at any time the child asked if he/she was permitted to color, the researcher responded "if you want to". During session 2, the researcher coded children's engagement with the stimulus. To allow for reliability coding of the child's engagement, as well as to allow for coding of attention and use of the distracters, all viewing sessions were videotaped (if explicitly approved by the parent) and subsequently coded by trained research assistants. After viewing was complete, children immediately completed posttest assessments. After answering questions associated with the perceived demand characteristic manipulation check, children completed narrative and educational content comprehension assessments (narrative was administered prior to educational content comprehension).

Apparatus

All viewing and testing was conducted using the same set-up materials and viewing apparatus to help ensure that the viewing experiences were as standardized as possible for each child. Specifically, two identical sets of children's furniture were used for all testing. Each furniture set consisted of a plastic rectangular table for the children to sit at, two plastic children's chairs (one for the child, one for the researcher), and a small plastic table for the television to sit upon. In all testing sessions, the furniture set up was identical such that the television was set on top of the small table and was placed to the side of the child (as opposed to in front of the child). The television was placed to the side of the child to help ensure that the child was choosing to view (he/she could choose to use the distracters instead) as well as to facilitate attention coding. During the second session, a digital video camera, tripod, and wireless microphone were set up to record the child's viewing experience. To minimize distraction, the wireless microphone was secured along the underside of the table (as opposed to securing the microphone on the participant). See Figure 1 for equipment and furniture layout.

All viewing was conducted on two identical Toshiba 15.6 inch widescreen LCD TVs with built-in DVD players. All video recording was conducted using two identical Sony digital video camera recorders (Handycam Model DCR-DVD101) and two identical Sennheiser wireless microphones (Model ew100g2).

Figure 1. *Furniture & Equipment Layout*



Experimental Stimuli

The stimulus had to meet several requirements. First, because story schemas cannot aid in processing content that violates schema expectations, the stimulus needed to conform to a prototypical story structure (Mandler & Johnson, 1977; Meadowcroft, 1986; Stein & Glenn, 1979). Second, in line with the capacity model (Fisch, 2000, 2004), the stimulus needed to have educational content embedded within the narrative plotline (i.e. the show must explicitly seek to teach specific concepts, and do so via a narrative storyline). Third, the stimulus needed to contain participatory cues which highlighted the educational content in the show. Fourth, the narrative structure needed to remain intact when such participatory cues are deleted from the stimulus. Finally, the stimulus needed to be developed for the target population (i.e. preschool-aged children) and be shown to be appealing to that audience. *Dora the Explorer* met all of these requirements.

In a recent content analysis designed to isolate the narrative structures which impact children's comprehension of a television programs, pilot data revealed that *Dora the Explorer* had a strong prototypical narrative structure (Piotrowski, 2007). Further, *Dora the Explorer* embeds educational content within a narrative plotline with a specific emphasis on Spanish language skills, math and visual skills, music skills, and physical coordination. The show explicitly includes participatory cues in each episode as a means of inviting viewers to help Dora and friends solve a problem. In addition to highlighting entertainment content (as with *Blue's Clues)*, the participatory cues highlight the embedded educational content. Moreover, an episode of *Dora the Explorer* titled *Sticky Tape* was successfully manipulated such that one version contained participatory cues and a second version omitted the participatory cues while maintaining the integrity of the narrative plotline (S.L. Calvert, personal communication, September 23, 2008). Finally, *Dora the Explorer* targets preschoolers and has been shown to be quite appealing to the target audience (e.g. in September 2007 *Dora the Explorer* was ranked fifth nationally with children aged 2 through 5, Nielsen Media Research, 2007).

Dr. Sandra Calvert, Director of the Children's Digital Media Center and Professor in the Department of Psychology at Georgetown University, provided the stimuli for this study. She provided an original copy of *Dora the Explorer: Sticky Tape* (i.e. participatory narrative) along with an alternate version in which participatory cues were omitted (i.e. non-participatory narrative). The episode has been used successfully in other research with preschoolers (i.e. Calvert et al., 2007). In this particular episode, Dora and Boots set out to save Benny the Bull, whose hot air balloon is going to crash because it has a hole in it. Dora and Boots decide that to fix the balloon, they need to use sticky tape. As they try to reach Benny and the balloon with their roll of sticky tape in hand, they encounter a number of obstacles that they must solve with the sticky tape including (1) fixing the holes in the sail of a boat so they can get across the windy river, (2) using sticky tape on their shoes to help them gain traction to climb over the slippery rock, and (3) using sticky tape to fix Benny's balloon right before it falls into Crocodile Lake. Throughout the episode, the characters elicit audience participation to help them solve problems. The episode ends as Benny is saved, and Dora and Boots thank the audience for helping (episode description adapted from Calvert et al., 2007).

In every episode of *Dora the Explorer*, viewers practice solving problems and engage in activities using seven types of intelligences (see Gardner, 2000): interpersonal, intrapersonal, visual/spatial, logical/mathematical, bodily/kinesthetic, musical/auditory, and verbal/linguistic (Taylor, 2006). In this specific episode, there are several educational goals embedded in the narrative (M. Diaz-Wionczek, Director of Research and Development for *Dora the Explorer,* personal communication, October 24, 2008) which lend themselves to evaluation. Each is discussed in more detail in the measures section.

Measures

Below is a listing of all measures implemented in this study. Independent variables are presented first, followed by dependent variables and possible covariates. While all measures are presented within this section, not all measures were incorporated in final analyses.

Independent Variable: Story Schema Task. Each participant completed the Story Schema Task during the first testing session. Results from the story schema task were used to assign children to either the high or low story schema group. Adapted from Meadowcroft & Reeves (1989), this assessment measured two different skills (1) the ability to distinguish between central and incidental content, and (2) the ability to put events in correct temporal order in a sequencing task. Both skills have been identified as fundamental to the development or use of story schema (A. L. Brown, 1975; W.A. Collins, 1983; Meadowcroft & Reeves, 1989) and the resulting scale created by combining performance on these tasks has been shown to meet criteria for construct and predictive validity (Meadowcroft, 1986).

As with Meadowcroft & Reeves (1989), a short television narrative was used as stimuli for assessment. The television narrative was required to meet three specific criteria. First, the narrative needed to conform to the prototypical narrative structure (Mandler & Johnson, 1977; Meadowcroft, 1986; Stein & Glenn, 1979). Second, because of the other assessments occurring during Session 1, the running length for the television narrative needed to be less than 15 minutes. Third, in order to ensure that the content was appropriate for the participants, the television narrative had to be developed for the target age of this study. The children's television program *Franklin* met all of these requirements. Featuring a 6-year old turtle named Franklin, the program utilizes a traditional narrative format to present its preschool viewers with stories about the challenges, adventures, and situations that Franklin and his friends encounter (*About Franklin*, 2010). The program utilizes a split-episode framework composed of two 11-minute episodes separated by a bumper or interstitial. For the story schema task, one eleven-minute episode titled *Franklin Goes to School* was selected.

To develop the story schema task, procedures discussed in Collins (1970) were followed. Specifically, a panel of ten adult judges[7] was provided with 42 screen shots representing the entire television narrative. After watching the episode, the judges were asked to identify which of the screen shots represented central story content and which represented incidental content. As with earlier research, the judges were instructed that "central content is content which is essential to the story" while "incidental content is non-essential content which is peripheral or incidental to the main gist of the story". All images receiving the same classification by at least eight judges were retained while all other images discarded. Following this process, three central content images and three

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[7] The adult judges were undergraduate research assistants working at the Children's Media Lab at the Annenberg School for Communication at the University of Pennsylvania. The judges were unaware of the purpose of the research study. Judges were told that were helping with the design of an assessment tool to be used with preschoolers, and that the assessment tool would be used as part of a dissertation research project conducted by one of the graduate students working within the Lab.

incidental images, representing several points throughout the story, were selected for inclusion in the task[8]. See Appendix A for the final images and judges' ratings.

During the assessment, children viewed the television narrative in its entirety. All children were given the same viewing instructions, "You are going to watch an episode of Franklin. I want you to pay close attention to the show. After you are done watching, I'm going to ask you some questions about the show". After viewing, the six story schema images were placed in front of the child one at a time in a predetermined random order along with a laminated strip of paper with six numbered squares demarcated. Then, using adapted directions from Meadowcroft & Reeves (1989), the data collector told the child " I want you to put the pictures in order so that they match what happened in the Franklin episode that you just watched. You can put the pictures on this board." Following these instructions, children were prompted as necessary to complete the task using standard prompt questions (e.g. "which of these pictures happened first in the episode? Great, let's move that to Spot #1 on our board. What happened next in the episode?"). Children were permitted to rearrange and self-correct image ordering when completing the task.

While Meadowcroft & Reeves (1989) used scoring procedures described by Collins (1979) such that one point was given for each adjacent pair of pictures places in the correct sequence for this sequencing procedure, in this assessment the scoring

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[8] Meadowcroft & Reeves (1989) utilized a total of eight pictures in their story schema assessment. Taking in conjunction the fact that the target population in this research is younger that those in Meadowcroft & Reeves' research, as well as the fact that previous research has found that seriation tasks can be challenging for this younger age group (Leifer et al., 1971; Linebarger & Piotrowski, 2006), it was decided that decreasing the number of items to seriate would be a sensible option to help decrease task complexity.

procedure described by Wright et al. (1984) was implemented. Wright et al.'s (1984) scoring procedure is a two-step scoring procedure that scores both how close the image was to its correct absolute position as well as how many pictures were sequenced correctly, regardless of absolute position. To score, images are numbered in the order that events occurred in the television narrative. Next, a child's picture order is compared with the correct order. One point is awarded for every picture with a lower number to the left of it. Then, one point is given for each correct adjacent pair of pictures (i.e. Meadowcroft & Reeve's scoring procedure). The final score for the sequencing task was created by summing both scores. Although the maximum number of possible points was 20 for the sequencing tasks, following procedures described by Wright et al. (1984), all points were adjusted because values of 1, 18, and 19 were numerically impossible. As such, all values between 2 and 17 were reduced by 1 and values of 20 were reduced to 17.

Following the sequencing procedure, the children were asked to again look at all six pictures carefully and select those that represent the "most important thing that happened in the story". After selecting the image, they were asked to select "the next most important thing that happened in the story". This procedure was continued until three pictures have been selected. Following procedures discussed in Meadowcroft (1986), children were awarded points for their picture selection based on the number of judges that identified that picture as central content. (For example, if nine of ten judges identified an image as central to the story, then the child would be awarded nine points for that image.) The final sorting score was created by summing the scores of each of the three selected images.

The final story schema task score was represented by summing the score obtained from the sequencing task with the score obtained in the sorting task. Prior to summing, scores were standardized to ensure they were on the same metric (similar procedure used in Meadowcroft, 1986). Based on this score, children were placed in low or high story schema groups using a median-split procedure (88 children in high story schema group, 84 children in low story schema group; median value = -.0635; standard deviation = 1.38).

Independent Variable: Perceived Demand Characteristics Manipulation Check. Perceived demand characteristics were manipulated such that children assigned to the PDC-FUN condition were instructed to view the program for enjoyment while children in the PDC-LEARN condition were instructed to watch the program carefully and remember as much as possible because they would be tested after viewing. A manipulation check was included in the assessments in order to ensure that the manipulation worked as expected. Specifically, after viewing their respective episode of *Dora the Explorer, c*hildren were asked three questions. Children were asked "how much did you pay attention to the show you just watched?", "how much did you try to understand what was happening in the show?", and "how much did you try to understand what Dora and Boots were doing in the show? For each response, children were given a three-point verbal response option coupled with visual hand gestures ("a whole lot", data collector places hands far apart; "a little bit", data collector places hands close together; "not at all", data collector crosses hands back and forth). The minimum points awarded for each item was zero while the maximum points per item was two. This measure was adapted from other measures (Bordeaux & Lange, 1991; D. E. Field & Anderson, 1985;

Salomon, 1984), however it is has not previously been used in this form. Research has shown that young children have difficulty reporting their own meta-cognitive behaviors (Pingree, 1986), thus confidence in this manipulation check was limited. Unfortunately, no other measures were identified to serve as a suitable alternative.

Cronbach's alpha yielded acceptable but weak internal consistency for these three items ($\alpha = .623$). To confirm one underlying dimension, the items were submitted to a confirmatory factor analysis utilizing principle axis factoring to reduce error variance (Gorsuch, 1983). The factor analysis yielded one factor thus supporting one underlying dimension. Based on these results, the internal consistency of these three items was deemed acceptable for the purposes of this research. A composite score was created by summing the scores from the three questions such that higher scores reflect greater attempt to understand content (Mean = 4.14, SD = 1.70).

Independent Variable: Narrative Type Manipulation Check. Narrative type was manipulated by using two identical stimuli, with the exception that one stimulus has all participatory cues intact while the other stimulus has all participatory cues omitted. The participatory cues were expected to encourage the viewer to interact with the stimuli, and thus support comprehension by inviting the viewer to engage with the stimuli content. Although the manipulation was clean, it was possible that viewer familiarity with the stimulus could override the manipulation. It was also possible that even in the absence of participatory cues, experienced viewers of *Dora the Explorer* may interact with the program more simply because they are used to doing so (S.M. Fisch, personal communication, November 5, 2008). Previous research suggests that this would likely occur during series-typical content (e.g. in each episode of *Dora the Explorer*, there is an entertainment segment in which viewers help Dora and her friends stop Swiper the Fox by yelling "Swiper, no swiping!", Crawley et al., 2002). Moreover, it was possible that despite inclusion of the participatory cues, children might not engage with the content. Based on these possibilities, engagement during viewing was coding to serve as a manipulation check.

Adapted from coding procedures described in Calvert et al. (2007), primary coding was completed during the testing session. While viewing their respective episode of *Dora the Explorer*, the researcher coded the child's engagement with the stimulus during 34 program points where Dora asks viewers to participate with her (because of the script deletions, only 32 of the 34 time points were selected in the non-participatory narrative condition). The child's behavior was coded on a 4-point scale. A score of a 0 represented *no engagement*; a score of a 1 represented *low level engagement* where there is low energy expenditure and sometimes mumbling; a score of 2 represented *average engagement* where the child is responding and participating with the television character; and a score of a 3 represented *enthusiastic engagement* where the child might jump up and down, shout, and point to the screen. To establish reliability, the viewing session was videotaped and a trained research assistant coded all available viewing sessions for engagement (n = 173 of 192 available). Krippendorff's alpha (Hayes & Krippendorff, 2007) indicated acceptable intercoder reliability for all engagement time points (Mean α = .88, ranging from .7580 to .9704; See Table 4). A mean score was calculated across the 34, or 32, timepoints. Higher mean scores reflect greater engagement with the television content (Mean = .3250, SD = .40). The engagement variables were also dummy coded to reflect none versus any engagement (any engagement = 1). The mean was calculated across the number of available time points and converted to reflect a percentage of time points that the child engaged at all (Mean = 19.97%, SD = 22.46%). Higher percentage scores reflect a greater percentage of time points engaging with the television content.

To facilitate post hoc analyses, the engagement data was coded to reflect the type of content the child engaged with. The time points were categorized as representing four types of content: central content (14 points; i.e. content represented information coded as central in the narrative comprehension assessment), educational content (22 points for cues condition, 20 points for no cues conditions; i.e. content represented information addressed in the educational content comprehension assessment), incidental content (4 points; i.e. content represented information coded as incidental in the narrative comprehension test), and entertainment content (7 points; i.e. other content not assessed that would be considered content included for entertainment). As expected, based on the integral nature of the narrative and educational content, central and educational content shared several time points. A mean was calculated across the number of available time points for each content type. Higher mean scores reflect greater engagement with the television content ($Mean_{Central} = .2903$, $SD_{Central} = .3880$; $Mean_{Educational} = .3056$, $SD_{Educational} = .3746$; $Mean_{Incidental} = .3285$, $SD_{Incidental} = .5316$; $Mean_{Entertainment} = .2982$, $SD_{Entertainment} = .4528$).

Table 4. *Reliability Coefficients for Engagement Coding*

Variable	Krippendorf's Alpha
Engagement, Point 1	.9537
Engagement, Point 2	.9188
Engagement, Point 3	.8415

Engagement, Point 4	.9171
Engagement, Point 5	.7729
Engagement, Point 6	.9212
Engagement, Point 7	.8870
Engagement, Point 8	.9063
Engagement, Point 9	.9164
Engagement, Point 10	.9151
Engagement, Point 11	.8844
Engagement, Point 12	.8763
Engagement, Point 13	.9407
Engagement, Point 14	.9699
Engagement, Point 15	.9322
Engagement, Point 16	.7580
Engagement, Point 17	.9330
Engagement, Point 18	.7838
Engagement, Point 19	.8878
Engagement, Point 20	.8877
Engagement, Point 21	.8705
Engagement, Point 22	.8790
Engagement, Point 23	.8050
Engagement, Point 24	.8936
Engagement, Point 25	.7599
Engagement, Point 26	.9455
Engagement, Point 27	.9653
Engagement, Point 28	.8561
Engagement, Point 29	.9001
Engagement, Point 30	.8886
Engagement, Point 31	.9406
Engagement, Point 32	.9704
Engagement, Point 33	.8789
Engagement, Point 34	.8462

Dependent Variable: Narrative Content Comprehension. Narrative content comprehension encapsulates three types of content investigated in this study: central content, inferential content, and incidental content. Central content is that content which is essential to the plotline and is explicitly portrayed in the program while inferential content is that plot-relevant content which is not portrayed explicitly but must be inferred by viewers. Incidental content (also referred to as peripheral content in the literature) is that content which is nonessential to plot understanding (W. A. Collins et al., 1978). Administered after viewing the experimental stimuli in Session 2, the narrative content comprehension assessment consisted of 25 questions evaluating central content comprehension, inferential content comprehension, and incidental content comprehension of the experimental stimuli.

Questions evaluating central content comprehension of the experimental stimuli have been successfully used in previous research (i.e. Calvert et al., 2007). Following procedures developed by Collins (1970), Calvert et al. (2007) developed the central content questions through a two-part process in which a panel of adult judges viewed the program episode and rated the content as central, plot relevant material or incidental material that was irrelevant to the plot. Questions with a minimum centrality rating of 70% were retained, resulting in 10 central content questions. For this study, all original questions (both retained and rejected) developed by Calvert et al. (2007) as well as additional newly created questions were submitted to a panel of eight adult judges[9] for evaluation. After viewing the original, unedited episode of the *Dora the Explorer: Sticky Tape*, the judges were asked to rate whether they felt the question evaluated central,

[9] See Footnote 7.

incidental, or inferential content. Central and incidental content definitions were equivalent to those definitions utilized for the story schema assessment development. Inferential content was defined as "content that is essential to the story, but is not explicitly portrayed in the episode". A total of 48 questions were evaluated.

In order to be eligible for inclusion on the final assessment, questions required a ranking of at least 70% agreement across judges. An effort was made to ensure that questions were representative of the entirety of the episode. Ten central content questions were identified of which six were identical to those utilized in Calvert et al. (2007). In order to facilitate possible future comparisons across studies, an additional four questions were included on the assessment that were said to measure central content knowledge in Calvert et al. (2007) but did not emerge as central content items from the current panel of judges. Six questions said to measure incidental content comprehension were identified for inclusion on the assessment. For inferential content, 3 questions were identified for inclusion. Based on judges' scoring, one question considered by Calvert et al (2007) to measure "implicit" content was also included as a possible measure of inferential content. Finally, based on previous research looking at inferential understanding (Paris & Paris, 2001), one additional question was added post-judges ranking for inferential knowledge. The resulting narrative comprehension assessment contained 25 items. Table 5 contains a listing of all narrative comprehension questions, their respective category, and judges' average ranking.

Table 5. *Narrative Comprehension Questions: Type and Average Judge Rating*

Question Number	Question	Type	% Agreed Judges
1	What is Benny the Bull stuck in?	Central	75%
2	What does Benny the Bull need?	Central	100%
3	Why does Benny need sticky tape?	Central	87.50%
4	Who helps Dora and Boots find out where the balloon is going?	Central*	62.5%
5	Where is the balloon headed?	Central	100%
6	Where do Dora & Boots go first?	Central	87.50%
7	Where do Dora & Boots go next?	Central	87.50%
8	What does Dora drop on the way to the Windy River?	Incidental	100%
9	Who helps Dora across the Windy River?	Incidental	100%
10	How do Dora and Boots get across the Windy River?	Central	100%
11	How do Dora and Boots fix the sailboat?	Central	75%
12	What do Dora, Boots, and Tico wear when they go across the Windy River in the sailboat?	Incidental	100%
13	Who patches up the sailboat?	Incidental	75%
14	What does Swiper try to do before Dora & Boots reach Slippery Rock?	Incidental	75%
15	Why can't Dora and Boots get over Slippery Rock?	Central*	62.5%
16	How do Dora and Boots get over Slippery Rock?	Central	87.50%
17	When Dora & Boots take the sticky tape off their shoes, where do they put the tape?	Incidental	100%
18	Where does Swiper throw the sticky tape?	Central*	0%
19	How do Dora and Boots get in the balloon?	Central*	62.5%
20	What do Dora and Boots use to help Benny fix the balloon?	Central	100%
21	How does Benny feel when he calls out to Dora & Boots?	Inferential	75%
22	What will happen if Benny's balloon goes in the lake?	Inferential	100%
23	Why did Dora want to help Benny?	Inferential	75%
24	Why doesn't Benny want the balloon to land in the lake?	Inferential*	62.5%
25	At the end of the show, Dora, Boots, and Benny celebrate. What do you think will happen next?	Inferential**	No Rating

Note. Central items demarcated with an asterisk (*) were ranked as central by Calvert et al. (2007) but did not receive the required ranking for inclusion. The inferential item demarcated with an asterisk (*) was ranked as implicit in Calvert et al. (2007) but included as a possible inferential item on this assessment. The inferential item with two asterisks (**) was added as a possible inferential item on the assessment.

In terms of administration, Calvert et al. (2007) provided each child with three verbal response options to choose from. In other research (e.g. Linebarger & Piotrowski, 2006), researchers have found that pictorial response options are superior to verbal options for preschoolers. As such, for the narrative comprehension assessment, all responses options were pictorially represented for central and incidental questions. Several episodes of *Dora the Explorer* were digitally captured to create screen shots of episode scenes. These screen shots were edited using professional editing software (e.g. *Adobe Photoshop 6.0*) to create stylistically equivalent pictorial response options. For those questions utilized in Calvert et al (2007), response options were similar or identical whereas response options were created for the additional questions used in this study. Because of the nature of the inferential questions, an image was selected from the show to help cue the child to the referred scene, but no responses options were provided. Appendix B contains a copy of the images used for the narrative comprehension assessment.

For the analyses, composite scores were created to represent central, incidental, and inferential content comprehension. Central content comprehension reflected performance on the ten questions identified as central by the current panel of judges (i.e. did not contain the four additional items included on the original Calvert et al. (2007) assessment). Incidental content reflected performance on the six questions identified as incidental by the panel of judges. Prior to creating the composite scores, the items were examined for internal consistency. The internal consistency of these four items was deemed acceptable. Cronbach's alpha yielded acceptable internal consistency for both variables ($\alpha_{central} = .79$; $\alpha_{incidental} = .65$) and a factor analysis utilizing principle axis factoring to reduce error variance (Gorsuch, 1983) supported one underlying dimension. For both central and incidental questions, correct answers received one point while incorrect answers received zero points. Higher composite scores reflected greater central or incidental comprehension ($Range_{central}$ = 1.0 to 10.0, $Mean_{central}$ = 7.49, $SD_{central}$ = 2.49; $Range_{incidental}$ = 0.0 to 6.0, $Mean_{incidental}$ = 4.42, $SD_{incidental}$ =1.56).

In this study, the five possible inferential content questions relied on open-ended responses. All open-ended responses were scored by the researcher and a trained research assistant. The codebook for these items can be found in Appendix C. Scores on these items ranged from a minimum of 0 points awarded to a maximum of 2 points awarded. Krippendorff's alpha (Hayes & Krippendorff, 2007) indicated strong intercoder reliability for all open-ended inferential questions (Mean α = .93, ranging from .87 to .96; See Table 6). In the current study, the single item not reviewed by the judges' panel was omitted from all analyses. Four items remained for potential inclusion on the inferential content composite variable and were analyzed for internal consistency. A correlation matrix was computed to assess inter-item correlation (See Table 7). The correlation matrix revealed that all items were significantly correlated with one another. Cronbach's alpha yielded a weak internal consistency (α = .571). A confirmatory factor analysis utilizing principle axis factoring to reduce error variance (Gorsuch, 1983) supported one underlying dimension. Based on these results, the internal consistency of these four items was deemed acceptable. A composite score was created by summing the scores from the four questions such that higher scores reflected greater inferential comprehension (Range = 0.0 to 8.0; Mean = 3.93, SD = 2.13).

Table 6. *Reliability Coefficients for Coding of Open-Ended Responses*

Assessment	Question Number	Question	Krippendorff's Alpha
Pretest Educational Content Comprehension	27	This is a picture of tape. What can you do with tape?	.8508
Narrative Comprehension	21	How does Benny feel when he calls out to Dora & Boots?	.9374
Narrative Comprehension	22	What will happen if Benny's balloon goes in the lake?	.9503
Narrative Comprehension	23	Why did Dora want to help Benny?	.9287
Narrative Comprehension	24	Why doesn't Benny want the balloon to land in the lake?	.9583
Narrative Comprehension	25	At the end of the show, Dora, Boots, and Benny celebrate. What do you think will happen next?	.8782
Posttest Educational Content Comprehension	28	What are all the things that Dora & Boots fixed with the sticky tape?	.9973
Posttest Educational Content Comprehension	29	Can you think of anything else that you can do with sticky tape?	.8658

Table 7. *Correlations among Inferential Comprehension Items*

Variables	21	22	23	24
21. How does Benny feel when he calls out to Dora & Boots?	--			
22. What will happen if Benny's balloon goes in the lake?	.211**	--		
23. Why did Dora want to help Benny?	.204**	.394**	--	
24. Why doesn't Benny want the balloon to land in the lake?	.170*	.355**	.327**	--

$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

Dependent Variable: Educational Content Comprehension. *C*hildren completed the educational content comprehension assessment after viewing their respective version of *Dora the Explorer*. As educational content comprehension was not assessed in previous research with this stimulus (i.e. Calvert et al., 2007), these items were developed by the researcher. Prior to the creation of this assessment, the director of Research and Development for *Dora the Explorer* provided a list of the educational goals embedded in the narrative of the *Sticky Tape* episode (M. Diaz-Wionczek, Director of Research and Development for *Dora the Explorer,* personal communication, October 24, 2008). Those educational goals that lent themselves to evaluation were included in the assessment. Specifically, visual/spatial knowledge, mathematical/logical skills, verbal/linguistic skills, and bodily/kinesthetic skill were evaluated via 26 questions. Additional questions designed to measure transfer of educational knowledge were included in the assessment but were not evaluated in this study as the goal of this study was content comprehension evaluation, not transfer evaluation.

In the *Sticky Tape* episode of *Dora the Explorer*, visual/spatial knowledge was defined as understanding how to read the map used in the show, shape identification (circle), color recognition (yellow), and item recognition in an embedded image. Six questions were developed to measure these skills. To assess map understanding, children were shown a map from the *Dora the Explorer* episode along with three images from the map. They were asked to place the pictures in the correct order according to the map. Correct answers received 1 point while incorrect responses received no credit. Shape and color identification were measured via three questions. Children were shown four shapes and were asked to name each one (with circle being among them, worth 1 point); were shown six blocks of color and asked to name each color (with yellow being one of them, worth 1 point); and were shown an image with multicolored shapes and asked to find the four hidden yellow circles (worth maximum of 4 points, also measures item recognition in embedded image). Item recognition in an embedded image was measured via two additional questions that required children to view images and find specific objects. Both images appeared in the *Dora the Explorer* episode (worth 1 point each).

Mathematical/logical skills were defined as enumeration and receptive understanding of the numbers 1 through 5 in English, and were measured via 6 questions. Verbal/linguistic skills were defined as enumeration, definition, and receptive understanding of the numbers 1 through 5 in Spanish, and were measured via 11 questions. For both skills, enumeration was measured by asking the child to count to 5 in English and Spanish. Completely incorrect responses were awarded 0 points, partially correct responses (e.g. counting to 3 correctly) received ½ point, and fully correct responses were awarded 1 point. Children completed two tasks to measure definition and receptive understanding of the numbers 1 through 5 in Spanish. First, they were asked to define each Spanish number (e.g. "tell me what dos means"). Correct responses were awarded 1 point, partially correct responses (i.e. responses indicating some understanding that the word was Spanish and/or represented a number) received ½ point, and incorrect responses received no credit. Next, a receptive assessment was administered in which children were shown three images of random objects (e.g. hearts, oranges, seashells) and were asked to select the image that depicted a specific number of objects (e.g. "Point to the picture that shows tres hearts"). Correct responses received one point while incorrect responses received zero points. Receptive understanding of the numbers 1 through 5 in

English was assessed using the same receptive measure and scoring framework implemented for Spanish numbers.

For bodily/kinesthetic understanding, reaching and stepping is promoted in the episode (the characters model climbing a rope ladder). One question was used to measure this skill, "show me how Dora & Boots climbed up the rope ladder into the balloon". Children correctly demonstrating the behavior were awarded one point while incorrect responses received zero points.

In addition to the items measuring the specific episode goals, two items were included to measure divergent processing of the educational content. Employed previously by Calvert et al. (2007), these questions required the participants to recall all of the uses of the sticky tape in the episode (maximum = 6 points, 1 point per item) and then provide additional ways to use sticky tape (no maximum, 1 point per unique use). These questions were open-ended response items. They were coded by the researcher and a trained research assistant to ensure reliability (See Appendix C for codebook). Krippendorff's alpha (Hayes & Krippendorff, 2007) for these items indicated strong intercoder reliability (α = .93 and .8658, see Table 6).

The scores across the 26 items were summed to create a composite score representing educational content comprehension with higher scores representing greater comprehension of the educational content (Range = 4.0 to 33.0, Mean = 18.75, SD = 5.80). Table 8 lists the 26 assessment questions, their associated skill level, and whether or not the question was pictorially supported. Pictorial representations of the images associated with the educational content assessment can be found in Appendix D.

Table 8. *Educational Content Comprehension Questions*

Question Number	Question	Type	Picture Support
1	Swiper the Fox hid the sticky tape in the jungle. Find the sticky tape for me.	Visual/Spatial	Yes
2	Dora & Boots need to find the sticky tape in Dora's backpack to help Benny the Bull. Find the sticky tape for me.	Visual/Spatial	Yes
3	This picture is all mixed up! Can you find the hidden yellow circles for me in this picture?	Visual/Spatial	Yes
4	Each of these pictures is a different shape. Tell me the shape of each of these.	Visual/Spatial	Yes
5	Each of these blocks is a different color. Tell me the color of each of these.	Visual/Spatial	Yes
6	This map shows me how to get to Crocodile Lake. Here are three pictures of places on the map– this is a picture of Slippery Rock, this is a picture of Crocodile Lake, and this is a picture of the Windy River. Using these pictures, show me how Dora and Boots got to Crocodile Lake to save Benny the Bull.	Visual/Spatial	Yes
7	Count to five for me.	Mathematical/logical	No
8	Tell me what "dos" means.	Verbal/linguistic	No
9	Tell me what "uno" means.	Verbal/linguistic	No
10	Tell me what "cuatro" means.	Verbal/linguistic	No
11	Tell me what "cinco" means.	Verbal/linguistic	No

12	Tell me what "tres" means.	Verbal/linguistic	No
13	Count to five for me in Spanish.	Verbal/linguistic	No
14	Point to the picture that shows cinco oranges.	Verbal/linguistic	Yes
15	Point to the picture that shows two oranges.	Mathematical/logical	Yes
16	Point to the picture that shows tres hearts.	Verbal/linguistic	Yes
17	Point to the picture that shows one heart.	Mathematical/logical	Yes
18	Point to the picture that shows dos strawberries.	Verbal/linguistic	Yes
19	Point to the picture that shows three strawberries.	Mathematical/logical	Yes
20	Point to the picture that shows uno leaves.	Verbal/linguistic	Yes
21	Point to the picture that shows four leaves.	Mathematical/logical	Yes
22	Point to the picture that shows cuatro seashells.	Verbal/linguistic	Yes
23	Point to the picture that shows five seashells.	Mathematical/logical	Yes
24	Show me how Boots & Dora climbed up the rope ladder into the balloon.	Bodily/kinesthetic	No
25	What are all the things that Dora & Boots fixed with the sticky tape? Follow-up with: Is there anything else that Dora & Boots fixed with sticky tape?	Divergent Processing	No
26	Can you think of anything else that you can do with sticky tape? Follow-up with: Is there anything else you can do with sticky tape?	Divergent Processing	No

Potential Covariate: Expressive Vocabulary. Because expressive vocabulary continues to develop throughout the preschool years, it was possible that the child's ability to express him/herself would be limited by his/her developing vocabulary. While every effort was made to ensure that the comprehension assessments were developmentally appropriate, it was possible that expressive vocabulary abilities could play a role in the outcomes. As such, all participants completed the Picture Naming Task (Missall & McConnell, 2004) during the first testing session. In this task, the child is shown a series of pictures and asked to name as many as he/she can in one minute. Categories of objects included animals, food, people, household objects, games and sports materials, vehicles, tools, and clothing. Psychometric properties for this measure have been shown adequate. Alternate forms reliability ranged between .44 and .78 while test-retest reliability over a two-week period was .69. Concurrent validity estimates with the Peabody Picture Vocabulary Test – 3rd Edition (Dunn & Dunn, 1997) and with the Preschool Language Scale – 3 (Zimmerman, Steiner, & Pond, 1992) are .53 and .79. The assessment has been shown sensitive to developmental status and growth over time. In this study population, the mean score was 18.31 with a standard deviation of 6.52.

Potential Covariate: Educational Content Knowledge. Dora the Explorer targets preschool aged children, which broadly encompasses children three through five years of age. Because all participants were participating in some form of childcare, it was possible that children in the sample may already know some of the educational content. As such, a version of the educational content comprehension assessment was created and administered during the first testing session. The pretest was identical in content to the posttest assessment, with the exception that any mention of *Dora the Explorer* was omitted and replaced (where necessary) with content that would ensure that question is interpretable. This assessment consisted of 25 questions, one less than the posttest assessment because the pretest corollary for divergent processing was only one question. One item (divergent processing) utilized an open-ended response. This item was coded by the researcher and a trained research assistant to ensure reliability (See Appendix C for codebook). Krippendorff's alpha (Hayes & Krippendorff, 2007) for this item indicated acceptable intercoder reliability ($\alpha = .85$, see Table 6).

The scores across the 25 items were summed to create a composite score representing educational content knowledge prior to viewing with higher scores representing greater knowledge of the educational content (Range = 5.5 to 28.50; Mean = 16.70, SD = 4.57).

Potential Covariate: Program Familiarity. Because program familiarity may play a role in how children experience the stimulus and because research has shown that viewing styles can transfer from one stimuli to another (Crawley et al., 2002), all participants completed a program familiarity assessment during the first testing session. The 33-question assessment contained images of characters from *Dora the Explorer* as well of images of characters from other shows that contain participatory cues designed to invite audience participation (i.e. *Go Diego Do!, Blue's Clues, Super Why!, Little Einsteins).* Sixteen questions, representing both main and secondary characters, were used to assess familiarity with *Dora the Explorer*. The remaining seventeen questions, representing main characters, were used to assess familiarity with other children's programs that invite audience participation. Children were asked to name the character for all questions. Correct responses receive 1 point, partially correct responses received

½ point (e.g. knew the program but not the character name), and incorrect responses received no credit.   Two scores were created from this assessment: one indicating familiarity with *Dora the Explorer* (Range = 0.0 to 16.0; Mean = 8.24, SD = 3.45), and one indicating experience with other programs that invite audience participation (Range = 0.0 to 15.0; Mean = 4.98, SD = 3.30). Appendix E illustrates all 33 images used for this assessment.

Potential Covariate: Parent Survey Variables. A 33 question parent survey was sent home with child consent forms (see Appendix F).   The parent survey was designed to assess demographic information (20 questions) as well as information on program familiarity (both *Dora the Explorer* and other audience participation programs), weekly media exposure estimates, and the child's favorite media products.

Four questions were used to assess the child's viewing experience and enjoyment of *Dora the Explorer* as well as other programs that invite audience participation (i.e. *Blue's Clues*, *Blue's Room*, *Little Einstein*, *Go Diego Go!*, and *Super Why!).* Parents were asked to report whether or not their child had seen each show before. If their child had seen the program, they were asked to report how many days per week their child watches the show, whether they own a DVD/VHS copy of the program for their child to view, and how much their child likes the show (4 point scale; strongly likes = 4, somewhat likes, somewhat dislikes, strongly dislikes = 1).

To assess awareness of programs, two variables were created.   One variable represented the number of children who had previously seen *Dora the Explorer* (i.e. parent answered affirmatively to previous viewing; n = 156 of 158 responses) while a second variable was created to represent the number of other audience participation programs the child had previously seen by summing the affirmative responses to questions on *Blue's Clues*, *Little Einsteins*, *Go Diego Go!*, and *Super Why!*[10] (Mean = 3.11, SD = .91 based on 157 responses).

To assess exposure to these programs, two variables were created. One variable represented the minimum number of episodes of *Dora the Explorer* the child watches in one week (i.e. number of days per week child watches show; Range = 0 to 7; Mean = 3.33, SD = 2.03 based on 148 responses). A second variable represented the minimum number of other audience participation programs the child views in one week by summing the number of days per week the child watches *Blue's Clues*, *Little Einsteins*, *Go Diego Go!*, and *Super Why!* (Range = 0 to 28; Mean = 7.36, SD = 5.36 based on 146 responses). These variables represent minimum viewing amounts because it is feasible that the child viewed more than one episode per day, however, repetitive viewing was not captured in this survey. Thus for *Dora the Explorer* viewing the maximum possible episodes viewed per week equals the maximum days per week (7) while for "other" programs the maximum possible viewed equals 7 days x 4 episodes (28).

Home ownership of *Dora the Explorer* and other audience participation programs on vide was measured via two variables. One variable represented the minimum number of DVD/VHS copies of *Dora the Explorer* available for the child to use at home (i.e. parent answered affirmatively to owning DVD/VHS copy; n = 89 of 153 responses). A second variable was created to represent the minimum number of other audience participation videos that the child had access to at home by summing the affirmative

[10] Questions regarding *Blue's Room* were not included because children were not asked about that question in the child level program familiarity assessment.

responses to questions regarding DVD/VHS ownership of *Blue's Clues*, *Little Einsteins*, *Go Diego Go!*, and *Super Why!* (Range = 0 to 4, Mean = .82, SD = 1.03 based on 152 responses). These variables represent minimum viewing DVD/VHS ownership because it is feasible that families have several DVDs of a particular program, however, ownership of several videos was not captured in this survey. Thus for *Dora the Explorer* the maximum ownership captured in the survey is one while for "other" programs the maximum ownership is four.

To assess appeal of these programs, two variables were created. One variable represented how much the child liked *Dora the Explorer* (Range = 1 to 4, Mean = 3.81, SD = .46 based on 155 responses). A second variable was created to represent the average appeal of *Blue's Clues*, *Little Einsteins*, *Go Diego Go!*, and *Super Why!* by taking the average of the appeal ratings for those four programs (Range = 2.67 to 4.0, Mean = 3.44, SD = .34 based on 154 responses). Higher values represent greater program appeal for both appeal variables.

Four multi-part questions were used to assess the amount of time the child spent on weekly media activities. Parents reported how many weekdays and how many minutes per weekday their child watched television, watched videos, played video games, played handheld video games, read or looked at books, used the computer with no internet, went online, and watched television programs online. Using the same media activities, parents reported how many weekend days and for how many minutes per weekend day their child did these activities. Seven variables were created representing weekly amount (in minutes) spent with each of the media activities (viewing TV shows online was omitted because of its redundancy with "going online"). The variables were creating by summing the amount of time reported for weekdays (i.e. number of weekdays reported x minutes per weekday reported) with the amount of time reported for weekends (i.e. number of weekend days reported x minutes per weekend day reported). Children in this sample spent an average of 582 minutes per week (SD = 560.7, 146 responses) watching television, 258.8 minutes (SD = 275.4, 145 responses) watching videos, 48.1 minutes (SD = 100.6, 152 responses) playing video games, 24.5 minutes (SD = 54.54, 150 responses) playing handheld video games, 246.6 minutes (SD = 241.1, 145 responses) reading or looking at books, 43.6 minutes (SD = 74.9, 152 responses) using the computer without internet, and 51.32 minutes (SD = 141.8, 152 responses) going online. These estimates are similar to other estimates for preschoolers (e.g. Rideout & Hamel, 2006).

Five open-ended questions were used to assess the child's favorite media products at the time of the study. Parents were asked to report their child's favorite television show, video, book, video game, and computer game. This data was not included in analyses, but is presented in the Appendix G to provide additional descriptive data regarding the participants.

Additional Measure: Attention to Stimulus. Attention is seen as indicator of content comprehensibility. Children are said to be active viewers who attend to content that is comprehensible and who strategically use program attributes as cues for attention (Anderson & Lorch, 1983; Huston, Bickham, Lee, & Wright, 2007). As attention and comprehension are linked, a measure of attention to the experimental stimulus was included in this study to facilitate potential post hoc analyses. Two trained coders separately coded all videos (n = 171[11]) for visual orientation to the experimental stimuli.

As attention was not a primary variable of interest in this study, coding for this variable was less specific than in other research. Rather than coding for looks onscreen to identify a total amount of time spent visually oriented to the screen (Anderson & Kirkorian, 2006), coders coded for the presence or absence of visual orientation to the screen during the 34 (or 32, depending upon participatory cues condition) time points established in the engagement coding. To help ensure intercoder reliability, a key word in the program script during each of the time points was used as a marker for when to code for attention to the screen. If during a selected time point the child was found to be off screen, the coder also coded for the use of the distracters using a binary scale of use/no use. Krippendorff's alpha (Hayes & Krippendorff, 2007) indicated acceptable intercoder reliability for all attention time points (Mean α = .90, ranging from .7866 to .9898; See Table 9) and for all distraction coding (Mean α = .8739, ranging from .6325 to 1.00; See Table 9). Six variables were created from this data.

For attention, the mean was calculated across the number of available time points that the child was visually oriented to the screen was calculate. To aid in interpretation, this data was converted to reflect the percentage of time points the child was visually oriented to the screen (Mean = 71.92%, SD = 24.26%). Higher percentage scores reflect a greater attention to the television content.

[11] Although 173 children (of 192 posttested children) had video recordings available for attention coding, equipment malfunctions resulted in 171 video recordings available.

To facilitate post hoc analyses, the attention data was coded to reflect the type of content the child engaged with. In procedures identical to that of the engagement data, the time points were categorized as representing four types of content: central content (14 points; i.e. content represented information coded as central in the narrative comprehension assessment), educational content (22 points for cues condition, 20 points for no cues conditions; i.e. content represented information addressed in the educational content comprehension assessment), incidental content (4 points; i.e. content represented information coded as incidental in the narrative comprehension test), and entertainment content (7 points; i.e. other content not assessed that would be considered content included for entertainment). As expected based on the integral nature of the narrative and educational content, central and educational content shared several time points. A mean was calculated across the number of available time points for each content type. To aid interpretation, this mean was converted to reflect the percentage of available time points that the child was visually oriented to the screen. Higher mean scores reflect greater attention to the television content ($Mean_{Central}$ = 69.3%, $SD_{Central}$ = 26.1%; $Mean_{Educational}$ = 73.3%, $SD_{Educational}$ = 24.6%; $Mean_{Incidental}$ = 76.6%, $SD_{Incidental}$ = 28.8%; $Mean_{Entertainment}$ = 64.6%, $SD_{Entertainment}$= 29.6%).

For distracter use (i.e. use of available crayons and/or paper), the mean was calculated across the number of available time points and converted to reflect the percentage of time points that the child used the distracters when eyes were off screen (Mean = 30.58%, SD = 37.22%). Higher percentage scores reflect a greater percentage of time points, when not attending to the television, that the child was using the distracters.

Table 9. *Reliability Coefficients for Attention and Distraction Coding*

Variable	Krippendorf's Alpha	Variable	Krippendorf's Alpha
Attention, Point 1	.8642	Distraction, Point 1	1.000
Attention, Point 2	.8592	Distraction, Point 2	.9384
Attention, Point 3	.8948	Distraction, Point 3	.9401
Attention, Point 4	.7866	Distraction, Point 4	1.000
Attention, Point 5	.8617	Distraction, Point 5	.9304
Attention, Point 6	.8496	Distraction, Point 6	.8923
Attention, Point 7	.8524	Distraction, Point 7	.9669
Attention, Point 8	.8792	Distraction, Point 8	.8393
Attention, Point 9	.9031	Distraction, Point 9	.9388
Attention, Point 10	.8812	Distraction, Point 10	.6325
Attention, Point 11	.8960	Distraction, Point 11	.7969
Attention, Point 12	.8909	Distraction, Point 12	.9595
Attention, Point 13	.9552	Distraction, Point 13	.9029
Attention, Point 14	.8497	Distraction, Point 14	.7400
Attention, Point 15	.9171	Distraction, Point 15	.8582
Attention, Point 16	.8917	Distraction, Point 16	.8796
Attention, Point 17	.8262	Distraction, Point 17	.9315
Attention, Point 18	.8941	Distraction, Point 18	.9272
Attention, Point 19	.8811	Distraction, Point 19	.9050
Attention, Point 20	.8956	Distraction, Point 20	.8530
Attention, Point 21	.9421	Distraction, Point 21	.9553
Attention, Point 22	.8907	Distraction, Point 22	.8971
Attention, Point 23	.9031	Distraction, Point 23	.7934
Attention, Point 24	.9151	Distraction, Point 24	.8808
Attention, Point 25	.9641	Distraction, Point 25	.7462
Attention, Point 26	.9598	Distraction, Point 26	.6749
Attention, Point 27	.9898	Distraction, Point 27	.8858

Attention, Point 28	.9385	Distraction, Point 28	.7653
Attention, Point 29	.9479	Distraction, Point 29	1.000
Attention, Point 30	.9248	Distraction, Point 30	.6738
Attention, Point 31	.9168	Distraction, Point 31	.8295
Attention, Point 32	.8238	Distraction, Point 32	1.000
Attention, Point 33	.9031	Distraction, Point 33	.9095
Attention, Point 34	.8915	Distraction, Point 34	.8674

Analytic Approach

All data was entered into a computerized database by a trained research assistant and validated by a second trained research assistant. In the validation procedure, all entered data is retrieved from the database and the validater compares the entered data to the hardcopy data to ensure no data entry errors. If errors are found, the validater corrects the entry error and the updated value is entered into the database. This two-step procedure of entry and validation minimizes entry errors, and has been shown to work effectively. After all data entry and validation was completed, all data was cleaned and variables created. All analyses were conducted with SPSS v. 15.0.

Manipulation Check. After variable creation, the manipulation check data was analyzed using 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) factorial analysis of variance model predicting the relevant manipulation check data. Due to dramatic deviations from a normal distribution, a reflective square root transformation was used for the perceived demand characteristic manipulation check while a square root transformation was used for the narrative type manipulation check (Tabachnick & Fidell, 2007). To ease interpretation, the non-transformed values are displayed in the text. To estimate the practical significance of the outcomes, SPSS-generated (v. 15.0) partial eta-squared effect sizes (Cohen, 1988) are reported. In addition to these tests, the Mann-Whitney test (*U)* was used to provide additional information on the differences in engagement by the narrative type condition. For these analyses, the effect size *r* was calculated by dividing the SPSS-generated (v. 15.0) z-scores by the sample size (Rosenthal, 1991).

Covariate Inclusion. Analysis of covariance models were planned for all final model analyses. Prior to these analyses, analyses related to covariate inclusion were completed. Bivariate relationships among potential covariates, independent variables, and dependent variables were examined. Up to three covariates were selected for inclusion in models predicting narrative comprehension while four covariates were selected for inclusion in models predicting educational content comprehension. A detailed discussion of covariate selection is included in the preliminary analyses section.

Final Analytic Models. Four models evaluating the hypotheses and research questions were used in the final analyses. A 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) factorial analysis of covariance model predicting each of the four outcome variables while controlling for specific covariates was conducted. Due to dramatic deviations from a normal distribution, a reflective log transformation was used for both central and incidental content comprehension (Tabachnick & Fidell, 2007) to more closely approximate a normal distribution. To ease interpretation, non-transformed values are displayed in the text. All means reported in the text reflect covariate-adjusted group means[12]. When pairwise comparisons were made, corrections

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[12] The covariate-adjusted means, in log values, were converted to reflect untransformed means.

for experiment-wise error were performed using modified Bonferroni adjustments of the alpha level (Jaccard, 1998). To estimate the practical significance of the outcomes, SPSS-generated (v. 15.0) partial eta-squared effect sizes are reported (Cohen, 1988).

Post hoc Analyses. Several post hoc analyses were conducted to address unexpected findings. In these analyses, a variety of statistical procedures were employed. For analyses related to the effect of story schema, attentional data was examined. As data deviated from a normal distribution, Mann-Whitney (*U)* tests were employed to compare differences by group while Friedman's analysis of variance was used to tests differences by attention to content type. To follow up on omnibus findings, Wilcoxon's signed-rank test (*T)* was used for pairwise comparisons using Bonferroni adjustments of the alpha level. For analyses related to the effect of narrative type, engagement data was evaluated. Spearman's correlation coefficient was used to examine relationships between engagement and outcomes. These relationships were followed up via ordinary least squares regression analyses to estimate the effects of engagement on outcomes, controlling for other variables of interest. For analyses related to the effect of perceived demand characteristics, Mann-Whitney *(U)* tests were employed to compare differences by group on attention and engagement. Where appropriate, the effect size *r* was calculated by dividing the SPSS-generated (v. 15.0) z-scores by the sample size (Rosenthal, 1991).

Preliminary Analyses

Manipulation Checks

Perceived Demand Characteristics. Perceived demand characteristics were manipulated such that children assigned to the PDC-FUN condition were instructed to view the program for enjoyment while children in the PDC-LEARN condition were instructed to watch the program carefully and remember as much as possible because they would be tested after viewing. This manipulation is said to impact the amount of invested mental effort while viewing and thus impact comprehension. A manipulation check in the form of three questions was included in the study to determine if the manipulation worked as anticipated. The questions were designed to assess whether the children invested heightened mental effort while viewing (e.g. “how much did you pay attention to what you just watched? “a whole lot”, “a little bit”, “not at all”). Data from the three questions were summed to create a composite score. If the manipulation worked as anticipated, children in the PDC-LEARN condition should have higher mean scores than children in the PDC-FUN condition. Moreover, there should be no significant differences by the other study conditions (i.e. story schema or narrative type) or significant interactions by conditions on this variable.

The manipulation check was evaluated using a 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) between-subjects factorial ANOVA. A reflective square root transformation was applied to the composite score to more closely approximate a normal distribution. As evidenced by an insignificant main effect, children in the PDC-LEARN condition (Mean = 4.11) reported levels of mental effort comparable with their PDC-FUN peers (Mean = 4.15), $F(1,162) = .202$, $p = .884$, partial

$\eta^2 = .001$. There were no significant main effects for the other conditions or any significant interactions across conditions. See Table 10.

Table 10. *Factorial ANOVA for PDC Manipulation Check*

	df	MS	*F*	Partial η^2
SS	1	.514	2.010	.012
NT	1	.052	.202	.001
PDC	1	.005	.022	.000
SS x NT	1	.077	.301	.002
SS x PDC	1	.046	.182	.001
NT x PDC	1	.119	.465	.003
SS x NT x PDC	1	.254	.993	.006
Error	162	.256		

Note. SS = Story Schema; NT = Narrative Type (Participatory Narrative; Non-Participatory Narrative); PDC = Perceived Demand Characteristics
$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

The manipulation check data suggests that the perceived demand characteristic manipulation failed. However, recall that there was some concern at study onset that this manipulation check may not work as intended because young children have difficulty reporting their own meta-cognitive behaviors (Pingree, 1986). Further, the high level of mental effort reported from all children (Mean = 4.14, SD = 1.70, Maximum Possible Value = 6.0) suggests that these children may have experienced a form of response bias (A.B. Jordan, personal communication, March 28, 2010) such that they felt inclined to report heighted attention. This trend towards reporting heightened attention makes sense when one considers the fact that all data collection occurred in a school setting where "paying attention" is frequently encouraged. Thus, while some caution should be used when interpreting the role of perceived demand characteristics, it seems fair to suggest that the manipulation may have worked and only the check on the manipulation failed.

Narrative Type. Narrative type was manipulated by using two identical stimuli; with the exception that one stimulus has all participatory cues intact while the other stimulus has all participatory cues omitted. The participatory cues were expected to encourage the viewer to overtly interact with the stimuli, and thus support comprehension by inviting the viewer to engage with the stimuli content. Children's engagement during viewing was measured as a way to evaluate whether this manipulation check worked as intended. Engagement was measured on a 4-point scale ranging from no engagement with the content (i.e. no overt interactions with the stimuli) to enthusiastic engagement with the content (e.g. the child might jump up and down, shout, and point to the screen when Dora asks them a question). Coded data from measured time points was averaged to create an average engagement score. If the manipulation worked as anticipated, children in the Participatory Narrative (cues) condition should have higher mean scores indicating greater overt engagement with the stimuli when compared to children in the Non-Participatory Narrative (no cues) condition. Moreover, there should be no significant differences by the other study conditions (i.e. story schema or PDC) or significant interactions by conditions on this variable.

The manipulation check was evaluated using a 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) between-subjects factorial ANOVA. A square root transformation was applied to the composite score to more closely approximate a normal distribution. Children in the Participatory Narrative (Mean = .54) were significantly more engaged with the television content compared to their Non-

Participatory Narrative peers (Mean = .1134), $F(1,164) = 87.40$, $p < .001$, partial η^2 = .348. As expected, there were no significant main effects for the other conditions or any significant interactions across conditions. See Table 11. Looking at this from another perspective, children who viewed the experimental stimuli with cues were found to overtly engage with the content during 32.6% of the measured time points (Median = 32.3) whereas children who viewed stimuli without cues were found to overtly engage with the content significantly less (only engaged during 7.27% of the measured time points; Median = 3.12), $U = 1225.5$, $p < .001$, $r = -.58$. Thus, the data suggests that the participatory cues manipulation worked as expected.

Table 11. *Factorial ANOVA for Narrative Type Manipulation Check*

	df	MS	*F*	Partial η^2
SS	1	.098	1.031	.006
NT	1	8.318	87.40**	.348
PDC	1	.075	.791	.005
SS x NT	1	.006	.063	.000
SS x PDC	1	.013	.138	.001
NT x PDC	1	.129	1.355	.008
SS x NT x PDC	1	.121	1.268	.008
Error	164	.095		

Note. SS = Story Schema; NT = Narrative Type (Participatory Narrative; Non-Participatory Narrative); PDC = Perceived Demand Characteristics
**$p < .01$, *$p < .05$, $^+p < .10$

Covariate Selection

Covariates are infrequently needed in experimental research by virtue of random assignment. However, when utilized in experimental research, the inclusion of covariates can increase the statistical power of the analysis by decreasing the within-group error variance. That being said, the inclusion of covariates comes at the loss of degrees of freedom. Thus, when considering covariate inclusion, it is a balancing act between decreasing error in the model and losing degrees of freedom. Referred to as “nuisance” variables (Wildt & Ahtola, 1978), covariates influence the dependent variable in a linear fashion and independently of the level of the independent variable(s) (Wildt & Ahtola, 1978). They are included in statistical models to either remove extraneous variation from the dependent variable, thus increasing precision of the analysis, or to remove bias due to the groups not being matched on the independent variable (Wildt & Ahtola, 1978).

Three extraneous variables known to impact the dependent variables were identified at the study outset. Previous research suggested that familiarity with the stimuli and similar stimuli (Crawley et al., 2002; Mares, 2007) as well as the child’s ethnicity (Calvert et al., 2007) may play an important role in program comprehension. As none of these variables were formally investigated as independent variables in this study, all three (familiarity with stimuli, familiarity with similar stimuli, and child ethnicity) were measured in this study as potential covariates.

Outside of these potential covariates, because story schema was an individual difference variable and thus not assigned randomly, and because of attrition threats resulting in possible group differences, there was some concern that the final groups may not be equally matched resulting in differences that could bias the analyses. Several variables were measured to help address these potential biases. First, because expressive vocabulary continues to develop throughout the preschool years, it was possible that children's performance on the outcome assessments could be impacted by their developing vocabulary. As such, all children in the study completed assessments of their expressive vocabulary level. Second, because different levels of educational content knowledge at pretest would subsequently impact measured educational content comprehension at posttest, all children completed a pretest assessment to establish baseline educational content knowledge. Beyond these child-directed assessments, parents in the study completed a parent survey designed to provide (1) demographic information, (2) information about their child's familiarity with study stimuli as well as similar audience participation programming, and (3) and the typical amount of media their child consumes weekly. These variables were thought to potentially relate to the dependent variable as well as offer a comprehensive background about the participants in the study.

The inclusion of covariates comes at the expense of degrees of freedom. While covariates can increase the precision of a model by decreasing within-group error variance, careful consideration and evaluation was necessary when determining covariate inclusion. The three extraneous variables thought to potentially covary with the dependent variable (i.e. familiarity with stimulus, familiarity with programs similar to stimulus, child ethnicity) were evaluated in relationship to the four dependent variables (central narrative comprehension, incidental narrative comprehension, inferential narrative comprehension, and educational content comprehension at posttest). Due to deviations from normality, Spearman's correlation coefficient (r_s) was used to describe the bivariate relationships between interval level variables while the Mann-Whitney (*U)* test was used to describe the relationship between dichotomous and interval level variables. Results illustrated that while both familiarity variables were significantly correlated with the dependent variables, child ethnicity was not significantly related to the narrative comprehension variables and showed only a weak relationship with educational comprehension ($p=.09$). While both familiarity variables remained eligible for inclusion as covariates, the child ethnicity variable was removed from contention. See Table 12 for correlation coefficients.

Following this step, all variables collected in the parent survey were analyzed by independent variable to determine if there were any significant differences by condition. If the variables were found to be significantly different by condition, and if this relationship was unexpected, this variable was considered a potential covariate because its exclusion from the model could bias the analyses. A total of ten variables (of 26) were either significantly or marginally significantly different across at least one of three independent variables. Table 3 (presented on page 51) lists all demographic variables by condition while Table 13 lists all household media use by condition. The bivariate relationships between nine of these ten variables (one variable was child ethnicity, already removed) and the dependent variables were examined. Spearman's correlation coefficient was used to examine the relationship for interval level variables ($n = 8$). The Mann-Whitney (*U)* test was used to describe the relationship for the dichotomous variable. Results (see Table 12) illustrated that of the nine variables, only age was significantly related to all four dependent variables. Weekly computer use and weekly online use had a significant positive correlation with educational content comprehension.

Reported familiarity with study stimuli as well as reported familiarity with similar stimuli was removed from covariate contention because the child program familiarity variables were more consistently related to the dependent variables.

Table 12. *Correlations among Potential Covariates and Dependent Variables*

	Test	**Central Narrative**	**Incidental Narrative**	**Inferential Narrative**	**Educ. Content**
DTE: Familiarity	r_s	.292**	.349**	.412**	.431**
OTR: Familiarity	r_s	.272**	.362**	.336**	.470**
Child Ethnicity	*U*	1073.0	1106.0	1063.0	896.0^{+}
Child Age at Pretest	r_s	.399**	.315**	.257**	.486**
DTE: Min. episodes/wk	r_s	-.107	.005	-.108	-.164*
DTE: Own at least one video	*U*	2526.0	2571.0	2348.5^{+}	2500.0
*DTE :*Appeal	r_s	-.088	.049	-.052	-.096
OTR: Sum Seen	r_s	.064	.144	.125	.143
OTR: Min. episodes/wk	r_s	-.157	.003	-.163*	-.112
Wkly TV Use	r_s	-.003	.073	-.003	.011
Wkly Computer Use	r_s	.158	.182*	.040	.223**
Wkly Online Use	r_s	.149	.162*	.066	.181*
Expressive Vocabulary	r_s	.394**	.426**	.306**	.592**
Educ. Content Pretest	r_s	---	---	---	.793**

Note. DTE = *Dora the Explorer*; OTR = Other Similar Stimuli
**$p < .01$, *$p < .05$, $^{+}p < .10$

Table 13. *Media Use at Home by Condition, Final Sample (n = 172)*

Variable	Story Schema: Low				Story Schema: High					SS	PDC	NT
	PDC Fun No Cues	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**	**PDC Fun No Cues**	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**	**Total** or **Median (n)**	χ^2 **(df)** or ***U***	χ^2 **(df)** or ***U***	χ^2 **(df)** or ***U***
DTE: Seen Show										.003(1)[a]	.000(1)[a]	.003(1)[a]
Yes (n)	18	19	19	19	22	18	22	19	156			
No (n)	0	0	1	0	0	1	0	0	*2*			
Not Reported (n)	*1*	*2*	*1*	*4*	*1*	*3*	*1*	*1*	*14*			
DTE: Minimum # Episodes/Wk (Median)	3.0	3.0	3.0	2.25	2.25	4..5	2.0	5.0	3.0 (148)	2594.5	2439.0	2247.5[+]
Not Applicable (n)	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*2*			
Not Reported (n)	*1*	*3*	*3*	*5*	*3*	*3*	*3*	*1*	*22*			
DTE: Own Video										.654(1)	.202(1)	5.46(1)*
Yes (n)	12	9	8	11	10	14	10	15	89			
No (n)	6	8	12	7	12	4	11	4	64			
Not Reported (n)	*1*	*4*	*1*	*5*	*1*	*4*	*2*	*1*	*19*			
DTE: Appeal (Median)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0 (155)	2651.0[+]	2829.0	2829.0
Not Applicable (n)	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*2*			
Not Reported (n)	*1*	*2*	*1*	*3*	*2*	*4*	*1*	*1*	*15*			

Variable	Story Schema: Low				Story Schema: High				Total or Median (n)	SS	PDC	NT
	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues	PDC Fun No Cues	PDC Fun Cues	PDC Learn No Cues	PDC Learn Cues		χ^2 (df) or *U*	χ^2 (df) or *U*	χ^2 (df) or *U*
OTR: Sum # Program Seen (Median)	3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0	3.0 (157)	2952.5	2615.5$^+$	2851.0
Not Reported (n)	*1*	*2*	*1*	*5*	*1*	*3*	*1*	*1*	*15*			
OTR: Minimum # Episodes/Wk (Median)	6.5	6.5	5.0	6.0	7.0	8.5	4.5	6.5	6.0 (146)	2405.0	2216.0$^+$	2326.0
Not Reported (n)	*1*	*3*	*2*	*8*	*3*	*4*	*3*	*2*	*26*			
OTR: Minimum # Videos Owned (Median)	1.0	0.0	1.0	0.0	1.0	.5	1.0	0.0	0.0 (n =152)	2761.5	2884.5	2610.0
Not Reported (n)	*2*	*4*	*1*	*5*	*1*	*4*	*2*	*1*	*20*			
OTR: Average Appeal Rating (Median)	3.38	3.50	3.42	3.33	3.50	3.58	3.42	3.50	3.50 (154)	2574.0	2559.5	2557.0
Not Reported (n)	*1*	*2*	*1*	*6*	*2*	*4*	*1*	*1*	*18*			
Wkly TV (mins, Median)	362.5	480.0	350.0	525.0	420.0	420.0	285.0	540.0	420.0 (146)	2469.5	2569.5	1894.0*
Not Reported (n)	*1*	*4*	*3*	*7*	*3*	*4*	*3*	*1*	*26*			
Wkly Video/DVD (mins, Median)	225.0	150.0	164.0	210.0	270.0	195.0	120.0	255.0	180.0 (145)	2514.0	2457.0	2261.5

Variable	**Story Schema: Low**				**Story Schema: High**					**SS**	**PDC**	**NT**
	PDC Fun No Cues	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**	**PDC Fun No Cues**	**PDC Fun Cues**	**PDC Learn No Cues**	**PDC Learn Cues**	**Total** or **Median (n)**	**χ^2 (df)** or ***U***	**χ^2 (df)** or ***U***	**χ^2 (df)** or ***U***
Not Reported (n)	*1*	*3*	*3*	*7*	*4*	*4*	*4*	*1*	*27*			
Wkly Video Game (mins, Median)	0.0	0.0	0.0	7.5	0.0	45.0	0.0	0.0	0.0 (152)	2634.5	2855.0	2548.5
Not Reported (n)	*1*	*2*	*3*	*5*	*2*	*3*	*3*	*1*	*20*			
Wkly HandHeld Vid Game (mins, Median)	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0 (150)	2566.5	2669.0	2628.0
Not Reported	*1*	*3*	*3*	*6*	*2*	*3*	*3*	*1*	*22*			
Wkly Book (mins, Median)	180	210	180	210	210	180	185	270	210 (145)	2285.5	2521.0	2342.0
Not Reported	*1*	*4*	*4*	*7*	*3*	*4*	*3*	*1*	*27*			
Wkly Computer (mins, Median)	5.0	0.0	0.0	0.0	27.5	0.0	0.0	40.0	0.0 (152)	2380.0*	2790.0	2735.0
Not Reported	*1*	*2*	*3*	*5*	*3*	*3*	*2*	*1*	*20*			
Wkly Online Use (mins, Median)	0.0	0.0	0.0	0.0	0.0	90.0	0.0	40.0	0.0 (152)	2546.5	2653.0	2256.0*
Not Reported	*1*	*2*	*3*	*6*	*2*	*3*	*2*	*1*	*20*			

Note. SS = Story Schema (Low, High); PDC = Perceived Demand Characteristics (Fun, Learn); NT = Narrative Type (Non-Participatory Narrative (No Cues), Participatory Narrative (Cues))

**$p < .01$, *$p < .05$, $^{+}p < .10$

[a] Cells have expected count less than 5 violating assumption of χ^2 statistic, consult frequency data

Following this step, the two remaining variables eligible for potential inclusion as covariates (expressive vocabulary and educational content pretest knowledge) were examined in relationship to the dependent variables. Expressive vocabulary was examined in relationship to all four dependent variables while educational content pretest knowledge was examined in relationship to its posttest corollary. Expressive vocabulary was found to be significantly correlated with all four dependent variables while educational content pretest knowledge was significantly related with its posttest counterpart. Both remained eligible for inclusion. Table 12 (page 102) depicts the bivariate correlations among all possible covariates and the dependent variables.

At this point, four variables (familiarity with stimulus, familiarity with programs similar to stimulus, child's age, and expressive vocabulary) were possible covariates for all measured outcomes while an additional three variables (weekly computer use, weekly online use, and educational content pretest knowledge) were possible covariates for educational content knowledge at posttest. The next step was to determine if these variables were unassociated with condition. If a covariate is correlated with the independent variable, then its inclusion in the model will underestimate the effect size of the independent variable because some effects attributable to the treatment are eliminated from the dependent variable (Wildt & Ahtola, 1978). However, as discussed earlier, if a variable is unexpectedly correlated with an independent variable, then treating this variable as a covariate is appropriate. Table 14 depicts the bivariate relationships among all of the possible covariates and the independent variables.

Table 14. *Correlations among Potential Covariates and Independent Variables*

		Independent Variable		
	Test	Story Schema	Perceived Demand Characteristics	Narrative Type
DTE: Familiarity	*U*	3393.0	2956.5*	3195.5
OTR: Familiarity	*U*	3013.0*	2859.5*	3281.5
Child Age at Pretest	*U*	3146.5^{+}	3457.5	2991.5*
Wkly Computer Use	*U*	2380.0*	2790.0	2735.5
Wkly Online Use	*U*	2546.5	2653.0	2256.0*
Expressive Vocabulary	*U*	2904.5*	3122.5	2921.0^{+}
Educ. Content Pretest	*U*	2657.0*	3512.5	3552.5

Note. DTE = *Dora the Explorer*; OTR = Other Similar Stimuli
$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

As previously determined, the three variables from the parent survey data (child's age, weekly computer use, and weekly online use) were significantly different by at least one condition. Child's age at pretest was shown to differ marginally by story schema assignment ($p < .09$) and narrative type. Difference by story schema was not surprising because story schema is a developmentally associated construct (Applebee, 1977; Riley et al., 2007), however, age was not expected to different by narrative assignment. Thus, while including age as a covariate when investigating the role of narrative type is appropriate, using age as a covariate when evaluating the role of story schema may underestimate the impact of story schema. Weekly computer use was related to story schema assignment while weekly online use was related to narrative assignment. Neither condition was expected to differ by these variables, thus both variables remain appropriate covariates.

Both familiarity variables were also shown to be significantly different by at least one condition. Familiarity with *Dora the Explorer* was shown to be significantly different by the perceived demand characteristic manipulation while familiarity with similar stimuli was shown to be significantly different by this manipulation as well as the story schema manipulation. As neither condition was expected to result in these differences, both familiarity variables remain appropriate covariates.

Educational content pretest knowledge and expressive vocabulary were also shown to be significantly different by at least one independent variable. Educational content knowledge at pretest was shown to be significantly different by story schema condition. This relationship is somewhat unsurprising as story schema has been positively associated with other academic outcomes in previous research (Paul & Smith, 1993) and thus this relationship is likely more indicative of shared skill set. While its inclusion may underestimate the effect of story schema, controlling for initial knowledge allows for a cleaner test of the predictive value of story schema, and thus it remained an appropriate covariate in analyses. Expressive vocabulary, on the other hand, differed significantly by story schema and marginally by narrative type ($p = .09$). Previous research suggested that the relationship between story schema and expressive vocabulary was expected (Ouellette, 2006), however the relationship between narrative type and expressive vocabulary was unexpected. Thus, while including expressive vocabulary as a covariate when investigating the role of narrative type is appropriate, using expressive vocabulary as a covariate when evaluating the role of story schema may underestimate the impact of story schema.

The analyses of potential covariates in relation to independent and dependent variables revealed somewhat messy relationships. The familiarity variables, child's age, and expressive vocabulary were found to be appropriate covariates when narrative comprehension (central, incidental, or inferential) is the core variable under investigation. These variables, along with educational knowledge at pretest, weekly computer use, and weekly online use, were found to be appropriate covariates when educational content comprehension is the core variable under investigation. However, in both cases, when the impact of story schema is of interest, it is likely that the inclusion of child's age, expressive vocabulary, and educational content at pretest will underestimate the effect of story schema. Thus, models which include these variables represent a conservative test of the study hypotheses related to story schema.

Because the inclusion of too many covariates can lower the precision of the estimate of treatment effects, the predictive value of the selected covariates in relation to each other as well as to each of the dependent variables was examined. Following procedures described by Darlington (1996), regression analyses predicting each dependent variable from their associated covariates (while omitting the independent variables) were conducted. The covariates were examined after each regression. The least significant covariate was deleted from the model, and the model re-run, until all t statistics for each covariate were 1.42 or above, in absolute value. Results from these analyses revealed that, when including all covariates in the model, familiarity with other similar stimuli was an insignificant predictor of all four dependent variables. Expressive vocabulary was also found to be an insignificant predictor of inferential comprehension while both weekly computer usage and weekly online usage were found to be insignificant predictors of educational content comprehension. Thus, final models predicting central and incidental content comprehension include child's age, familiarity with *Dora the Explorer*, and expressive vocabulary. Final models predicting inferential content comprehension include child's age and familiarity with *Dora the Explorer*. Final models predicting educational content comprehension include child's age, familiarity with *Dora the Explorer*, expressive vocabulary, and educational content knowledge at pretest.

The covariates were examined for multicollinearity to ensure there were no interpretation errors regarding the effects of the independent variables (Allison, 1999a). Spearman's correlation coefficient was used to examine the relationship between the covariates (See Table 15). Because many of the variables were significantly correlated with one another, it was important to determine if these correlations were strong enough to cause multicollinearity concerns. Following procedures described in Allison (1999a), each covariate was regressed on the other covariates and the resulting collinearity statistics were examined. Tolerance values lower than .40 were considered indicative of collinearity concerns (Allison, 1999a). The regressions resulted in acceptable tolerance values (between .596 and .865) suggesting that while many covariates are intercorrelated, the intercorrelations are not so high that they will lead to interpretation errors.

Table 15. *Correlations (r_s) among Covariates*

	1	2	3	4
1. Dora the Explorer: Familiarity	1.00	.133	.456**	.389**
2. Child Age at Pretest		1.00	.353**	.489**
3. Expressive Vocabulary			1.00	.584**
4. Educ. Content Pretest				1.00

**$p < .01$, *$p < .05$, $^{+}p < .10$

Testing Model Assumptions

Because analyses of covariance models were planned for all outcome-based analyses, it was critical to ensure that all models met the assumptions under which ANCOVA is reliable. In addition to requiring independent observations and a dependent variable measured at the interval level, ANCOVA models analyses require that the (1) data is normally distributed, (2) variances in each experimental condition are fairly similar (i.e. homogeneity of variance), and (3) that the relationship between covariates and the dependent variable does not differ by groups (i.e. homogeneity of regression slopes; Wildt & Ahtola, 1978).

The skewness and kurtosis of all dependent variables and covariates were evaluated in relationship to the three independent variables to ensure normally distributed data. All covariates were found to closely approximate a normal distribution. For dependent variables, while inferential content comprehension and educational content comprehension were found to be sufficiently normal, both central and incidental content comprehension deviated drastically from a normal distribution. Using a reflective logarithmic transformation, these variables were transformed to more closely approximate a normal distribution and thus satisfy the normality assumption for analysis of covariance (Tabachnick & Fidell, 2007).

Homogeneity of variance was evaluated by calculating Levene's test, a test designed to test the null hypothesis of equality of variance. If Levene's test is significant, then the variances are significantly different from one another and thus the assumption of homogeneity of variance is violated (A. Field, 2005). The assumption of homogeneity of variance was confirmed for each dependent variable: central content comprehension (*F*

(7,160) = 1.17, *p* = .325); incidental content comprehension (*F* (7,160) = .748, *p* = .632); inferential content comprehension (*F* (7,164) = 1.89, *p* = .07); educational content comprehension (*F* (7,160) = .954, *p* = .47).

Homogeneity of regression slopes was tested by running customized ANCOVA models in which the main effects for the independent variable and covariates, as well as the interaction terms between the covariates and the independent variables, were evaluated. If the interaction terms are significant in the model, then the assumption of homogeneity of regression slopes is not tenable (A. Field, 2005). The assumption of homogeneity of regression slopes was confirmed for all dependent variables, although there were several marginally significant relationships present between independent variables and covariates present. As ANCOVA has been shown to be robust to small violations of this assumption (Wildt & Ahtola, 1978) , these marginal relationships were accepted. See Table 16.

Table 16. *Testing Homogeneity of Regression Slopes*

Term	**Central Content Comp.**	**Incidental Content Comp.**	**Inferential Content Comp.**	**Educational Content Comp.**
SS x Age	$F(1,152) = .161$	$F(1,152) = .166$	$F(1,160) = 1.78$	$F(1,148) = 3.60^{+}$
NT x Age	$F(1,152) = .185$	$F(1,152) = .001$	$F(1,160) = .644$	$F(1,148) = .086$
PDC x Age	$F(1,152) = .478$	$F(1,152) = .313$	$F(1,160) = .953$	$F(1,148) = 3.01^{+}$
SS x DTE Fam.	$F(1,152) = .583$	$F(1,152) = .031$	$F(1,160) = 1.32$	$F(1,148) = 1.37$
NT x DTE Fam.	$F(1,152) = .020$	$F(1,152) = 1.42$	$F(1,160) = 2.26$	$F(1,148) = 1.81$
PDC x DTE Fam.	$F(1,152) = 1.35$	$F(1,152) = 3.14^{+}$	$F(1,160) = 1.77$	$F(1,148) = 2.75^{+}$
SS x EV	$F(1,152) = .790$	$F(1,152) = .032$	---	$F(1,148) = 3.26^{+}$
NT x EV	$F(1,152) = .005$	$F(1,152) = .020$	---	$F(1,148) = .629$
PDC x EV	$F(1,152) = .015$	$F(1,152) = .860$	---	$F(1,148) = .518$
SS x PreEduc	---	---	---	$F(1,148) = 1.81$
NARR x PreEduc	---	---	---	$F(1,148) = .012$
PDC x PreEduc	---	---	---	$F(1,148) = 2.80^{+}$

Note. SS = Story Schema; NT = Narrative Type (Participatory Narrative; Non-Participatory Narrative); PDC = Perceived Demand Characteristics; DTE Fam = Familiarity with *Dora the Explorer*; EV = Expressive Vocabulary; PreEduc = Educational Content Knowledge at Pretest
$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

Results

Central Content Comprehension

H3. *Preschool-aged children with high story schema will demonstrate greater central content comprehension than their low story schema peers.*

H6. *Preschool-aged children viewing a television program with participatory cues (Participatory Narrative) will demonstrate greater central content comprehension than their peers viewing a television program without participatory cues (Non-Participatory Narrative).*

RQ5. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of story schema on central content comprehension with preschool-aged children?*

RQ10. *Are the relationships across any two variables moderated by the presence of a third variable for any of the comprehension outcomes measured in this study?*

Recall that central content comprehension is one aspect of narrative television processing investigated in this study. Defined as comprehension of information that is explicitly presented in the program, central content comprehension is said to occur in working memory and is presumed to be given priority over educational content processing (i.e. principle of narrative dominance; Fisch, 2004). In this study, it was hypothesized that high story schema (H3) and the presence of participatory cues in a television program (H6) would both aid in processing central content in a narrative-structured television program. A research question (RQ5) asked whether these variables would interact to support central content comprehension. Finally, although perceived demand characteristics were not assumed to support central content comprehension, a research question (RQ10) addressed whether perceived demand characteristics interacted with story schema and narrative type on this outcome.

To address hypotheses and research questions, a 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) factorial analysis of covariance model predicting central content comprehension while controlling for child's age, expressive vocabulary, and familiarity with *Dora the Explorer* was conducted (see Table 17). The hypothesis related to story schema (H3) was confirmed. Children with high story schema (Mean = 8.66, SD = 2.15) exhibited greater central content comprehension than their low story schema peers (Mean = 7.93, SD = 1.91), $F(1,157) = 7.59$, $p < .05$, partial $\eta^2 = .05$. The inclusion of participatory cues (H6), however, did not significantly impact central content comprehension, $F(1,157) = 1.91$, $p = .17$, partial $\eta^2 = .01$. Children viewing content with participatory cues (Mean = 8.13, SD = 2.18) performed similarly to their non-cues viewing peers (Mean = 8.50, SD = 1.98). H6 was rejected.

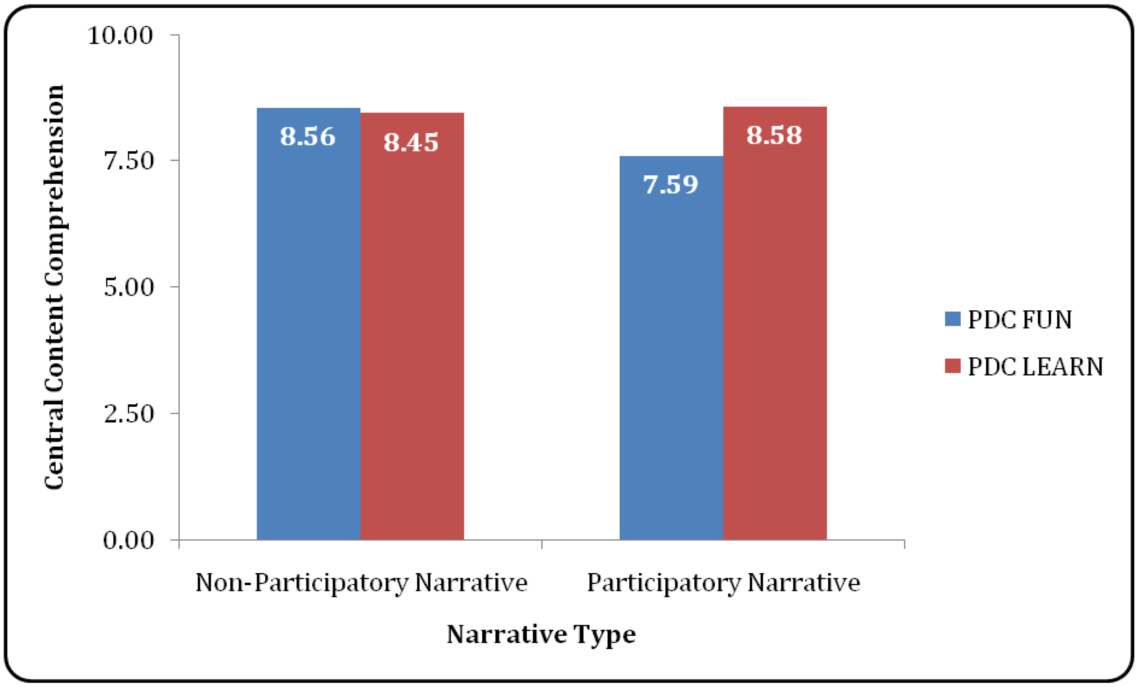
Table 17. *Factorial ANCOVA on Central Content Comprehension*

	df	MS	*F*	Partial η^2
Child's Age	1	1.231	16.711**	.096
Expr. Vocab.	1	.175	2.375	.015
DTE Familiarity	1	.573	7.781*	.047
SS	1	.559	7.588*	.046
NT	1	.141	1.912	.012
PDC	1	.167	2.262	.014
SS x NT	1	.031	.417	.003
SS x PDC	1	.032	.430	.003
NT x PDC	1	.294	3.986*	.025
SS x NT x PDC	1	.045	.613	.004
Error	157	.074		

Note. Expr. Vocab = Expressive Vocabulary, *DTE* Familiarity = Familiarity with *Dora the Explorer;* SS = Story Schema (Low, High); NT = Narrative Type (Non-Participatory Narrative (No Cues), Participatory Narrative (Cues)); PDC = Perceived Demand Characteristics (Fun, Learn)
$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

Narrative type (i.e. participatory cues versus no participatory cues) did not interact with story schema to support central content comprehension (RQ5), $F(1,157) = .417$, $p = .52$, partial $\eta^2 = .003$, nor was there a three-way interaction between story schema, narrative type, and perceived demand characteristics (RQ10), $F(1,157) = .613$, p = .43, partial $\eta^2 = .004$. As expected, perceived demand characteristics did not impact central content comprehension, $F(1,157) = 2.26$, p = .14, partial $\eta^2 = .014$. Interestingly, however, there was an unexpected interaction between perceived demand characteristics and narrative type on central content comprehension, $F(1,157) = 3.99$, p < .05, partial $\eta^2 = .03$. Pairwise comparisons revealed that while children in the PDC-LEARN condition performed similarly regardless of narrative type ($Mean_{\text{No Cues}} = 8.45$, $SD_{\text{No Cues}} = 1.84$; $Mean_{\text{Cues}} = 8.58$, $SD_{\text{Cues}} = 2.15$; $F(1,157) = .15$, $p = .70$, partial $\eta^2 = .001$), children in the PDC-FUN condition who viewed the participatory narrative (Mean = 7.59, SD = 2.18) performed significantly *worse* than their PDC-FUN peers who viewed the non-participatory narrative (Mean = 8.56, SD = 2.11), $F(1,157) = 5.66$, $p < .05$, partial $\eta^2 = .04$. Moreover, for children viewing the participatory narrative, children in the PDC-LEARN condition performed significantly better than children in the PDC-FUN condition, $F(1,157) = 6.20$, $p < .05$, partial $\eta^2 = .04$. No differences were seen by PDC manipulation for children viewing content with no cues See Figure 2.

Figure 2. *PDC and Narrative Type on Central Content Comprehension*



Incidental Content Comprehension

RQ1. *How will preschool-aged children viewing a television program with participatory cues (Participatory Narrative) differ from their peers viewing a television program without participatory cues (Non-Participatory Narrative) on incidental content comprehension?*

RQ10. *Are the relationships across any two variables moderated by the presence of a third variable for any of the comprehension outcomes measured in this study?*

Like central content comprehension, incidental content comprehension is one aspect of narrative television processing. Defined as comprehension of content that is that is nonessential to plot understanding (W. A. Collins et al., 1978), incidental content comprehension in the face of weak central and/or inferential content comprehension is an indicator that the narrative was not properly processed. In this study, neither story schema nor perceived demand characteristics were expected to differentially impact incidental content comprehension. As it was unclear the potential role that narrative type may play on incidental content comprehension, a research question (RQ1) was posited. Additionally, a research question regarding the possible interactive role of the three independent variables on this outcome was posited (RQ10).

To address research questions, a 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) factorial analysis of covariance model predicting incidental content comprehension while controlling for child's age, expressive vocabulary, and familiarity with *Dora the Explorer* was conducted (see Table 18).

Table 18. *Factorial ANCOVA on Incidental Content Comprehension*

	df	MS	*F*	Partial η^2
Child's Age	1	.365	6.647*	.041
Expr. Vocab.	1	.455	8.268*	.050
DTE Familiarity	1	.328	5.957*	.037
SS	1	.375	6.818*	.042
NT	1	.004	.071	.0004
PDC	1	.026	.469	.003
SS x NT	1	.010	.189	.001
SS x PDC	1	.006	.112	.001
NT x PDC	1	.021	.381	.002
SS x NT x PDC	1	.005	.084	.001
Error	157	.055		

Note. Expr. Vocab = Expressive Vocabulary, *DTE* Familiarity = Familiarity with *Dora the Explorer;* SS = Story Schema (Low, High); NT = Narrative Type (Non-Participatory Narrative (No Cues), Participatory Narrative (Cues)); PDC = Perceived Demand Characteristics (Fun, Learn)
$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

Results illustrated that narrative type did not differentiate incidental content comprehension (RQ1), (F(1,157) = .071, p = .79, partial η^2 = .0004) nor did any of the independent variables interact on incidental content comprehension (RQ10).

Unexpectedly, however, a main effect for story schema emerged. Children with high story schema (Mean = 5.10, SD = 1.81) exhibited greater incidental content comprehension then their low story schema peers (Mean = 4.64, SD = 1.81), $F(1,157) = 6.82$, $p < .05$, partial $\eta^2 = .04$.

Inferential Content Comprehension

H1. *Preschool-aged children viewing to learn (PDC-LEARN) will demonstrate greater comprehension of inferential content than their peers viewing for fun (PDC-FUN).*

H4. *Preschool-aged children with high story schema children will demonstrate greater inferential content comprehension than their low story schema peers.*

RQ2. *How will preschool-aged children viewing a television program with participatory cues (Participatory Narrative) differ from their peers viewing a television program without participatory cues (Non-Participatory Narrative) on inferential content comprehension?*

RQ3. *Do perceived demand characteristics (PDC-FUN versus PDC-LEARN) moderate the impact of story schema on inferential comprehension with preschool-aged children?*

RQ6. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of story schema on inferential comprehension with preschool-aged children?*

RQ8. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of perceived demand characteristics (PDC-FUN versus PDC-LEARN) on inferential comprehension with preschool-aged children?*

RQ10. *Are the relationships across any two variables moderated by the presence of a third variable for any of the comprehension outcomes measured in this study?*

Defined as comprehension of information that is implied by events on screen, inferential content comprehension is the third domain of narrative processing measured in this study. Inferential content comprehension is considered a more cognitively sophisticated skill than central content comprehension (W. A. Collins et al., 1978) and is presumed to occur in working memory (Fisch, 2004). It was hypothesized that perceived demand characteristics would differentially support inferential comprehension such that children in the PDC-LEARN group would outperform their peers in the PDC-FUN group (H1). Additionally, it was hypothesized that children with high story schema would perform significantly better than children with low story schema on inferential content comprehension (H4). A research question was posited for the role of narrative type on inferential content comprehension (RQ2). Additionally, several research questions were posited as to the possible two-way (RQ3, RQ6, RQ8) and three-way interactions between independent variables on this outcome (RQ10).

To address hypotheses and research questions, a 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) factorial analysis of covariance model predicting inferential content comprehension while controlling for child's age and familiarity with *Dora the Explorer* was conducted (see Table 19). Results illustrated that the hypothesis for story schema (H4) was rejected, although means were in the expected direction ($F(1,162) = 1.75$, $p = .19$, partial $\eta^2 = .01$). Children in the high story schema scored on average 4.11 points (SD = 1.92) on inferential content comprehension while children in the low story schema group scored on average 3.72 points (SD = 1.92). For H1, there was a marginally significant main effect in the hypothesized direction, $F(1,162) = 2.80$, $p < .10$, partial $\eta^2 = .02$. Children in the PDC-LEARN condition (Mean = 4.16, SD = 1.92) scored higher than children in the PDC-FUN condition (Mean = 3.66, SD = 1.92). For RQ1, there were no significant differences by narrative type ($F(1,162) = .253$, $p = .62$, partial $\eta^2 = .002$. There were no significant interactions of the independent variables on inferential content comprehension (RQ3, RQ6, RQ8, RQ10).

Table 19. *Factorial ANCOVA on Inferential Content Comprehension*

	df	MS	*F*	Partial η^2
Child's Age	1	26.103	7.220*	.043
DTE Familiarity	1	118.153	32.680**	.168
SS	1	6.334	1.752	.011
NT	1	.915	.253	.002
PDC	1	10.105	2.795$^+$	.017
SS x NT	1	5.096	1.409	.009
SS x PDC	1	.356	.099	.001
NT x PDC	1	2.627	.727	.004
SS x NT x PDC	1	.012	.003	.000
Error	162	3.615		

Note. *DTE* Familiarity = Familiarity with *Dora the Explorer;* SS = Story Schema (Low, High); NT = Narrative Type (Non-Participatory Narrative (No Cues), Participatory Narrative (Cues)); PDC = Perceived Demand Characteristics (Fun, Learn)
**$p < .01$, *$p < .05$, $^+p < .10$

Educational Content Comprehension

H2. *Preschool-aged children viewing to learn (PDC-LEARN) will demonstrate greater comprehension of educational content than their peers viewing for fun (PDC-FUN).*

H5. *Preschool-aged children with high story schema children will demonstrate greater educational content comprehension than their low story schema peers.*

H7. *Preschool-aged children viewing a television program with participatory cues (Participatory Narrative) will demonstrate greater educational content comprehension than their peers viewing a television program without participatory cues (Non-Participatory Narrative).*

RQ4. *Do perceived demand characteristics (PDC-FUN versus PDC-LEARN) moderate the impact of story schema on educational content comprehension with preschool-aged children?*

RQ7. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of story schema on educational content comprehension with preschool-aged children?*

RQ9. *Does narrative type (Participatory Narrative; Non-Participatory Narrative) moderate the impact of perceived demand characteristics (PDC-FUN versus PDC-LEARN) on educational content comprehension with preschool-aged children?*

RQ10. *Are the relationships across any two variables moderated by the presence of a third variable for any of the comprehension outcomes measured in this study?*

Educational content comprehension is defined as comprehension of the underlying concept or messages which the television program is intended to convey (Fisch, 2000). It is content that has been purposefully included in the television narrative to educate, benefit, or inform the viewers. In this study, it was hypothesized heightened demand characteristics (PDC-LEARN) and high story schema would lead to increased processing of educational content (H2, H5). Additionally, it was hypothesized that narratives that utilized participatory cues would provide greater opportunities for engagement and rehearsal of content, and thus translate to improved processing of the content (H7). Research questions were posited as to how the independent variables may interact on educational content comprehension (RQ4, RQ7, RQ9, RQ10).

To address hypotheses and research questions, a 2 (story schema) x 2 (perceived demand characteristics) x 2 (narrative type) factorial analysis of covariance model predicting educational content comprehension while controlling for child's age, expressive vocabulary, familiarity with *Dora the Explorer*, and educational knowledge at pretest was conducted (see Table 20). Results illustrated that hypotheses related to perceived demand characteristics (H2; $F(1,156) = .909$, $p = .34$, partial $\eta^2 = .006$) and narrative type (H7; $F(1,156) = .201$, $p = .65$, partial $\eta^2 = .001$) were rejected. Children in the PDC-LEARN group scored on average 18.66 points (SD = 3.36) while children in the PDC-FUN group scored on average 19.16 points (SD = 3.36). Children viewing stimuli with participatory cues scored on average 18.79 points (SD = 3.40) while children viewing stimuli without cues scored on average 19.03 points (SD = 3.39). Although only marginally significant, findings supported H5 such that children with high story schema (Mean = 19.36, SD = 3.37) performed better than low story schema children (Mean = 18.47, SDC = 3.37), $F(1,156) = 2.83$, $p < .10$, partial $\eta^2 = .02$. There were no significant interactions across independent variables on educational content comprehension (RQ4, RQ7, RQ9, RQ10).

Table 20. *Factorial ANCOVA on Educational Content Comprehension*

	df	MS	*F*	Partial η^2
Child's Age	1	66.366	6.042	.037
Expr. Vocab.	1	44.350	4.038	.025
DTE Familiarity	1	44.649	4.065	.025
PreEduc	1	1026.652	93.469**	.375
SS	1	31.129	2.834^{+}	.018
NT	1	2.209	.201	.001
PDC	1	9.983	.909	.006
SS x NT	1	5.343	.486	.003
SS x PDC	1	1.161	.106	.001
NT x PDC	1	1.088	.099	.001
SS x NT x PDC	1	4.079	.371	.002
Error	156	10.984		

Note. Expr. Vocab = Expressive Vocabulary, *DTE* Familiarity = Familiarity with *Dora the Explorer;* PreEduc = Educational Knowledge at Pretest; SS = Story Schema (Low, High); NT = Narrative Type (Non-Participatory Narrative (No Cues), Participatory Narrative (Cues)); PDC = Perceived Demand Characteristics (Fun, Learn)
$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

Post Hoc Analyses

While several of the hypotheses posited in this study were confirmed, the independent variables did not always act in the hypothesized ways. Perceived demand characteristics did emerge a marginal predictor of inferential comprehension (as hypothesized) but unexpectedly did not support educational content comprehension. Story schema emerged an unexpected predictor of incidental content comprehension such that children with high story schema recalled greater incidental content. The inclusion of participatory cues (i.e. the narrative type manipulation) did not support educational content comprehension and, when used in conjunction with a viewing for fun atmosphere (PDC-FUN), appeared to suppress central content comprehension. In an effort to help better understand these findings, post hoc analyses using the coded engagement and attention data were conducted. Analyses are presented by independent variable.

Perceived Demand Characteristics

Perceived demand characteristics were hypothesized to support educational and inferential comprehension. Marginal trends supported H1 for PDC such that children in the PDC-LEARN group outperformed children in the PDC-FUN group on inferential content comprehension. This finding was not echoed for educational content comprehension (H2). For educational content comprehension, we would expect that children who were instructed to view for learning should have attended to and overtly engaged with the educational content more so than their peers who were instructed to view for fun. Furthermore, as inferential comprehension results from processing both central and educational content, it seems fair to expect that children in the PDC-LEARN group will attend to and overtly engage with central and educational content more so than children in the PDC-FUN group. Attention and engagement data was examined by the perceived demand characteristic manipulation to evaluate whether and how attention and engagement data was impacted.

When looking at the attentional data by perceived demand characteristics, Mann Whitney *(U)* tests revealed no significant differences across attention type by PDC ($U_{\text{Central Content}} = 2767.0$, $p = .474$, $r = -.06$; $U_{\text{Educational Content}} = 2739.0$, $p = .415$, $r = -.06$; $U_{\text{Incidental Content}} = 2874.5$, $p = .728$, $r = -.02$; $U_{\text{Entertain Content}} = 2515.5$, $p = .101$, $r = -.13$). Mean differences were in the expected direction such that children in the PDC-LEARN group attended to all types of content at higher rates than children in the PDC-FUN group. The largest differences between groups was seen for educational (4.48% more attention by PDC-LEARN), central (5.48% more attention by PDC-LEARN), and entertainment content (7.63% more attention by PDC-LEARN), while the smallest difference was found for incidental content (1.37% more attention by PDC-LEARN). See Figure 3.

Mann Whitney *(U)* tests revealed no significant differences across engagement type by PDC ($U_{\text{Central Content}} = 3523.0$, $p = .578$, $r = -.04$; $U_{\text{Educational Content}} = 3472.0$, $p = .408$, $r = -.06$; $U_{\text{Incidental Content}} = 3616.5$, $p = .777$, $r = -.02$; $U_{\text{Entertain Content}} = 3648.5$, $p = .872$, $r = -.01$). Children in both the PDC-FUN and PDC-LEARN group overtly engaged with stimuli equally, although means illustrate that children in the PDC-LEARN group exhibited slightly more engagement for all content types except incidental content. See Figure 4.

Figure 3. *Content-specific Attention by Perceived Demand Characteristics*

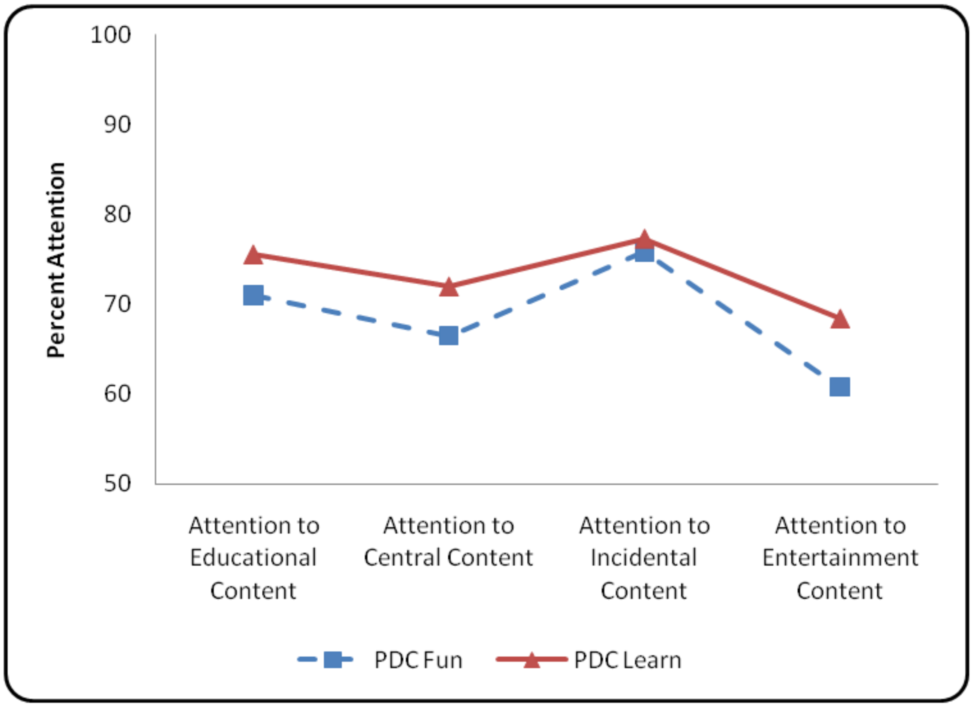
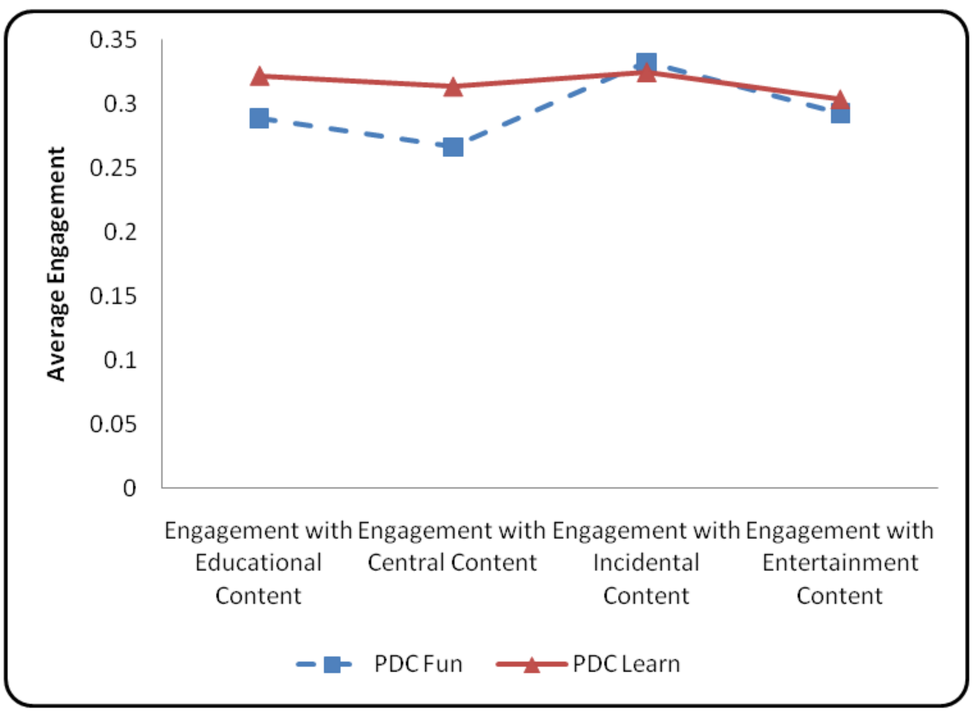


Figure 4. *Content-specific Engagement by Perceived Demand Characteristics*



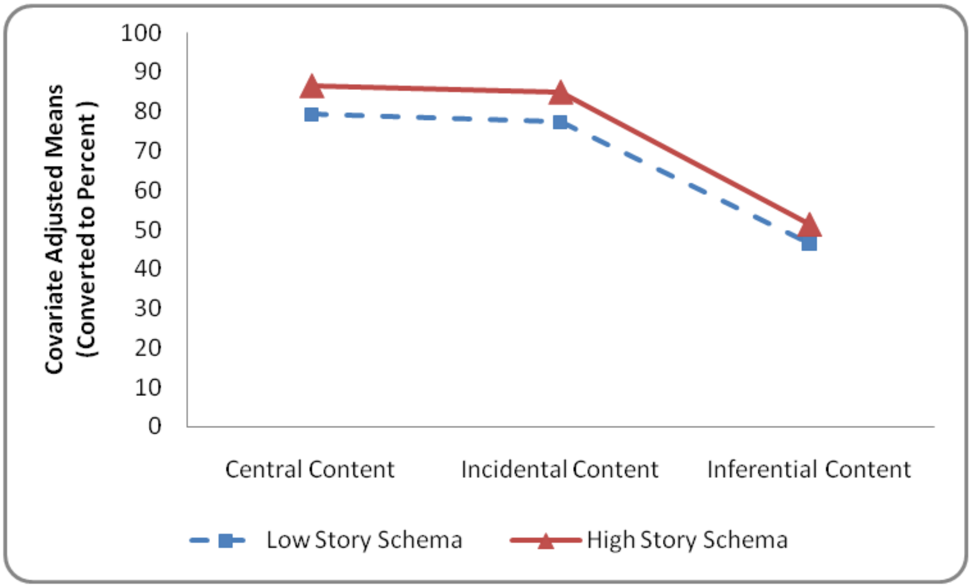
The attention data suggests that the PDC-LEARN manipulation did work to increase attention to show content somewhat. However, considering that children in the PDC-LEARN group attended to entertainment content 7.62% more than the PDC-FUN group, it seems that the children in the PDC-LEARN had some challenges in selectively focusing their attentional behaviors which likely translated to the null differences between groups on tests of educational content comprehension and the weak differences between groups on tests of inferential content comprehension.

Story Schema

Story schema was hypothesized to support central (H3), inferential (H4), and educational content comprehension (H5). Analyses revealed that story schema did significantly support central content comprehension, and marginal trends suggested that schema supported educational content comprehension as well. Means were in the expected direction for inferential content comprehension. Surprisingly, however, there were also significant differences in favor of high story schema for incidental content comprehension.

Previous work (Meadowcroft & Reeves, 1989) evaluating the role of story schema on television comprehension found no differences in favor of story schema for incidental content comprehension. Here, incidental comprehension was found to be fairly high for both groups ($Mean_{HSS}$ = 85% recalled, $Mean_{LSS}$ = 77.3% recalled) with high story schema children recalling a significantly greater percentage of incidental content. Considering the fact that central content comprehension for each group ($Mean_{HSS}$= 86.6% recalled, $Mean_{LSS}$ =79.3%) was nearly identical to the incidental content comprehension with high story schema children again recalling a greater amount of content, it seems as though incidental content in this study was comprehended similarly to central content. This heightened recall of incidental content is concerning as performance on inferential comprehension was weak for both groups (Mean $_{HSS}$ = 51.4% recalled, Mean $_{LSS}$ =46.5% recalled; see Figure 5).

Figure 5. *Central, Incidental, and Inferential Performance by Story Schema*



Performance on inferential comprehension is expected to be weaker than central content comprehension because central content represents the most accessible surface level content. However, the fact that incidental content performance was greater than inferential for both groups suggests that the narrative was not properly processed (Thorndyke & Yekovich, 1979) and that the incidental content possibly culled working memory resources away from inferential content processing. Incidental content should be less salient in a narrative, and thus attract less attention yet it is often the case that children's educational programs highlight incidental content as a means of entertainment. It is possible that the incidental content in this stimulus was salient enough to garner greater attention than the scenes representing central and educational content (through which presumably children extract the necessary information for inferential content comprehension).

Data on children's attention to the television content was evaluated to determine whether the incidental content was particularly salient in the stimuli. The attention data was divided into four content groups: attention to time points with central content, attention to time points with incidental content, attention to time points with educational content, and attention to time points with entertainment content. Meadowcroft & Reeves (1989) found that children attended to central content more than incidental content – regardless of story schema. Like Meadowcroft & Reeves (1989), Mann Whitney *(U)* tests revealed that story schema did not moderate attention to content types in this study ($U_{\text{Central Content}} = 2921.5$, $p = .899$ $r = -.01$; $U_{\text{Educational Content}} = 2955.5$, $p = .997$, $r = -.0003$; $U_{\text{Incidental Content}} = 2956.5$, $p = 1.00$, $r = 0$; $U_{\text{Entertain Content}} = 2887.5$, $p = .800$, $r = -.02$). However, unlike Meadowcroft & Reeves (1989), time points with incidental content elicited the greatest attention of all content types. Friedman's ANOVA revealed a significant difference by attention types, χ^2 (3) = 73.19, $p < .01$. The Wilcoxon signed-rank test *(T)* was used to follow up this omnibus test to evaluate the attention of incidental content compared to other content. A Bonferroni correction was applied such that all effects are reported at a .008 (α / 6) level of significance. Children attended to incidental content significantly more than educational ($T = 3268.00$, r = -.15), central ($T = 2222.5$, r = -.28), or other entertainment content ($T = 1414.50$, r = -.35). Children attended to educational content significantly more than central content ($T = 2071.00$, r = -.32) and entertainment content ($T = 2486.00$, r = -.31). Children also attended to central content significantly more than entertainment content (*T* = 3468.00, r = -.19). These results suggest that incidental content was the most salient content in the stimuli followed by educational content, central content, and entertainment content. It is likely that this saliency disrupted processing of inferential content.

While this saliency does help address why incidental content may have been recalled more, it does not address why children with high story schema recalled significantly more content than their low story schema peers. It may be that high story schema children had more cognitive resources free to process content, and while those cognitive processes should have been used for inferential processing, the saliency of the incidental content redirected the resources. Alternatively, it may be that story schema works differently with audiovisual narratives. Incidental content recognition was in the same direction in Meadowcroft & Reeves (1989) study with high story schema children recognizing more incidental content than lower story schema children. As inferential content comprehension was not assessed in that research, a comparison is not possible but it may be that audiovisual narratives – by virtue of their nature – highlight incidental content more so than traditional print-based narratives and thus result in a greater percentage of recall than content which is not explicitly portrayed (i.e. inferential content comprehension).

Narrative Type

Participatory cues in a televised narrative were hypothesized to foster overt engagement with stimuli content, thus providing a form of rehearsal which would ultimately lead to improved comprehension of the content - specifically central (H6) and educational content (H7). While it was expected that children in the participatory narrative condition would not overtly interact with every participatory cue, it was generally expected that children viewing content with cues would engage more with the stimuli (e.g. would yell out answers or point to specific areas on the screen in response to to characters' queries) than their peers viewing content without cues. The manipulation check using the engagement data confirmed that the inclusion of cues led to greater overt engagement with stimuli content. Despite this finding, analyses looking at the impact of narrative type revealed that children who viewed content with participatory cues did not perform significantly differently than children viewing content without cues on tests of educational content. For central content comprehension, children in the PDC-LEARN condition performed similarly in both narrative types while children in the PDC-FUN condition performed significantly *worse* when viewing content with participatory cues. In previous research using the study stimuli (Calvert et al., 2007), researchers did not find a significant effect of narrative type on central content comprehension (educational content comprehension was not measured) however they did find that as children were more engaged with the content, they were more likely to comprehend central content. Based on this finding, investigating the role of engagement on outcomes seems appropriate.

Participatory cues in a television narrative are presumed to work by encouraging overt engagement with the stimuli content. It is expected that the relationship between engagement with stimuli content and comprehension outcomes should differ by the presence or absence of these cues. To evaluate this, the bivariate relationships between average engagement and study outcomes were examined separately by narrative type using Spearman's correlation coefficient (r_s). For children viewing the participatory narrative (n = 86), as their level of engagement increased, so did their inferential (r_s = .256, p <.05, two-tailed based on RQ2) *and* educational content comprehension (r_s = .208, p <.05, one-tailed based on H7). Engagement was not significantly related to study outcomes for children viewing the non-participatory narrative (n = 86). When looking at the relationships between engagement and central content comprehension separated by the PDC manipulation (to help address the interaction), no significant relationships emerged. The bivariate relationships lend support to the hypothesis related to narrative type and educational content comprehension (H7), but do not support the hypothesis related to narrative type and central content comprehension (H6).

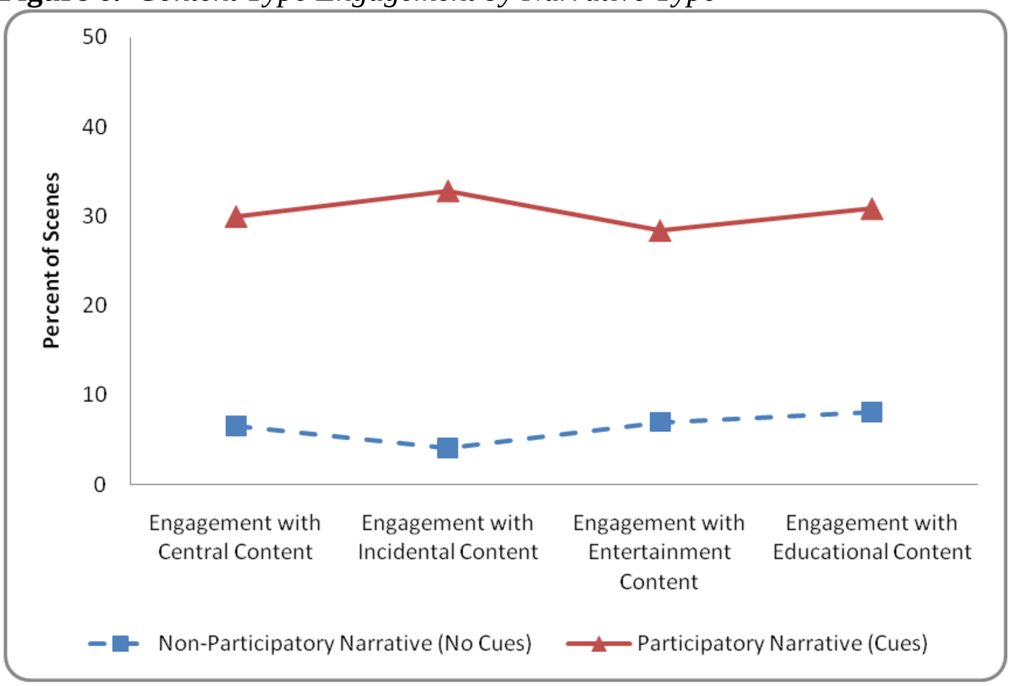
To parse the relationships between engagement and outcomes further, the engagement data was coded to reflect engagement with specific content (i.e. engagement with central content, educational content, incidental content, and other entertainment content). As expected, children in the non-participatory narrative condition engaged significantly less with all types of content when compared to children in the participatory narrative condition (see Table 21 for results of Mann Whitney *(U)* tests). Participatory narrative viewers engaged with 30% of the scenes featuring central content whereas non-participatory narrative viewers engaged with only 6.56% of the scenes featuring central content. Similarly, participatory narrative viewers engaged with 30.8% of the scenes featuring educational content while non-participatory narrative viewers engaged during only 8.08% of them. Patterns were the same for incidental and entertainment content with participatory narrative viewers engaging with 32.8% of the scenes featuring incidental content and 28% of the scenes featuring entertainment content, compared to 4.07% and 6.98% for non-participatory narrative viewers. See Figure 6.

Table 21. *Mann Whitney Tests on Type of Engagement by Narrative Type*

		Engagement with Central Content	Engagement with Incidental Content	Engagement with Educational Content	Engagement with Entertain. Content
Mean (Median)	Non-Participatory Narrative	.1013 (.0000)	.0669 (.0000)	.1244 (.0000)	.1096 (.0000)
	Participatory Narrative	.4792 (.3571)	.5901 (.5000)	.4868 (.4545)	.4867 (.2857)
U		1430.5**	1618.0**	1460.5**	1830.0**
r		-0.55	-0.56	-0.53	-0.47

*$p < .01$, *$p < .05$, $^{+}p < .10$

Figure 6. *Content Type Engagement by Narrative Type*



Extrapolating from initial study hypotheses (H6, H7), it is expected that engagement with central content should be positively related to increased central content comprehension while engagement with educational content should be positively related to increased educational content comprehension[13]. It is unclear what relationships would be expected between engagement with specific content and incidental or inferential content comprehension (RQ1, RQ2). As the initial bivariate relationships looking broadly at engagement were only found significant for children in the participatory cues condition, bivariate relationships between engagement with specific content and study outcomes were examined only for children in the participatory cues condition. Engagement with central content was not significantly related to central content comprehension (r_s = .059, p = .294, one-tailed based on H6, n = 86). Engagement with educational content was positively related to educational content comprehension (r_s = .259, p < .01, one-tailed based on H7, n = 86). Engagement with all four content types was not significantly related with incidental content comprehension. Engagement with central (r_s = .251, p < .05, two-tailed based on RQ1, n = 86) *and* educational content (r_s = .306, p < .01, two-tailed based on RQ1, n = 86) was significantly related to inferential content comprehension.

In thinking about interaction that initially emerged between narrative type and perceived demand characteristics, coupled by the fact that average engagement does not differ by perceived demand characteristic manipulation for participatory narrative viewers (U = 905.0, p = .87), the lack of relationship between engagement with central content and central content comprehension is informative. It suggests that H6 was wrong – the presence of participatory cues in a narrative and/or the engagement with these cues does not support central content comprehension. Rather, it seems that perceived demand

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[13] Central and educational content time points are not mutually exclusive. As the narrative successfully integrates the educational content into the narrative storyline, some time points represent both types of content.

characteristics work differently depending upon the presence or absence of cues to support or suppress central content comprehension. These bivariate relationships do, however, lend support and logically extend H7 by suggesting that it is not the presence or absence of participatory cues in a narrative that impact educational content comprehension but rather the interactions with these cues that are impactful.

As a final step, the significant bivariate relationships between content-specific engagement and educational and inferential comprehension were evaluated further via ordinary least squares regression analyses. Only data from children in the participatory narrative condition (n= 86) was analyzed in the regression analyses thus sample size was relatively small resulting in low power to detect relationships. Allison (1999b, p. 57) argues that, with small samples, statistically significant coefficients "should be taken seriously but a nonsignificant coefficient is extremely weak evidence for the absence of an effect". Findings from the regression analyses should be interpreted with care. Model assumptions were tested and confirmed for all final regression models (i.e. tolerance values indicated multicollinearity was not a concern; assumption of independent errors was confirmed via the Durbin-Watson statistic; assumptions of homoscedasticity and linearity were confirmed by examining plots of the standardized predicted values by standardized residuals; and assumption of normally distributed errors was confirmed by examining histograms and normal probability plots of residuals). If interaction terms were significant, the strength of the interaction term was calculated by computing the difference in squared multiple correlations for the main-effect only model as compared with the interaction model (Jaccard & Turrisi, 2003).

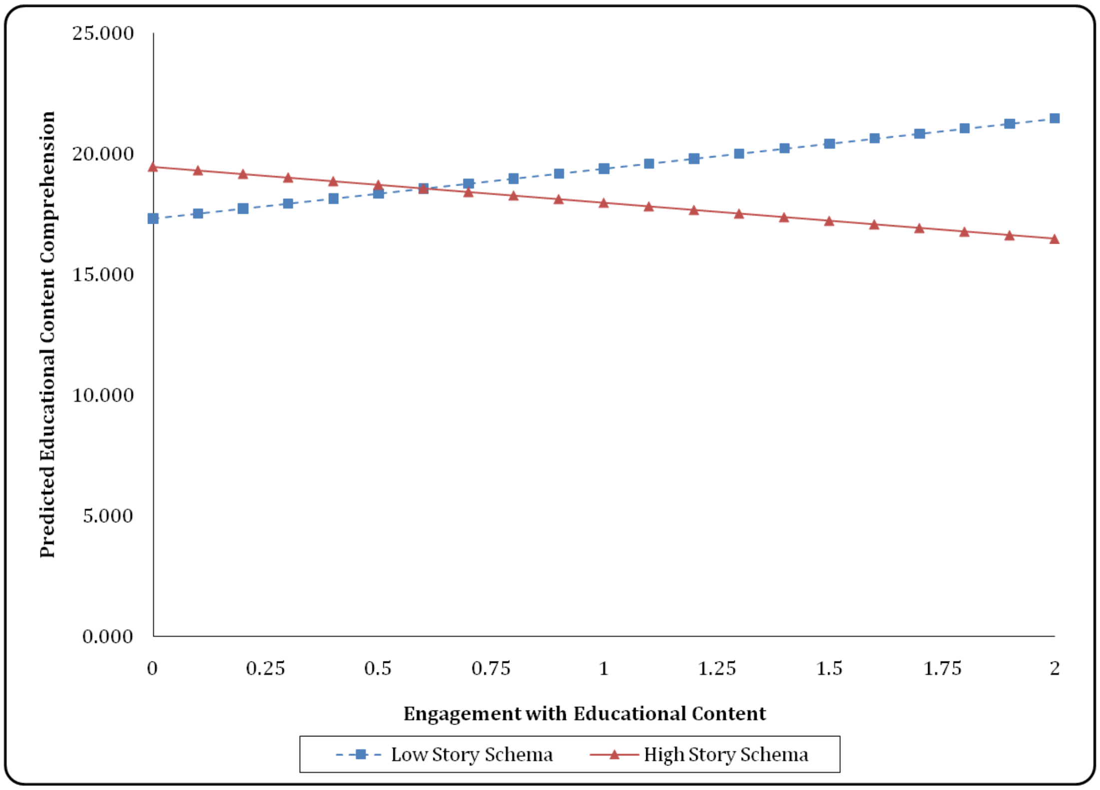
A multiple regression predicting educational content comprehension from story schema condition (low = 0), perceived demand characteristics condition (PDC FUN = 0), engagement with educational content, and all covariates used in the original study analyses (i.e. child's age at pretest, expressive vocabulary, child's familiarity with *Dora the Explorer*, and educational knowledge at pretest) was conducted. Product terms representing two-way and three-way interactions between the original independent variables and engagement were individually entered in the model to determine if their inclusion significantly improved the fit of the model. Only the interaction term between story schema and engagement with educational content marginally improved the model fit (*Fchange* (1,75) = 3.29, $p < .10$). The model significantly predicted educational content comprehension, $F(8,75) = 24.91$, $p < .001$, $R^2 = .727$. While engagement with educational content was not found to be a significant predictor ($\beta = .137$, $t(75) = 1.33$, $p = .19$), story schema ($\beta = .180$, $t(75) = 1.71$, $p < .10$) and the interaction term between engagement and story schema ($\beta = -.239$, $t(75) = -1.81$, $p < .10$) were found to be marginally significant predictors of educational content comprehension (See Table 22) . The interaction between story schema and engagement with educational content accounted for only 1.2% of the variance in educational content comprehension. The interaction suggests that as low story schema children engage more with the participatory cues that highlight educational content, their comprehension of educational content improves slightly while the opposite pattern emerges for children with high story schema (see Figure 7).

Table 22. *Regression Summary for Educational Content Engagement Predicting Educational Content Comprehension*

Variable	B	SEB	β
Child's Age	1.221	.892	.099
Expr. Vocab.	.169	.082	.179*
DTE Familiarity	.325	.139	.177*
PreEduc	.719	.118	.533**
SS	2.151	1.261	.180^{+}
PDC	-.036	.737	-.003
EducEngage	2.071	1.560	.137
SS x EducEngage	-3.569	1.969	-.239^{+}

R^2 = .727** (n = 84)
Note. Expr. Vocab = Expressive Vocabulary, *DTE* Familiarity = Familiarity with *Dora the Explorer;* PreEduc = Educational Knowledge at Pretest; SS = Story Schema (Low, High); PDC = Perceived Demand Characteristics (Fun, Learn); EducEngage = Engagement with Educational Content
***p* < .01, **p* < .05, ^{+}p < .10

Figure 7. *Story Schema & Educ. Content Engagement on Educ. Content Comp.*



Because engagement with educational content and engagement with central content were highly correlated ($r_s = .874$, $p < .001$[14]), separate regressions were calculated to predict inferential comprehension. A multiple regression predicting inferential content comprehension from story schema condition (low = 0), perceived demand characteristics condition (PDC FUN = 0), engagement with educational content, and all covariates used in the original study analyses (i.e. child's age at pretest and child's familiarity with *Dora the Explorer*) was conducted. Product terms representing two-way and three-way interactions between the original study independent variables and engagement were individually entered in the model to determine if their inclusion significantly improved the fit of the model. Only the interaction term between perceived demand characteristics and engagement with educational content improved the model fit (*Fchange* (1,79) = 3.95, $p = .05$). The model significantly predicted inferential content comprehension, $F(6,79) = 5.82$, $p < .001$, $R^2 = .307$ (See Table 23). Perceived demand characteristics were found to marginally predict inferential content comprehension ($\beta = .299$, $t(79) = 1.94$, $p < .10$) while engagement with educational content was found to significantly predict inferential content comprehension, $\beta = .396$, $t(79) = 2.98$, $p < .05$. These main effects were qualified by a significant interaction ($\beta = -.354$, $t(79) = -1.99$, $p = .05$) which accounted for 3.5% of the variance in inferential content comprehension. The interaction suggests that as children in the PDC -FUN group engaged more with educational content, their comprehension of inferential content improved while

[14] This was an expected correlation because many of the same time points were used for both calculations.

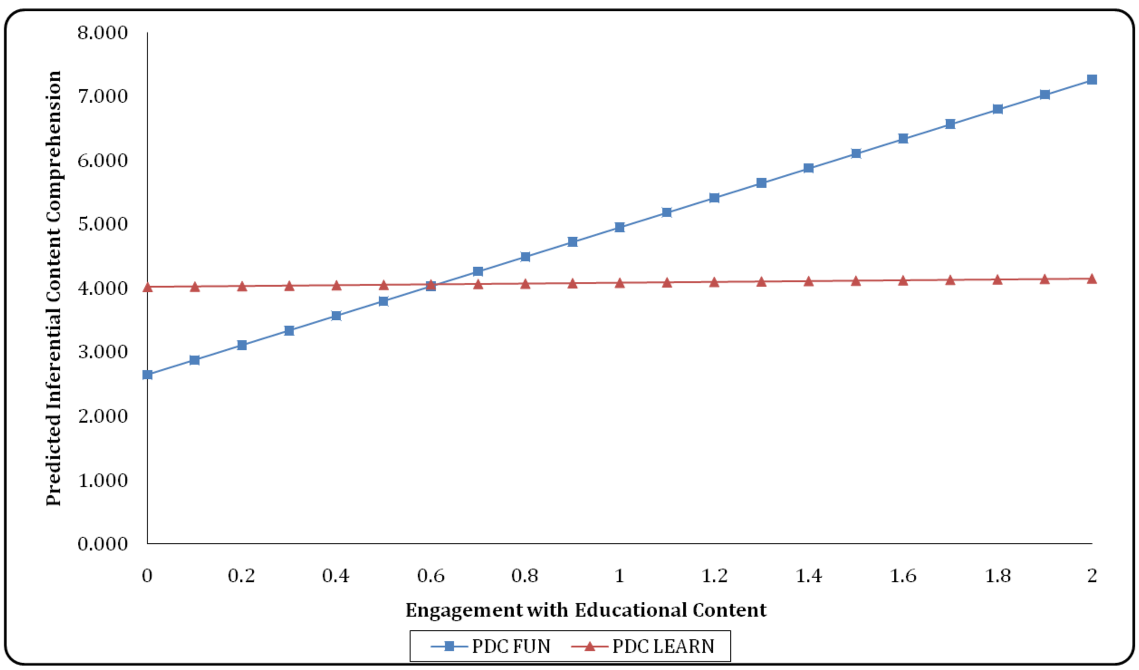
performance of children in the PDC-LEARN group did not change much when engaging with educational content (see Figure 8).

Table 23. *Regression Analysis for Educational Content Engagement Predicting Inferential Content Comprehension.*

Variable	B	SEB	β
Child's Age	.340	.462	.074
DTE Familiarity	.273	.072	.388**
SS	.100	.447	.022
PDC	1.377	.709	.299^{+}
EducEngage	2.309	.775	.396*
PDC x EducEngage	-2.245	1.130	-.354*

R^2 = .307** (n = 86)
Note. *DTE* Familiarity = Familiarity with *Dora the Explorer;* SS = Story Schema (Low, High); PDC = Perceived Demand Characteristics (Fun, Learn); EducEngage = Engagement with Educational Content
***p* < .01, **p* < .05, $^{+}$*p* < .10

Figure 8. *PDC and Educ. Content Engagement on Inferential Content Comp.*



Lastly, a multiple regression predicting inferential content comprehension from story schema condition (low = 0), perceived demand characteristics condition (PDC FUN = 0), engagement with central content, and all covariates used in the original study analyses (i.e. child's age at pretest and child's familiarity with *Dora the Explorer*) was conducted. Product terms representing two-way and three-way interactions between the original study independent variables and engagement were individually entered in the model to determine if their inclusion significantly improved the fit of the model. No interaction terms improved the model fit. The model significantly predicted inferential content comprehension, F(5,80) = 5.82, p <.001, R2 = .267 (See Table 24). While neither story schema nor perceived demand characteristics significantly predicted inferential content comprehension, engagement with central content did (β = .202, t(80) = 2.035, p < .05). As engagement with central content increased, the inferential content comprehension of children in the participatory narrative condition improved.

Table 24. *Regression Analysis for Central Content Engagement Predicting Inferential Content Comprehension*

Variable	**B**	**SEB**	**β**
Child's Age	.628	.463	.136
DTE Familiarity	.274	.073	.390**
SS	.007	.452	.001
PDC	.227	.449	.049
CentralEngage	1.112	.546	.202*

R^2 = .267** (n = 86)
Note. *DTE* Familiarity = Familiarity with *Dora the Explorer;* SS = Story Schema (Low, High); PDC = Perceived Demand Characteristics (Fun, Learn); CentralEngage = Engagement with Central Content
$^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

The post hoc analyses investigating the role of narrative type suggest that it is not the presence or absence of participatory cues in a narrative that impact comprehension outcomes but rather the overt engagement that results from the inclusion of participatory cues that impacts outcomes. The analyses also highlight the importance of considering the type of content the child is engaging with when attempting to link engagement to comprehension outcomes. When parsing the engagement by content type, we see that engagement with educational content seems to support educational content comprehension, particularly for low story schema children (lending support to H7). We also see that engagement with central and educational content supports inferential content comprehension, particularly for children in the PDC-FUN group (addressing RQ6). Participatory cues do not appear to support or suppress central content comprehension (rejecting H6). Rather, for central content comprehension, the impact of participatory cues (and the resulting engagement from the cues) appears to depend upon the demand characteristics of the viewing situation.

Discussion

Despite the general agreement that children can and do learn from television, there are few existing theories which explain how children learn from educational television. To this end, Fisch (2000, 2004) presented the capacity model- a systematic model of comprehension with its roots in information processing research. Central to the model is the idea that working memory is limited, and if content is to be processed effectively, the demands of the viewing task must not exceed the available resources. The model posits that demands for children's working memory resources come from processing the narrative, processing the educational content, and the distance between the narrative and educational content. The allocation of working memory resources are said to be a function of the demands of both narrative and educational content, with the caveats that (1) priority will be given to narrative over educational content processing, (2) the cognitive resources available to process educational content are a function of the amount of resources not already committed to processing the narrative, and (3) viewers can allocate resources differentially but narrative processing can never be completely abandoned in favor of educational content. Based on the governing principles of the capacity model, Fisch (2000, 2004) highlights five ways in which comprehension of educational television content can be increased: (1) by increasing the total amount of working memory resources to understanding the television program as a whole , (2) by reducing the demands of processing the narrative so that more resources are available to process the educational content, (3) by reducing the demands of the educational content so that fewer resources are needed, (4) by minimizing the distance between narrative and educational content in the program so that content complements rather than competes, and (5) via viewers' voluntary allocation of a greater proportion of working memory resources to the processing of educational content. Guided by the tenets of the capacity model, this research study was designed to investigate how preschool children's comprehension of narrative and educational content was affected when (1) total working memory resources are increased, (2) when narrative processing demands are reduced, and (3) when viewers voluntary allocation of working memory resources to content are increased.

Increasing Total Working Memory Resources

The capacity model (Fisch, 2000, 2004) posits that by increasing the total amount of working memory resources devoted to processing television content, there will be greater resources available to process the educational content within the program. This prediction is akin to Gavriel Salomon's theory of Amount of Invested Mental Effort (AIME; 1983b; 1984) which argues that comprehension of print and audiovisual media relies directly on the viewer's AIME. Salomon's theory posits that the benefits of increased AIME will translate to increased performance on inferential comprehension of content - not performance which relies on shallow level processing. Salomon and others (e.g. D. E. Field & Anderson, 1985; Krendl & Watkins, 1983; Salomon & Leigh, 1984) have demonstrated that the AIME can be successfully manipulated by altering the perceived demand characteristics (PDC) of the viewing situation. However, to date, no study has evaluated whether manipulating the PDC of the viewing situation with preschool aged children will support their inferential comprehension of the program. Further, extrapolating from Salomon's work as well as the predictions of the capacity model, it was expected that by increasing the pool of working memory resources there would be additional resources available to process the educational content within the program – content which is presumed to require deeper processing like that of inferential content. In this study, the impact of increased AIME – as induced by manipulating PDC – was evaluated in the context of inferential and educational content comprehension.

The findings related to PDC corroborate previous research but lend only weak support to the capacity model. As expected, children in conditions where perceived demand characteristics were low (PDC-FUN) performed similarly to children in conditions where perceived demand characteristics were high (PDC-LEARN) on tests of comprehension that relied on shallow, surface-level processing (i.e. central and incidental content comprehension). Furthermore, as hypothesized, children in the PDC-LEARN condition outperformed their PDC-FUN peers on inferential content comprehension (mean differences were marginally significant at $p < .10$). However, counter to expectations, children in the PDC-FUN group performed similarly to their PDC-LEARN peers on educational content comprehension. This null finding was surprising in light of the capacity model's prediction that increased heightened AIME (as induced by increased perceived demand characteristics) should lead to greater allocation of working memory resources to the educational content within the program.

Attentional and engagement data related to different program content were examined in post hoc analyses to help understand the relationship between PDC and educational content comprehension. As inferential comprehension results from processing both central and educational content, increased attentional and engagement behaviors from children in the PDC-LEARN group was expected. Similarly, for educational content comprehension, heightened attention and engagement to educational content was expected from children in the PDC-LEARN group. The post hoc analyses revealed no significant differences by condition but means suggested that children in the PDC-LEARN condition attended to *all* content types more so than children in the PDC-FUN condition. Means also suggested that, with the exception of incidental content, children in the PDC-LEARN condition engaged slightly more with all content than PDC-FUN children. When reflecting on these attentional and engagement patterns, particularly the fact that children in the PDC-LEARN condition attended to entertainment content time points 7.62% more often than children in the PDC-FUN condition (the largest difference between content types), it seems that these young children were able to slightly increase their working memory capacity but struggled to differentially allocate mental capacity to content which would aid their inferential and educational content comprehension. As such, if television programmers are interested in creating content which utilizes a specific formal feature to heighten the perceived demand characteristics of the medium, these results suggest that strategic use of the formal features on critical content– rather than attempting to enhance overall attention – may be advisable.

It is important to keep several things in minds regarding the perceived demand characteristics results. First and foremost, it is important to remember that the manipulation check for perceived demand characteristics failed. Groups did not differ when children were asked how much effort was invested in viewing. Children this young are just beginning to develop their metacognitive abilities thus this manipulation check was not developmentally appropriate. However, in the absence of other more appropriate checks, the measure was employed. While the attentional data suggest that children in the PDC-LEARN group were attempting to allocate more attention to the content, it is likely that their developmental limitations prevented them from knowing how to direct their attention to appropriate content (especially when one considers the fact that, for preschoolers, all television content is educational to some extent) as well as from being aware of their attentional patterns (thus the null difference finding for the manipulation check).

The study design also may have impacted the differences between groups. The need to test for story schema knowledge with television stimuli meant that all children in the study viewed a television program and answered questions with a researcher prior to the viewing the study stimulus. It is possible that, during the second testing session, children in the PDC-FUN condition recalled the first round of testing and anticipated testing on the stimuli content. While an effort was made to minimize this concern by requiring that session 2 occur 7 to 10 days after session 1 testing, the concern remains. Considering that any effect of the session 1 testing would have heightened the PDC of the PDC-FUN group, the findings in favor of the PDC-LEARN group represent a stronger test of hypotheses. Similarly, because all viewing and testing occurred in available space within the recruited childcare centers, it was possible that children interpreted the viewing as more serious than at-home viewing (see Salomon & Leigh, 1984 for a similar issue). Findings in favor of the PDC-LEARN group, as with the previous testing session concern, would only lead to a conservative error reducing the difference between the PDC-FUN and PDC-LEARN conditions.

Reducing Narrative Processing Demands

The capacity model (Fisch, 2000, 2004) predicts that by decreasing the demands associated with processing the narrative content, more cognitive resources will be available to process and comprehend the educational content within the program. While there are several ways to reduce the demands of narrative processing, in this study, one area of research which has successfully translated from the print-based to audiovisual literature was examined: story schema. Defined as "memory structures which consist of clusters of knowledge about stories and how they are typically structured and the ability to use this knowledge in processing stories" (Meadowcroft, 1986, p. 7), past research dictated that story schema would support central content comprehension (Meadowcroft & Reeves, 1989). It was also hypothesized that the cognitive resources freed via advanced story schema would support both inferential and educational content comprehension.

The findings related to story schema support the capacity model as well as corroborate and extend existing research. As hypothesized, children with a higher story schema outperformed their peers with low story schema on tests of central content comprehension. Means also suggested that high story schema children comprehended greater inferential content than low story schema children, and marginally significant differences ($p < .10$) indicated that high story schema children recalled greater educational content than low story schema children. Unexpectedly, children with high story schema comprehended greater incidental content than low story schema children.

Incidental content comprehension was greater than inferential content comprehension for all children – a finding of initial concern because such a pattern indicates that the narrative was improperly processed (Thorndyke & Yekovich, 1979). The saliency of the incidental content (in the face of the other stimuli content) was evaluated in a post hoc analysis to better understand this finding. Examinations of the attention data by content type and schema level revealed that while children attended to content similarly regardless of schema level, incidental content elicited the greatest attention. Children attended to incidental content significantly more than educational, central, or other entertainment content suggesting that incidental content was highly salient in the study stimuli. While this finding does not explain why children with high story schema comprehended incidental content more so than their low story schema peers, it is possible that the freed cognitive resources available to the high story schema children were applied to comprehending the more salient incidental content as opposed to fully comprehending the deeper content within the program (thus explaining the pattern of differences by means for inferential content comprehension). Pushing this idea further, it may be that story schema works differently for television. Although story schema may help organize content such that central and inferential content are recalled better than incidental, it may be that audiovisual saliency of content can override this organization for this age group.

With the exception of this study, there currently exists no research evaluating central, incidental, *and* inferential content comprehension of an audiovisual medium by story schema. Research with traditional print-based literature has not found story schema to support incidental content. It may be that by virtue of its audiovisual nature, incidental content is more salient content that is easily comprehensible – and for children with high story schema, they choose to allocate their available cognitive resources to this more salient content as opposed to content which is not explicitly portrayed (i.e. inferential content comprehension). Alternatively, it may something inherent about the *Dora the Explorer's* presentation and inclusion of incidental content. Expanding this research with alterative stimuli to determine whether these patterns are replicated with other preschooler-targeted audiovisual narratives would be an important next step. From the perspective of program development, if cognitive resources are being directed away from deeper processing because of the saliency of incidental content, decreasing the saliency of incidental content is advisable. Of course, as television is primarily an entertainment medium in which the saliency of incidental content is often considered entertaining to young viewers, educational television programmers must work to strike the fine balance between appealing program content and content which redirects cognitive resources away from deeper processing.

As with perceived demand characteristics, there are several issues to keep in mind when reflecting upon the story schema findings. It is important to remember that relationships between story schema and television have not been examined with children under the age of five. While the story schema measure was carefully developed to match previous measures while being sensitive to the developmental limitations of the population, this specific measure has not been used previously with children of this age group. However, considering the expected relationships that emerged between story schema, expressive vocabulary, child's age, and educational knowledge at pretest, it seems fair to suggest that the measure worked as expected. The second more important caveat is related to these relationships. Several measures that held expected correlations with story schema were treated as covariates in final models because of their unexpected relationships with other independent variables. It is likely that the effect size of story schema was underestimated because some effects attributable to story schema were eliminated from the dependent variables (Wildt & Ahtola, 1978). Thus, all findings for story schema represent a conservative test of the impact of story schema on dependent variables. Considering the significant and marginally significant relationships uncovered, remembering that the findings represent a conservative test of story schema is important[15].

Increasing Allocation of Working Memory Resources to Stimuli Content

The capacity model posits that viewers' voluntary allocation of working memory resources to stimuli content should support educational content comprehension (Fisch, 2000, 2004). In this study, voluntary allocations of working memory resources were expected to result from engaging with participatory cues present within the stimuli. Participatory cues, or queries embedded within television content designed to encourage overt interaction by the viewer, are thought to foster rehearsal of stimuli content in either a motoric or linguistic manner (Anderson et al., 2000; Calvert & Goodman, 1999; Calvert et al., 2007). This rehearsal is thought to encourage allocation of greater working memory resources to the stimuli content, thus aiding in comprehension of the content. Although limited research exists on the role of participatory cues, the existing literature suggests that the inclusion of participatory cues in a program will highlight essential content and thus translate to improved central content comprehension. Moreover, in accordance with the capacity model, exposure to a stimulus that utilizes participatory cues with educational content was also expected to support educational content

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[15] In fact, when rerunning models with only familiarity with *Dora the Explorer* as covariate, story schema is found to significantly predict central content comprehension (F (1,163) = 10.77, $p < .01$, partial $\eta^2 = .06$), incidental content comprehension (F (1,163) = 9.80, $p < .05$, partial $\eta^2 = .06$), *and* educational content comprehension (F (1,163) = 9.13, $p < .05$, partial $\eta^2 = .05$). No differences were found for inferential content comprehension (F (1,163) = 2.67, $p = .104$, partial $\eta^2 = .02$) although means were in the expected direction with high story schema demonstrating greater inferential content comprehension ($Mean_{HSS} = 4.15$, $SE_{HSS} = .207$; $Mean_{LSS} = 3.67$, $SE_{LSS} = .212$).

comprehension. As the research evidence is quite limited, research questions were posited regarding the role of participatory cues on incidental and inferential comprehension.

Results for the role of participatory cues did not support predictions. Children in the participatory narrative condition performed similarly to their non-participatory narrative peers on tests of central and educational content. There were also no differences between conditions on tests of inferential or incidental comprehension. Considering that the manipulation check revealed that children in the participatory narrative condition were significantly engaging with the television stimuli (e.g. responding to the program queries, pointing to the screen to indicate where objects were hidden, counting with the characters) more than children in the non-participatory narrative condition, these findings were somewhat surprising. The engagement data was evaluated in a post hoc analysis in an effort to better understand these findings (similar to that of Calvert et al., 2007).

When looking solely at children in the participatory narrative condition, there were no differences in patterns of engagement by content type. Children engaged with all types of content equally. However, when looking at relationships between engagement with specific content and related outcomes, several patterns emerged. Engagement with central content was not related to central content comprehension suggesting that a child's overt engagement with central content does not support comprehension of central content. This finding is at odds with previous research using this stimuli (Calvert et al., 2007), however, previous research with this stimuli included an adult coviewer who engaged with the content simultaneously with the child. As coviewing has been often cited in the literature as a means of supporting and extending children's television comprehension (e.g. Watkins, Calvert, Huston-Stein, & Wright, 1980), it is possible that central content comprehension is only supported when central content engagement is supported by an adult coviewer. Children in this study only engaged with 30% of the time points containing central content, thus there is certainly room for additional engagement with the content.

A significant positive relationship also emerged between educational content engagement and educational content comprehension. When submitted to a regression analysis with all study variables in the model, this main effect was replaced with a marginally significant interaction between story schema and engagement on educational content comprehension. The interaction suggested that engaging with educational content was more effective for low story schema children than high story schema peers. This finding should be interpreted with some caution as the sample size and variance explained was small and the interaction only marginally significant. That being stated, low story schema children performed worse than children in the high story schema children on the educational knowledge test at pretest illustrating that they had more information to gain from viewing the stimulus. For low story schema children, engaging with content may have had a stronger positive effect.

When exploring the relationships between engagement types and inferential content comprehension, both central and educational content engagement was significantly related to inferential comprehension. Inferential comprehension is expected to result from comprehension of both narrative and educational content in the stimulus (because the narrative and educational content are integral to one another in the stimulus), so these relationships made sense. Regression analyses revealed that engagement with central content supported inferential content comprehension. Additionally, engagement with educational content was a significant predictor of inferential content comprehension and was qualified by a significant interaction with perceived demand characteristics. The interaction suggested that engaging with content benefited children in the PDC-FUN condition while children in the PDC-LEARN condition did not experience additional benefits of engaging.

Several findings regarding narrative type emerge when reflecting on the main study analyses as well as the post hoc analyses. While it is true that the inclusion of participatory cues in preschooler-targeted television narrative leads to greater engagement with stimuli content, the general inclusion of cues is not sufficient to support comprehension. Rather, it is the quality of the engagement with the cues - *how* involved the child is with the cues - that matters (a sentiment similar to that expressed by Calvert et al, 2007). The post hoc analyses suggest that creators of children's educational television should employ participatory cues strategically. While a formal experiment is required to determine whether a stimulus that only includes cues with educational content would be more effective than a stimulus that includes cues for all types of content, the post hoc analyses looking at engagement and outcomes suggest that the strategic use of cues during educational content presentation only is advisable. Finally, the significant interaction between engagement with educational content and perceived demand characteristics suggests that the benefit of engagement may be impacted by the viewing environment such that children viewing in their natural environments (i.e. viewing for fun) will experience benefits from engaging with educational content. So, while simply including cues may not alter the perceived demand characteristics of the medium (Crawley et al., 1999), engaging with the cues leads to benefits similar to those experienced when PDC is heightened.

Viewer Characteristics, Contextual Expectations, and Stimuli Features

The study design permitted testing interactions across the independent variables on study outcomes. Interestingly, across all study outcomes, only one interaction across independent variables emerged. Perceived demand characteristics and narrative type interacted on central content comprehension. Children in the PDC-LEARN condition performed similarly regardless of narrative type. Children in the PDC-FUN condition viewing a participatory narrative performed significantly worse than their peers viewing a non-participatory narrative. Moreover, children in the PDC-LEARN condition viewing a participatory narrative significantly outperformed children the PDC-FUN condition viewing a non-participatory narrative. Recall that the post hoc analyses on narrative type illustrated that there was no relationship between engagement and central content comprehension, and further illustrated that average engagement for children viewing a participatory narrative did not differ by perceived demand characteristics. It seems that, rather than suggesting that the inclusion of participatory cues differentially impacts central content comprehension based on the viewing environment, perceived demand characteristics work differently depending upon the presence or absence of cues to support or suppress central content comprehension.

These findings for central content comprehension are quite interesting when one considers the fact that Salomon (Salomon, 1983b, 1984) posits that perceived demand characteristics should *not* impact central content comprehension but rather should only impact deeper (i.e. inferential) comprehension. As participatory cues are a rather new feature to the children's television landscape, this is the first study in which the interactive effect of participatory cues and perceived demand characteristics on comprehension have been investigated. It may be that, for central content comprehension, viewing participatory narratives while viewing for fun had an additive effect which resulted in a heightened "viewing for fun" atmosphere (parent survey data suggests that children find *Dora the Explorer* highly appealing) which ultimately suppressed central content comprehension. Because such an enhanced viewing for fun atmosphere has not been created in previous research, there exist no findings which document support of perceived demand characteristics for central content comprehension. Considering that most home television viewing occurs under the auspices of viewing for fun, this finding is concerning and suggests that youngsters viewing programming with participatory cues may be comprehending less of the narrative than might be possible.

However, before a claim is made that participatory cues should be excluded from children's television, it is important to carefully reflect on the post hoc analyses as they suggest contradictory findings. Recall that in the post hoc analyses an interaction between engagement with educational content and PDC on inferential content comprehension emerged. Children in the PDC-FUN group experienced benefits from engaging with educational content. This finding suggests that engagement with participatory cues may be heightening the demand characteristics of the medium. This interaction seems to contradict the findings related to central content comprehension which suggested that children in the PDC-FUN group are experiencing suppressed central content comprehension when viewing participatory narratives. Additional empirical research on the role of participatory narratives is needed to address this contradiction. The findings here suggest that when participatory cues are used throughout a stimulus to highlight a variety of content types, children who are viewing for fun (i.e. a traditional home viewing environment) comprehend less central narrative content. These same children experience deeper narrative comprehension (i.e. inferential comprehension) when *engaging* with the educational content within the show. It may be that, when a children's television program utilizes participatory cues throughout a program, the demand characteristics of the viewing environment are suppressed rather than heightened. However, if programmers minimize the use of participatory cues such that their inclusion is strategically present within educational content scenes only, it is likely that inferential and educational content comprehension would be supported without suppressing central content comprehension (because the viewing for fun environment would not be as enhanced). Testing this prediction in an experimental setting would be an important next step for future research.

Concluding Thoughts

Having conducted the first experimental investigation to evaluate one aspect of three key areas of a child's viewing experience - an individual difference variable (story schema), a stimuli variable (narrative type), and an environment variable (perceived demand characteristics) – what answers can be offered? In support of Fisch's capacity model (2000, 2004), what the child brings to the viewing experience clearly matters. Advanced story schema supported narrative comprehension, and this reduction in narrative processing demands translated to educational content comprehension. As such, television programmers are advised to create preschooler-targeted educational television content which conforms to a prototypical story structure while integrating educational content within the narrative. Moreover, efforts to support children's narrative skills via exposure to strong televised and print narratives are worthwhile (Linebarger & Piotrowski, 2009; Mandler & Johnson, 1977; Stein & Glenn, 1979). In addition, while young children do seem to be able to devote greater attention to content when the demand characteristics of a medium are enhanced (in support of capacity model), they appear to struggle with how to differentially distribute their cognitive resources resulting in minimally enhanced inferential processing but no additional benefits to educational content comprehension. While formal features can be incorporated into television content to heighten perceived demand characteristics, these features should be used strategically to highlight critical content for young viewers. Third, the inclusion of participatory cues in children's television programming is not sufficient to support content comprehension. Rather, as Fisch would posit, it is the voluntary allocation of working memory resources to the content *via engagement* that is necessary to support outcomes. When integrating the findings for perceived demand characteristics and participatory cues, television programmers are advised to use participatory cues strategically to highlight educational content. Such strategic use should lead to engagement with the content which should translate to improved educational and inferential comprehension while neither supporting *nor* suppressing central content comprehension.

As with all empirical studies, these answers come with several limitations. This study sought to evaluate how three independent variables independently and interactively impacted comprehension – with particular interest in educational content comprehension.

In this study, the pretest data revealed that children in the study knew a good deal of educational content prior to viewing. Performance at pretest suggested that most children were already able to identify the target shape and target color, were able to enumerate to five in English, possessed a receptive understanding of the numbers 1 through 5, and could model reaching and stepping behaviors (bodily/kinesthetic skill). Although the children in the study fell within the target age of the program, they all attended some form of childcare where it is likely that many of these educational content messages were taught. It is possible that the findings for educational content comprehension may have been strengthened had the children in the study knew less of the content at study onset. Despite this challenge, there were some variables that had room for growth. When looking at growth by content type from pretest to posttest, most significant growth was experienced for enumeration and definition of the numbers 1 through 5 in Spanish (verbal/linguistic skills) and item recognition in an embedded image (a visual/spatial skill). No significant change was experienced for map understanding and receptive understanding of the numbers 1 through 5 in Spanish, although there was room for improvement on these variables.

It is also possible that testing environment impacted the findings in this study. While the research design was set up to replicate a traditional viewing experience by using children's furniture and providing distracter tasks, the replication was not a strong one. First, individual viewing was conducted within the school day – a non-normative behavior for many of the children in this study[16]. Second, the individual viewing was

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[16] While many of the childcare centers did use television during the school day (a finding similar to Jordan, 2005), anecdotal observations in the schools suggests that the children

conducted with a researcher in the room – a researcher that the child did not know. These two factors may have impacted how the child viewed the program, particularly how they engaged with the content if viewing with cues. While this experience was the same for all children (and thus does not impact the findings presented here), it limits the generalizability of these findings to more traditional viewing environments. It is also important to remember that the data was collected from a convenience sample across nineteen different childcare centers in and around the Philadelphia area. While media use patterns of the children in this sample are similar to that of nationally representative samples of preschoolers, claims to generalizability should be made cautiously.

These limitations aside, the work presented here offers both theoretical and applied contributions to the literature. Theoretically, the work lends support to Fisch's capacity model while also providing suggestions for ways to hone the model's predictions. Practically, the work offers children's television creators suggestions for creating narrative-based educational television programs for preschoolers that strategically incorporate participatory cues. The findings push us forward to answer more questions about how children learn from television, and remind us that what children bring to the viewing experience plays an important role in what they take out. The findings also illustrate that the stories we read, tell, or show our children do more than facilitate positive adult-child interactions, they provide our children with skills that can help maximize the potential of educational television.

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infrequently viewed television independently. Television viewing was most often completed in groups, and tended to occur during transition periods (e.g. at the beginning or ending of the school day). Additionally, teachers would utilize group viewing when weather did not permit outdoor activities or when understaffing occurred.

References

About Franklin. (2010) Retrieved February 10, 2010 from http://www.nickjr.com/franklin/about-franklin/.

Allison, P. D. (1999a). *Logistic Regression using SAS: Theory and Application*. Cary, NC: SAS Insititute Inc.

Allison, P. D. (1999b). *Multiple regression: A primer*. Thousand Oaks, CA: Pine Forge Press.

Anderson, D. R. (1998). Educational Television Is Not an Oxymoron. *Annals of the American Academy of Political and Social Science, 557*, 24-38.

Anderson, D. R., Bryant, J., Wilder, A., Santomero, A., Williams, M., & Crawley, A. M. (2000). Researching Blue's Clues: Viewing behavior and impact. *Media Psychology, 2*(2), 179-194.

Anderson, D. R., Huston, A. C., Schmitt, K. L., Linebarger, D. L., & Wright, J. C. (2001). Early childhood television viewing and adolescent behavior: The Recontact Study. *Monographs of the Society for Research in Child Development, 66*(1), 1-143.

Anderson, D. R., & Kirkorian, H. L. (2006). Attention and television. In J. Bryant & P. Vorderer (Eds.), *Psychology of Entertainment* (pp. 35-54). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Anderson, D. R., & Lorch, E. P. (1983). Looking at television: action or reaction. In J. Bryant & D. R. Anderson (Eds.), *Children's understanding of television: research on attention and comprehension*. San Diego, CA: Academic.

Applebee, A. N. (1977). A sense of story. *Theory into Practice, 16*(4), 342-347.

Beentjes, J. W. J., & van der Voort, T. H. A. (1993). Television viewing versus reading: Mental effort, retention, and inferential learning. *Communication Education, 42*, 191-204.

Berk, L. E., & Winsler, A. (1995). *Scaffolding Children's Learning: Vygotsky and Early Childhood Education*. Washington, DC: National Association for the Education of Young Children.

Best, R. M., Floyd, R. G., & McNamara, D. S. (2008). Differential competencies contributing to children's comprehension of narrative and expository texts. *Reading Psychology, 29*, 137-164.

Bleakley, A., Hennessy, M., Fishbein, M., & Jordan, A. (2008). It Works Both Ways: The Relationship Between Exposure to Sexual Content in the Media and Adolescent Sexual Behavior. *Media Psychology, 11*(4), 443 - 461.

Bordeaux, B. R., & Lange, G. (1991). Children's reported investment of mental effort when viewing television. *Communication Research, 18*(5), 617-635.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. Washington, D.C.: National Academy Press.

Brown, A. L. (1975). Recognition, reconstruction, and recall of narrative sequences by preoperational children. *Child Development*, *46,* 156-166.

Brown, J. D., L'Engle, K. L., Pardun, C. J., Guo, G., Kenneavy, K., & Jackson, C. (2005). Sexy Media Matter: Exposure to Sexual Content in Music, Movies, Television, and Magazines Predicts Black and White Adolescents' Sexual Behavior. *Pediatrics, 117*, 1018.

Bryant, J., Mullikin, L., Maxwell, M., Mundorf, N., Mundorf, J., Wilson, B. J., et al. (1999). *Effects of Two Years' Viewing of Blues Clues: Report submitted to Nick Jr.*: Institute for Communication Research, University of Alabama

Buss, R. R., Yussen, S. R., Mathews II, S. R., Miller, G. E., & Rembold, K. L. (1983). Development of children's use of a story schema to retrieve information. *Developmental Psychology, 19*(1), 22-28.

Byrnes, J. P. (1996). *Cognitive development and learning in instructional contexts*. Boston: Allyn and Bacon.

Calvert, S. L., & Goodman, T. (1999). *Enactive rehearsal for young children's comprehension of songs*. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Albuquerque, NM.

Calvert, S. L., Strong, B. L., Jacobs, E. L., & Conger, E. E. (2007). Interaction and participation for young Hispanic and Caucasian girls' and boys' learning of media content. *Media Psychology, 9*, 431-445.

Cennamo, K. S. (1993). Learning from video: Factors influencing learners' preconceptions and invested mental effort. *Educational Technology, Research and Development, 41*(3), 33-45.

Chandra, A., Martino, S. C., Collins, R. L., Elliott, M. N., Berry, S. H., Kanouse, D. E., et al. (2008). Does watching sex on television predict teen pregnancy? Findings from a national longitudinal survey of youth. *Pediatrics, 122*, 1047-1054.

Cohen, J. (1988). *Statistical power analysis for the behavioral science* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Collins, R. L., Elliott, M. N., Berry, S. H., Kanouse, D. E., Kunkel, D., Hunter, S. B., et al. (2004). Watching Sex on Television Predicts Adolescent Initiation of Sexual Behavior. *Pediatrics, 114*(3), 280-289.

Collins, W. A. (1970). Learning of Media Content: A Developmental Study. *Child Development, 41*(4), 1133-1142.

Collins, W. A. (1979). Children's comprehension of televison content. In E. Wartella (Ed.), *Children communicating: Media and development of thought, speech, and understanding* (pp. 21-51). Beverly Hills, CA: Sage.

Collins, W. A. (1983). Interpretation and inference in children's television viewing. In J. Bryant & D. R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension* (pp. 221-240). New York: Academic Press.

Collins, W. A., Wellman, H., Keniston, A. H., & Westby, S. D. (1978). Age-related aspects of comprehension and inference from a televised dramatic narrative. *Child Development, 49*, 389-399.

Collins, W. A., & Wellman, H. M. (1982). Social scripts and developmental patterns in comprehension of televised narratives. *Communication Research, 9*(3), 380-398.

Cooney, J. G. (2001). Foreword. In S. M. Fisch & R. T. Truglio (Eds.), *"G" is for Growing: Thirty years of research on children and Sesame Street* (pp. xi-xii). Mahwah, NJ: Lawrence Erlbaum.

Crawley, A. M., Anderson, D. R., Santomero, A., Wilder, A., Williams, M., Evans, M. K., et al. (2002). Do children learn how to watch television? The impact of extensive experiences with *Blue's Clues* on preschool children's television viewing behavior. *Journal of Communication, 52*(2), 267-280.

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposure to a single episode of the television program *Blue's Clues* on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology, 91*(4), 630-637.

Darlington, R. B. (1996). How many covariates to use in randomized experiments? Retrieved March 8, 2010, from http://www.psych.cornell.edu/darlington/covarnum.htm

Dempster, F. N. (1981). Memory span: Sources of individual and developmental differences. *Pyschological Bulletin, 89*(1), 63-100.

Dunn, L. M., & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test-Third Edition*. Bloomington, MN: Pearson Assessments.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191.

Federal Communications Commission. (1996). *Policies and rules concerning children's television programming: Revision of programming policies for television broadcast stations*. Washington, DC: U.S. Government Printing Office

Field, A. (2005). *Discovering statistics using SPSS*. London: Sage.

Field, D. E., & Anderson, D. R. (1985). Instruction and modality effects on children's television attention and comprehension. *Journal of Educational Psychology, 77*(1), 91-100.

Fisch, S. M. (2000). A capacity model of children's comprehension of educational content on television. *Media Psychology, 2*, 63-91.

Fisch, S. M. (2003). *The Impact of Cyberchase on Children's Mathematical Problem Solving*. Teaneck, NJ: MediaKidz Research & Consulting

Fisch, S. M. (2004). *Children's Learning from Educational Television*. Mahwah, New Jersey: Lawrence Erlbaum.

Fisch, S. M., Kirkorian, H. L., & Anderson, D. R. (2005). Transfer of learning in informal education: The case of television. In J. P. Mestre (Ed.), *Transfer of learning from a modern multidisciplinary perspective* (pp. 371-393). Greenwich, CT: Information Age.

Fisch, S. M., & McCann, S. K. (1993). Making broadcast television participative: Eliciting mathematical behavior through Square One TV *Educational Technology Research and Development, 41*(3), 103-109.

Fisch, S. M., & Truglio, R. T. (Eds.). (2001). *"G" is for growing: Thirty years of research on children and Sesame Street*. Mahwah, NJ: Lawrence Erlbaum Associates.

Fitzgerald, J. (1984). The relationship between reading ability and expectations for story structures. *Discourse Processes, 7*, 21-42.

Fitzgerald, J. (1989). Research on stories: Implications for teachers. In K. D. Muth (Ed.), *Children's Comprehension of Text: Research into Practice*. Newark, DE: International Reading Association.

Fitzgerald, J., & Teasley, A. B. (1986). Effects of instruction in narrative structure on children's writing. *Journal of Educational Psychology, 78*(6), 424-432.

Friedrich, L. K., & Stein, A. H. (1973). Aggressive and prosocial television programs and the natural behavior of preschool children. *Monographs of the Society for Research in Child Development, 38*(4).

Gardner, H. (2000). The theory of multiple intelligences. In P. S. Fass & M. A. Mason (Eds.), *Childhood in America* (pp. 339-342). New York, NY: New York University.

Gerrig, R. J. (1993). *Experiencing Narrative Worlds*. New Haven, CT: Yale University Press.

Gorsuch, R. L. (1983). *Factor Analysis* (2nd ed.). Hillsdale, New Jersey: Lawrence Erlbaum.

Groesz, L., M., Levine, M. P., & Murnen, S. K. (2002). The effect of experimental presentation of thin media images on body satisfaction: A meta-analytic review. *International Journal of Eating Disorders, 31*(1), 1-16.

Gunter, B., Furnham, A., & Griffiths, S. (2000). Children's memory for news: A comparison of three presentation media. *Media Psychology, 2*, 93-118.

Hall, E. R., Miller, B. A., & Fisch, S. M. (1990). *Children's problem-solving behavior and their attitudes toward mathematics: A study of the effects of Square One TV* (Vol. 4, The *Square One TV* interview: Children's reactions to the series). New York, NY: Children's Television Workshop

Harrison, K., & Hefner, V. (2006). Media exposure, current and future body ideals, and disordered eating among preadolescent girls: A longitudinal panel study. *Journal of Youth and Adolescence, 35*, 153-163.

Haskell, R. J. (1999). *Transfer of learning: Cognition, instruction, and reasoning*. San Diego: Academic Press.

Hayes, A. F., & Krippendorff, K. (2007). Answering the call for a standard reliability measure for coding data. *Communication Methods and Measures, , 1,* 77-89.

Hudson, J. A., & Shapiro, L. R. (1991). From knowing to telling: The development of children's scripts, stories, and personal narratives. In A. McCabe & C. Peterson (Eds.), *Developing narrative structure* (pp. 89-136). Hillsdale, NJ: Lawrence Erlbaum.

Huesmann, L. R. (1986). Psychological processes promoting the relationship between exposure to media violence and aggressive behavior by the viewer. *Journal of Social Issues, 42*, 125-139.

Huston, A. C., Bickham, D. S., Lee, J., & Wright, J. C. (2007). From attention to comprehension: How children watch and learn from television. In N. Pecora, J. P. Murray & E. Wartella (Eds.), *Children and Television: Fifty Years of Research* (pp. 41-63). Mahwah, NJ: Lawrence Elrbaum.

Huston, A. C., & Wright, J. C. (1989). The forms of television and the child viewer. In G. Comstock (Ed.), *Public communication and behavior* (Vol. 2, pp. 103-158). San Diego, CA: Academic Press.

Ilgaz, H., & Aksu-Koc, A. (2005). Episodic development in preschool children's play-prompted and direct-elicited narratives. *Cognitive Development, 20*, 526-544.

Institute of Medicine [IOM] of the National Academies. (2006). *Food marketing to children: Threat or opportunity?* Washington, DC: National Academies Press

Jaccard, J. (Ed.). (1998). *Interaction effects in factorial analysis of variance*. Thousand Oaks, CA: Sage.

Jaccard, J., & Turrisi, R. (2003). *Interaction effects in multiple regressions* (2nd ed.). Thousand Oaks: Sage.

Jordan, A. B. (1996). *The state of children's television: An examination of quantity, quality, and industry beliefs*. Philadelphia, PA: Annenberg Public Policy Center, University of Pennsylvania

Jordan, A. B. (2000). *Is the Three-Hour Rule Living Up to Its Potential? An Analysis of Educational Television for Children in the 1999/2000 Broadcast Season*. Philadelphia, PA: Annenberg Public Policy Center, University of Pennsylvania

Jordan, A. B. (2004). The Three-Hour Rule and Educational Television for Children. *Popular Communication, 2*(2), 103 - 118.

Jordan, A. B. (2005). Learning to Use Books and Television. *American Behavioral Scientist, 48*(5), 525-538.

Kendeou, P., Bohn-Gettler, C., White, M. J., & Van Den Broek, P. (2008). Children's inference generation across different media. *Journal of Research in Reading*, doi: 10.1111/j.1467-9817.2008.00370.x.

Kendeou, P., Lynch, J. S., van den Broek, P., Espin, C. A., White, M. J., & Kremer, K. (2005). Developing successful readers: Building early comprehension skills through television viewing and listening. *Early Childhood Education Journal, 33*(2), 91-98.

Kirkorian, H. L., Wartella, E., & Anderson, D. R. (2008). Media and Young Children’s Learning. *The Future of Children, 18*(1), 39-61.

Kremer, K. E., Lynch, J. S., Kendeou, P., Butler, J., & van den Broek, P. (2002). *The role of early narrative understanding in predicting future reading comprehension*. Paper presented at the Meeting of the American Educational Research Association. Retrieved April 30, 2007, from http://www.ciera.org/library/presos/2002/index.html

Krendl, K. A., & Watkins, B. (1983). Understanding television: An exploratory inquiry into the reconstruction of narrative content. *Educational Technology Research and Development, 31*(4), 201-212.

Kunkel, D. (1981). *Assessing AIME: An empirical analysis of the relationship between mental effort and learning from TV.* Unpublished manuscript, University of Southern California.

Lang, A. (2000). The limited capacity model of mediated message processing. *Journal of Communication, 50*(1), 46-70.

Lee, J. H., & Huston, A. C. (2003). Educational televisual media effects. In E. L. Palmer & B. M. Young (Eds.), *The faces of televisual media: Teaching, Violence, Selling to Children* (2nd ed., pp. 83-106). Mahwah, New Jersey: Lawrence Erlbaum.

Leifer, A. D., Collins, W. A., Gross, B. M., Taylor, P. H., Andrews, L., & Blackmer, E. R. (1971). Developmental Aspects of Variables Relevant to Observational Learning. *Child Development, 42*(5), 1509-1516.

Linebarger, D. L., & Kosanic, A. Z. (2001). *Summative evaluation of Dora the Explorer: A final report to Nickelodeon television (Part 1: Learning Outcomes; Part 2: Character Study)*. Kansas City, KS: Media & Technology Projects

Linebarger, D. L., Kosanic, A. Z., Greenwood, C. R., & Doku, N. S. (2004). Effects of viewing the television program *Between the Lions* on the emergent literacy skills of young children. *Journal of Educational Psychology, 96*(2), 297-308.

Linebarger, D. L., & Piotrowski, J. T. (2006). *Pinky Dinky Doo: Evaluating the educational impact and appeal of Pinky Dinky Doo on preschool children. A final report to Sesame Workshop.* Philadelphia, PA: Annenberg School for Communication

Linebarger, D. L., & Piotrowski, J. T. (2008). Evaluating the Educational Potential of Health PSAs with Preschoolers. *Health Communication, 23*(6), 516-525.

Linebarger, D. L., & Piotrowski, J. T. (2009). TV as storyteller: How exposure to television narratives impacts at-risk preschoolers' story knowledge and narrative skills. *British Journal of Developmental Psychology, 27*, 47-69.

Linebarger, D. L., & Wainwright, D. K. (2007). Learning while viewing: Urban myth or dream come true? In S. R. Mazzarella (Ed.), *20 Questions about youth and the media* (pp. 179-196). New York, NY: Peter Lang.

Lorch, E. P., Bellack, D. R., & Augsbach, L. H. (1987). Young children's memory for televised stories: Effects of importance. *Child Development, 58*(2), 453-463.

Low, J., & Durkin, K. (1998). Structure and Causal Connections in Children's On-Line Television Narratives: What Develops? *Cognitive Development, 13*, 201-225.

Luke, C. (1987). Television discourse and schema theory: Toward a cognitive model of information processing. In M. E. Manley-Casimir & C. Luke (Eds.), *Children and Television: A Challenge for Education* (pp. 76-107). New York, NY: Praeger.

Mandler, J. M. (1979). Categorical and schematic organization in memory. In C. R. Puff (Ed.), *Memory organization and structure* (pp. 259-302). New York: Academic Press.

Mandler, J. M., & Johnson, N. S. (1977). Remembrance of things parsed: Story structure and recall. *Cognitive Psychology, 9*, 111-151.

Mares, M. L. (2007). Developmental changes in adult comprehension of a television program are modified by being a fan. *Communication Monographs*, *74*(1), 55-77.

McCabe, A., & Peterson, C. (Eds.). (1991). *Developing narrative structure*. Hillsdale, NJ: Lawrence Erlbaum.

McCabe, A., & Rollins, P. R. (1994). Assessment of preschool narrative skills. *American Journal of Speech-Language Pathology*, *3*(1), 45-56.

McClure, E., Mason, J., & Williams, J. (1983). Sociocultural variables in children's sequencing of stories. *Discourse Processes, 6*, 131-143.

Meadowcroft, J. M. (1986). Children's attention to television: The influence of story schema development on allocation of cognitive capacity and memory (Vol. 46, pp. 2847). University of Wisconsin-Madison: Dissertation Abstracts International.

Meadowcroft, J. M., & Reeves, B. (1989). Influence of story schema development on children's attention to television. *Communication Research*, *16*(3), 352-374.

Mielke, K. W. (1990). Research and development at the Children's Television Workshop. *Educational Technology Research and Development*, *38*(4), 7-16.

Missall, K. N., & McConnell, S. R. (2004) *Technical Report: Psychometric characteristics of individual growth and development indicators – Picture Naming, Rhyming & Alliteration.* Minneapolis, MN: Center for Early Education and Development Retrieved from http://ggg.umn.edu/techreports/dissemination.html#TechRep .

Neuman, S. B. (1992). Is learning from media distinctive? Examining children's inferencing strategies. *American Educational Research Journal, 29*(1), 119-140.

Neuman, S. B. (1995). *Literacy in the television age: The myth of the TV effect* (2nd ed.). Norwood, NJ: Ablex Publishing Corporation.

Newcomb, A. F., & Collins, W. A. (1979). Children's comprehension of family role portrayals in televised dramas: Effects of socioeconomic status, ethnicity, and age. *Developmental Psychology, 15*(4), 417-423.

Nezworski, T., Stein, N. L., & Trabasso, T. (1982). Story structure versus content in children's recall. *Journal of Verbal Learning and Verbal Behavior, 21*, 191-206.

Nielsen Media Research. (2007). *Nielsen Galaxy Explorer: September 1 - 31, 2007*. New York: Nielsen Media Research.

Ouellette, G. P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology, 98*(554-566).

Palmer, E. L., & Fisch, S. M. (2001). The beginnings of Sesame Street research. In S. M. Fisch & R. T. Truglio (Eds.), *"G" is for Growing: Thirty years of research on children and Sesame Street* (pp. 3-25). Mahwah, NJ: Lawrence Erlbaum.

Paris, A. H., & Paris, S. (2001). *Children's comprehension of narrative picture books* (No. 3-012). Ann Arbor: University of Michigan, Center for the Improvement of Early Reading Achievement

Pascual-Leone, J. (1970). A mathematical model for the transition rule in Piaget's developmental stages. *Acta Psychologica, 32*, 301-345.

Paul, R., & Smith, R. L. (1993). Narrative skills in 4-year-olds with normal, impaired, and late-developing language. *American Speech-Language-Hearing Association, 36*, 592-598.

Pierce, R. P. (1998). *The NICHD Study of Early Child Care*. Retrieved February 12, 2010. from http://www.childresearch.net/RESOURCE/DATA/SURVEY/NICHD/DATA02.

Pingree, S. (1986). Children's activity and television comprehensibility. *Communication Research, 13*(2), 239-256.

Piotrowski, J. T. (2006). *The time-crunched family & preschool television: Is 24-hour television the answer?* Paper presented at the meeting of the National Communication Association, San Antonio, TX.

Piotrowski, J. T. (2007). *Measuring narrative in children's television programming.* Paper presented at the workshop Exploring Media Narratives: New Concepts and Methods, Erfurt, Germany.

Poulsen, D., Kintsch, E., & Kintsch, W. (1979). Children's comprehension and memory for stories. *Journal of Experimental Child Psychology, 28*, 379-403.

Rahman, T., & Bisanz, G. L. (1986). Reading ability and use of a story schema in recalling and reconstructing information. *Journal of Educational Psychology, 78*(5), 323-333.

Reiser, R. A., Williamson, N., & Suzuki, K. (1988). Using "Sesame Street" To Facilitate Children's Recognition of Letters and Numbers. *Educational Communication and Technology Journal 36*(1), 15-21.

Rideout, V., & Hamel, E. (2006). *The Media Family: Electronic media in the lives of infants, toddlers, preschoolers and their parents*. Menlo Park, CA: The Henry J. Kaiser Family Foundation

Riley, E., Freer, B., Lorch, E. P., & Milich, R. (2007). *Developmental changes in children's goal-based story representation*. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Boston, MA.

Roberts, D. F., & Foehr, U. G. (2008). Trends in Media Use. *The Future of Children, 18*(1), 11-37.

Rockman et al. (1996). *Evaluation of the Bill Nye The Science Guy Television Series and Outreach: A report to KCTS-TV*. San Francisco, CA

Rosenthal, R. (1991). *Meta-analytic procedures for social research* (revised ed.). Newbury Park: Sage.

Salomon, G. (1983a). The differential investment of mental effort in learning from different sources. *Educational Psychologist,, 18*(1), 42-50.

Salomon, G. (1983b). Television watching and mental effort: A social psychological approach. In J. Bryant & D. R. Anderson (Eds.), *Children's Understanding of Television: Research on attention and comprehension* (pp. 181-198). San Diego, CA: Academic Press.

Salomon, G. (1984). Television is “easy” and print is “tough”: The differential investment of mental effort as a function of perceptions and attributions. *Journal of Educational Psychology, 76*, 647-658.

Salomon, G., & Cohen, A. A. (1978). On the meaning and validity of television viewing. *Human Communication Research, 4*(3), 265-270.

Salomon, G., & Leigh, T. (1984). Predispositions about learning from print and television. *Journal of Communication, 34*(2), 119-135.

Schank, R. C., & Abelson, R. P. (1977). *Scripts, plans, goals, and understanding*. Hillsdale, NJ: Lawrence Erlbaum.

Schmidt, M. E., & Anderson, D. R. (2007). The impact of television on cognitive development and educational achievement. In N. Pecora, J. P. Murray & E. A. Wartella (Eds.), *Children and Television* (pp. 65-85). Mahwah, NJ: Lawrence Erlbaum.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2001). *Experimental and Quasi-Experimental Designs For Generalized Causal Inference*. New York, NY: Houghton-Mifflin.

Singer, J. L. (1980). The Powers and Limitations of Television: A Cognitive-Affective Analysis. In P. Tannenbaum (Ed.), *The Entertainment Functions of Television* (pp. 31-60). Hillsdale, NJ: Erlbaum.

Singley, M. K., & Anderson, J. R. (1989). *The transfer of cognitive skill*. Cambridge, MA: Harvard University Press.

Stein, N. L., & Glenn, C. G. (1979). An analysis of story comprehension in elementary school children. In R. O. Freedle (Ed.), *New directions in discourse processing* (pp. 53-120). Norwood, NJ: Ablex.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Allyn and Bacon.

Taylor, J. L. (2006). *Repeated viewings of Dora the Explorer and its influence on young children's learning.* Paper presented at the Eastern Communication Association, Philadelphia, PA.

Thorndyke, P. W. (1977). Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology, 9,* 77-110.

Thorndyke, P. W., & Yekovich, F. R. (1979). *A critique of schemata as a theory of human story memory* (No. P-6307). Santa Monica, CA. Rand.

Trabasso, T., & Stein, N. L. (1997). Narrating, representing, and remembering event sequences. In P. van den Broek, P. J. Bauer & T. Bourg (Eds.), *Developmental spans in event comprehension and representation: Bridging fictional and actual events* (pp. 237-270). Mahwah, NJ: Lawrence Erlbaum.

van den Broek, P., Lorch, E. P., & Thurlow, R. (1996). Children's and adult's memory for television stories: The role of causal factors, story-grammar categories, and hierarchical level. *Child Development, 67*(6), 3010-3028.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wartella, E. (1995). Media and problem behaviors in young people. In M. Rutter & D. Smith (Eds.), *Psychosocial disorders in young people: Time trends and their origins*. Chichester, England: Wiley.

Watkins, B., Calvert, S. L., Huston-Stein, A., & Wright, J. C. (1980). Children's recall of television material: Effects of presentation mode and adult labeling. *Developmental Psychology, 16*, 672-679.

Wildt, A. R., & Ahtola, O. T. (1978). *Analysis of covariance*. Newbury Park, CA: Sage Publications.

Wilson, B., Kunkel, D., & Drogos, K. L. (2008). *Educationally/Insufficient? An analysis of the availability and educational quality of children's E/I programming*. Oakland, CA: Children Now

Winn, M. (1985). *The plug-in drug*. New York, NY: Penguin.

Wright, J. C., Huston, A. C., Murphy, K. C., St. Peters, M., Pinon, M., Scantlin, R., et al. (2001). The relations of early television viewing to school readiness and vocabulary of children from low income families: The early window project. *Child Development, 72*(5), 1347-1366.

Wright, J. C., Huston, A. C., Ross, R. P., Calvert, S. L., Rolandelli, D. R., Weeks, L. A., et al. (1984). Pace and continuity of television programs: Effects on children's attention and comprehension. *Developmental Psychology, 20*(4), 653-666.

Wright, J. C., Huston, A. C., Scantlin, R., & Kotler, J. (2001). The Early Window Project: *Sesame Street* prepares children for school. In S. M. Fisch & R. Truglio (Eds.), *"G" is for "growing": Thirty years of research on children and Sesame Street* (pp. 97-114). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Zakin, A. (2007). Metacognition and the use of inner speech in children's thinking: A tool teachers can use. *Journal of Education and Human Development, 1*(2), 1-14.

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (1992). *Preschool Language Scale - 3: Examiner's Manual*. San Antonio, TX: The Psychological Corporation.

Appendix A. *Story Schema Images and Judges Rating*

Image 1: Central Content
9 Central, 1 Incidental

Image 2: Incidental Content
0 Central, 10 Incidental

Image 3: Central Content
9 Central, 1 Incidental

Image 4: Incidental Content
1 Central, 9 Incidental

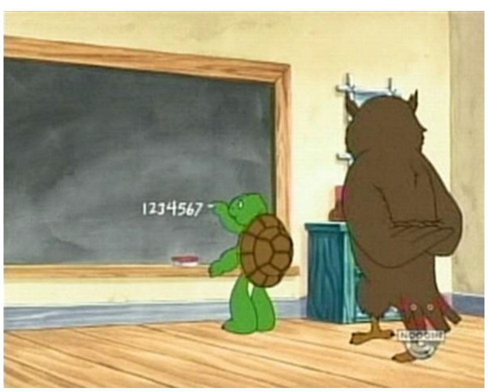
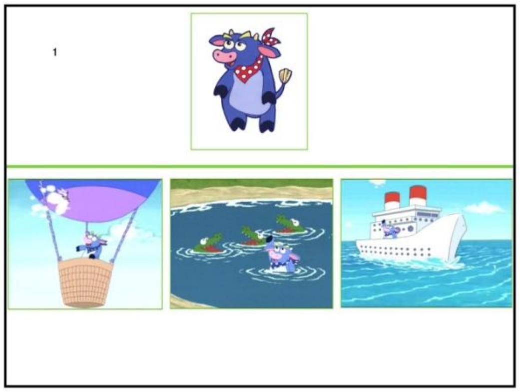
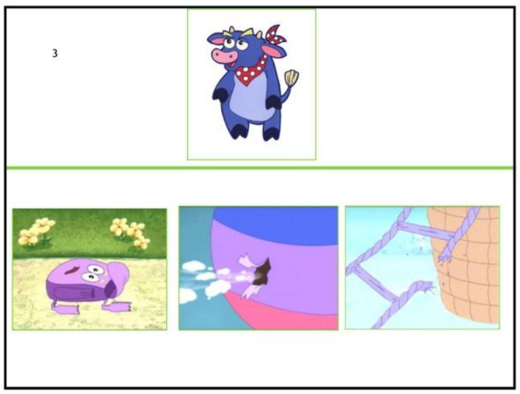


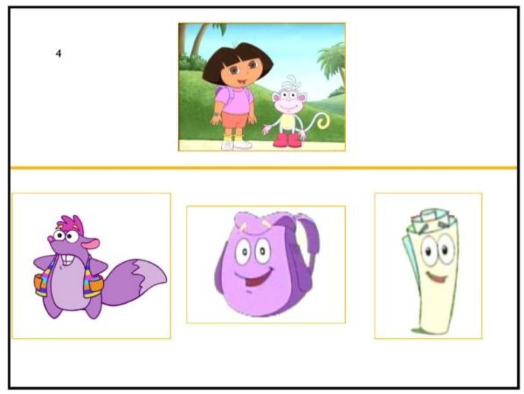
Image 5: Central Content
10 Central, 0 Incidental

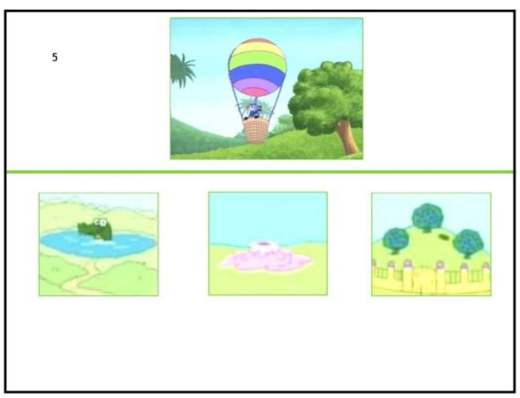
Image 6: Incidental Content
2 Central, 8 Incidental

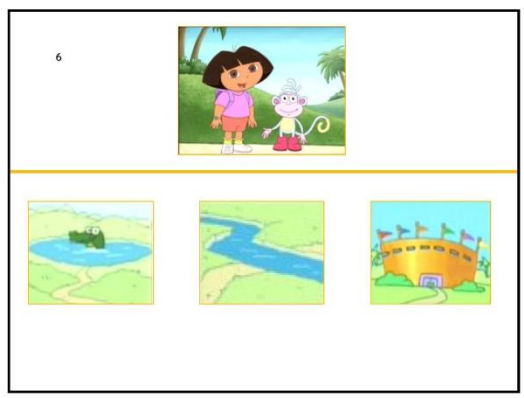
Appendix B. *Narrative Comprehension Assessment Images*

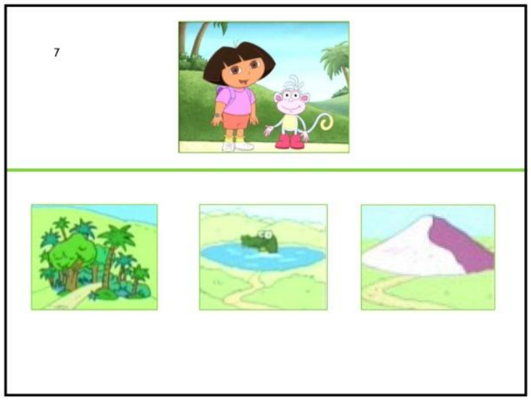








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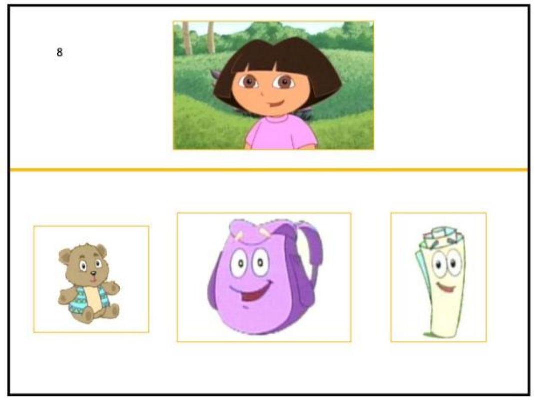
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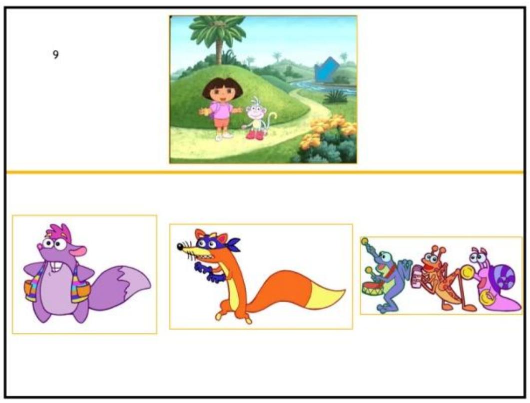
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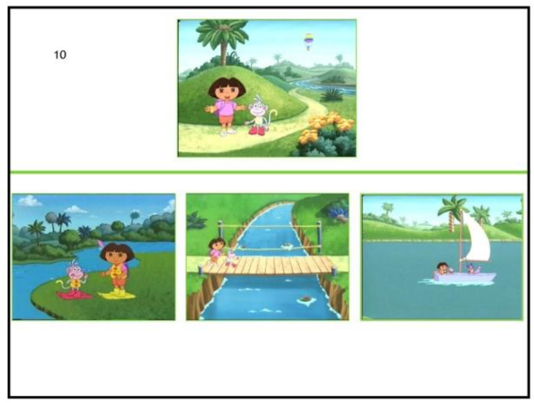
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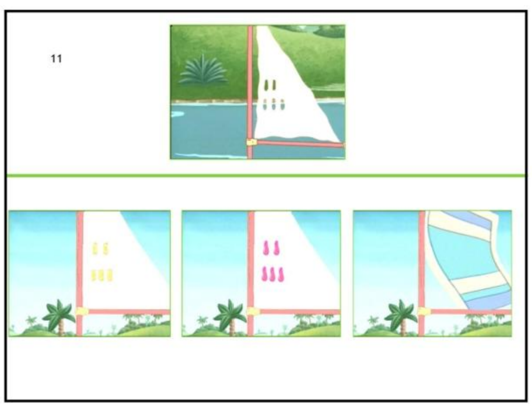
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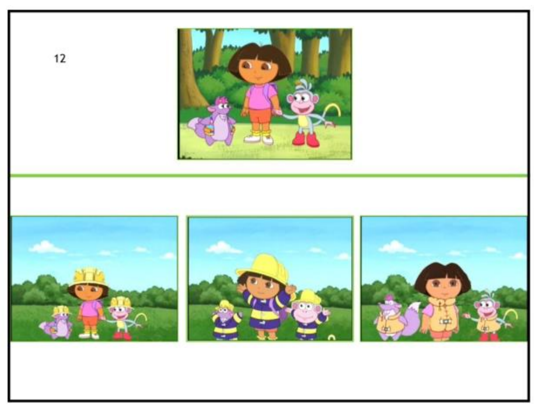
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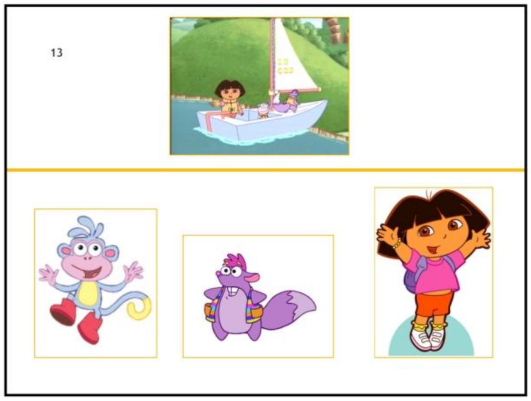
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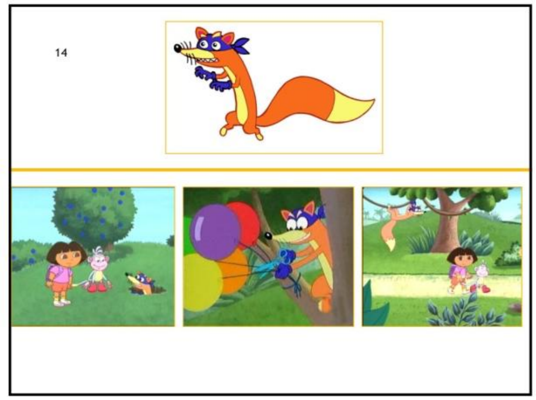
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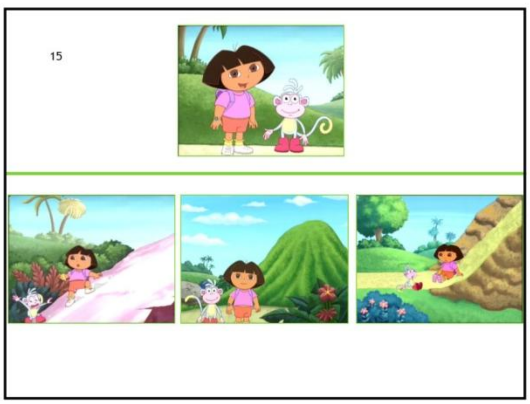
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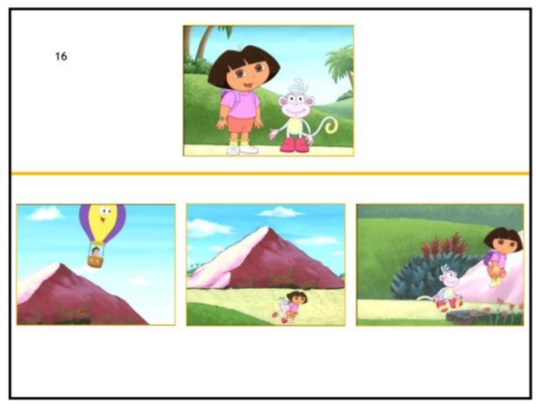
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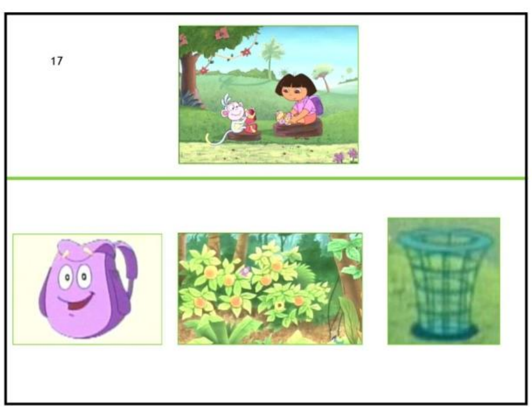
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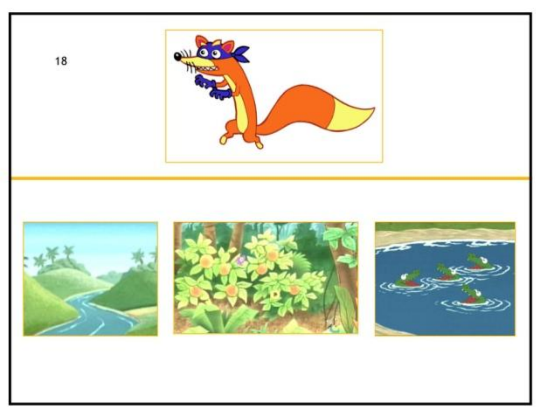
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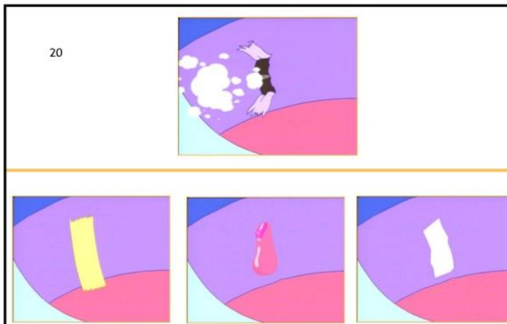

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Appendix C. *Codebook for Open-Ended Response Items*

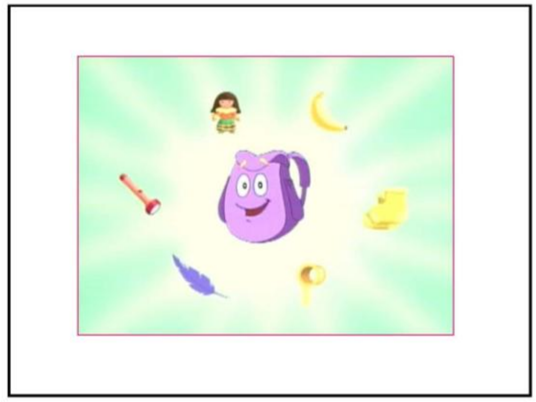
Assessment	Question	Codes
Educational Content Knowledge at Pretest	This is a picture of tape. What can you do with tape?	-96 = Bad Data 0 = "Don't Know", Irrelevant Answers, answers in which child only says "rip it off", "take it off" with no explanation of use 1 = Provides one **unique** use of tape 2 = Provides two **unique** uses of tape 3 = Provides three **unique** uses of tape 4 = Provides four **unique** uses of tape 5 = Provides five **unique** uses of tape 6 = Provides six **unique** uses of tape X = Provides X **unique** uses of tape (*Because this is pretest, responses redundant with the episode are counted*) (*A use should be broadly defined as a logical use, but latitude will be allowed here*)
Inferential Comp.	How do you think Benny feels when he calls out to Dora and Boots for help? *Probe: When Benny is in the balloon asking Dora and Boots for help, how do you think he is feeling?*	-96 = Bad Data 0 = "Don't Know", Irrelevant Answer (e.g. doesn't address feeling), responses that use term feeling colloquially ("feel sick", "feel tired") 1 = Responds with positive feeling (i.e. happy) 2 = Responds with negative feeling (i.e. sad, mad) (In all cases, score should be assigned to the response BEFORE the probe UNLESS the response AFTER the probe yields a higher score)

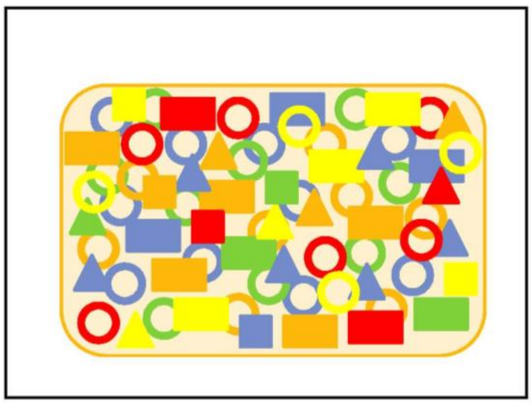
Assessment	Question	Codes
Inferential Comp.	What will happen if Benny's balloon goes in the lake? *Probe: What do you think will happen if Benny's balloon goes into the lake?*	-96 = Bad Data 0 = "Don't Know", Irrelevant Answer that does not address what would happen if balloon goes into lake. *Examples: Broke the balloon; he needs sticky tape.* 1 = Responds with reference to what will occur if balloon goes in lake, withOUT focusing specifically on crocodiles action. *Example: his balloon will pop* 2 = Responds with reference to what will occur if balloon goes in lake, WITH specific focus on crocodiles' action (i.e. eating balloon and/or Benny). *Examples: he gets eaten by crocodiles; he floats and the crocodiles eat him*
Inferential Comp.	Why did Dora and Boots want to help Benny? *Probe: Dora and Boots wanted to help Benny. Why do you think they wanted to help him?*	-96 = Bad Data 0 = "Don't Know", Irrelevant Answer that does refer to why Dora and Boots want to help Benny. *Examples: I want to help Benny; to go to Crocodile Lake* 1 = Responds with reference to Benny's reason for help (i.e. needs sticky tape, has hole in balloon, doesn't want to go to Crocodile Lake), withOUT referencing friendship with Benny. *Examples: because he didn't have sticky tape for his balloon; because Dora and Boots need to help him; Because he broke his balloon* 2 = Responds with reference to being Benny's friend and wanting to help him b/c he was their friend and needed help. *Examples: because he's their friend; Because it's so important because Dora and Benny is friends, best friends.*

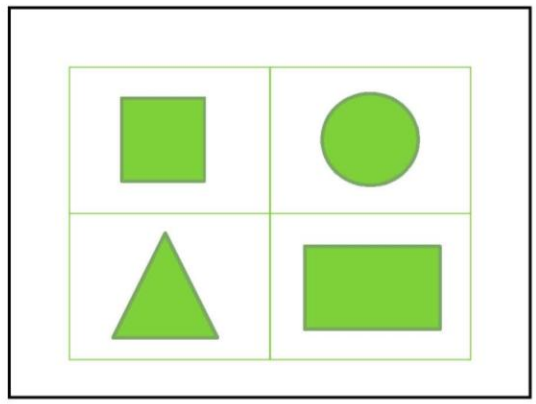
Assessment	Question	Codes
Inferential Comp.	Why doesn’t Benny want the balloon to land in the lake?	-96 = Bad Data 0 = “Don’t Know”, Irrelevant Answer, Response that is not a plausible reason for not wanting to go in the lake. Also includes restatement of question as responses (i.e. “because he doesn’t want to”) *Examples: Cause it's real, Because that's why he wanted to go up in the air, Because he wants sticky tape* 1 = Responds with plausible reason for not wanting to land in lake, but NO reference to crocodiles’ possible action (i.e. eating Benny / eating balloon). *Examples include: Because he will sink, Because he's scared of crocodiles, Because he'll drown.* 2 = Responds with reason for not wanting to land in lake that references crocodiles’ action *(i.e. eating Benny / eating balloon) Examples: Because he'll get eat by crocodiles; Cause him will get eaten.*
Inferential Comp.	At the end of the show, Dora, Boots, and Benny celebrate. What do you think will happen next? *Prompt with: what do you think Dora, Boots, and Benny will do after they are done celebrating?*	-96 = Bad Data 0 = “Don’t Know”, Response with reference to show being over, or Irrelevant Answer that has nothing to do with celebration at end of show. *Example: They're going in the balloon, they'll fix the hole; Swiper take the sticky tape in the forest.* 1 = Responds with an action that was demonstrated at the end of the show as part of the celebration (i.e. singing, dancing, “we did it” song) or the closing(i.e. “favorite part” recap, balloon flies away. *Example: Maybe sing a song; They float up in the air; Talk about the show.* 2 = Responds with an action that could potentially take place afterwards. *Example: Go Home*

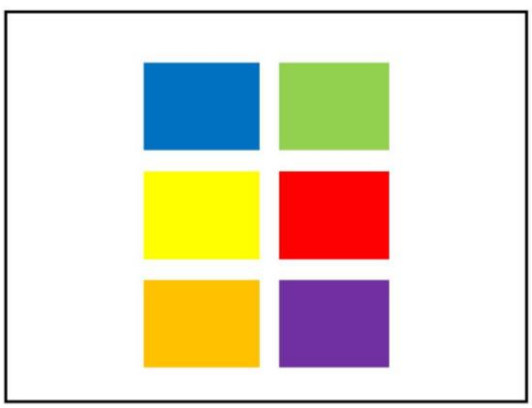
Assessment	Question	Codes
Educational Content Knowledge at Posttest	What are all the things that Dora & Boots fixed with the sticky tape? *Follow-up with: Is there anything else that Dora & Boots fixed with sticky tape?*	-96 = Bad Data 0 = No correct item mentioned 1 = One correct item mentioned 2 = Two correct items mentioned 3 = Three correct items mentioned 4 = Four correct items mentioned 5 = Five correct items mentioned 6 = Six correct items mentioned (All items fixed with sticky tape = 6 = Dora's Backpack, bird's nest, Tico's sailboat, shoes/mountain, ladder, Benny's balloon)
Educational Content Knowledge at Posttest	Can you think of anything else that you can do with sticky tape? *Follow-up with: Is there anything else you can do with sticky tape?*	-96 = Bad Data 0 = "Don't Know", Irrelevant Answer 1 = Provides one **unique** use of tape 2 = Provides two **unique** uses of tape 3 = Provides three **unique** uses of tape 4 = Provides four **unique** uses of tape 5 = Provides five **unique** uses of tape 6 = Provides six **unique** uses of tape X = Provides X **unique** uses of tape (*Because this is posttest, responses redundant with the episode are **NOT** counted*)

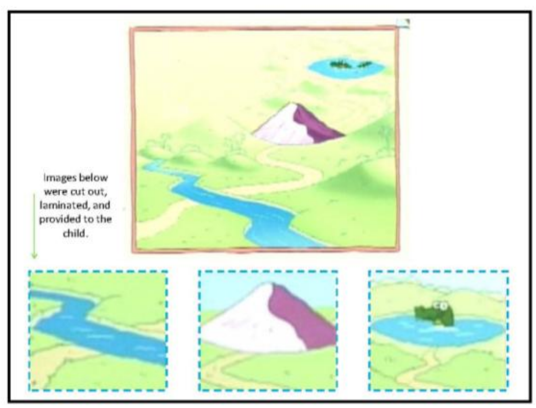
Appendix D*. Educational Content Comprehension Assessment Images*

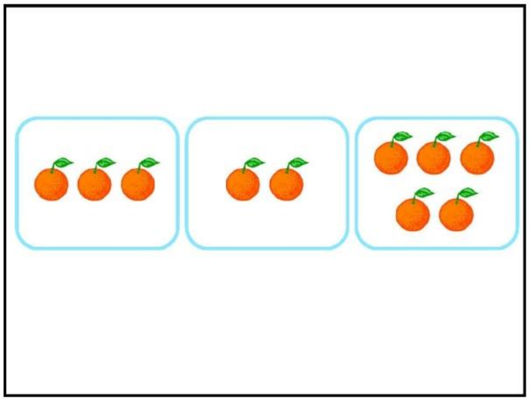
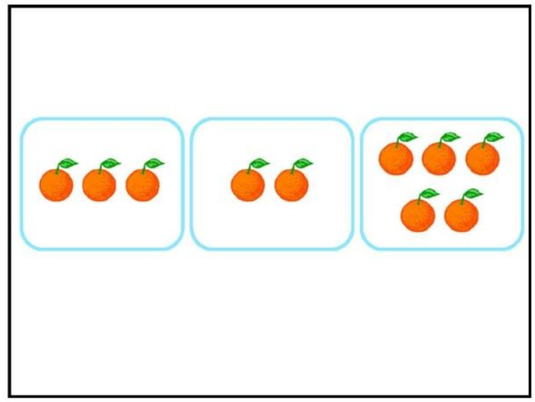
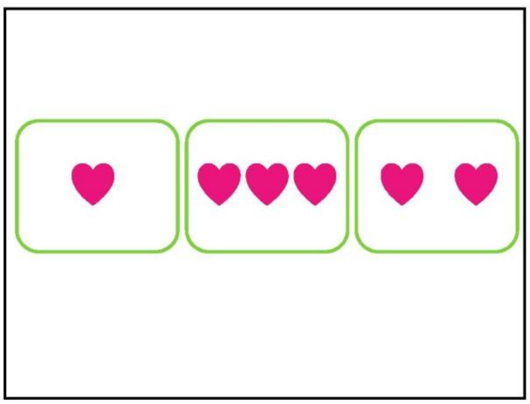
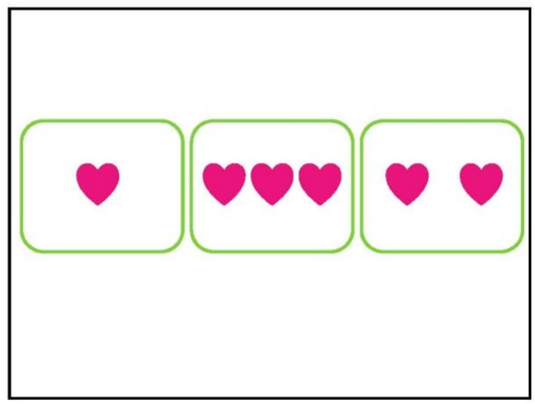
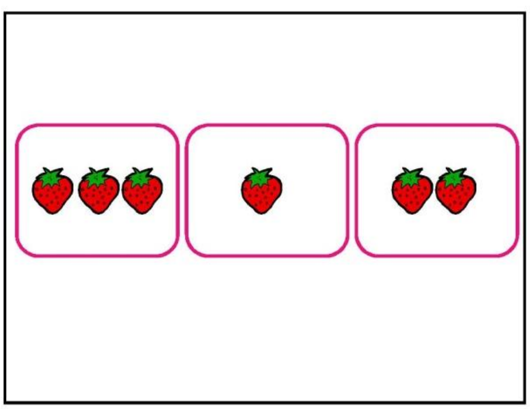
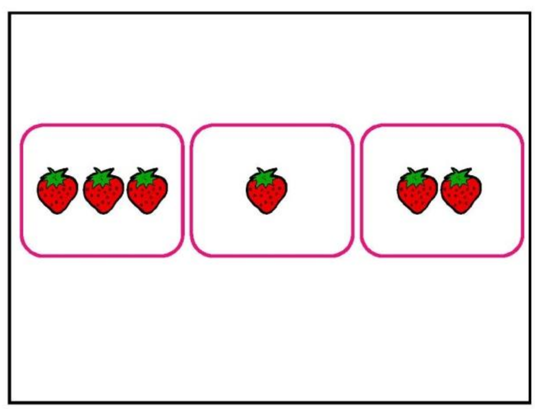


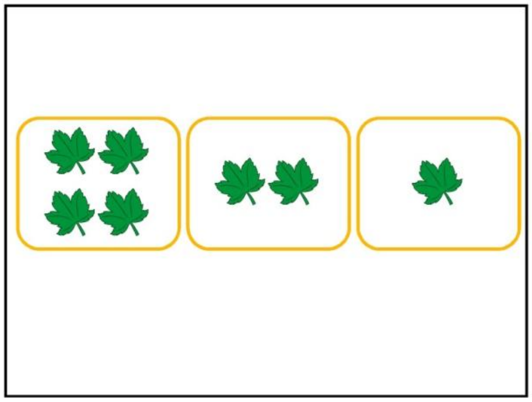
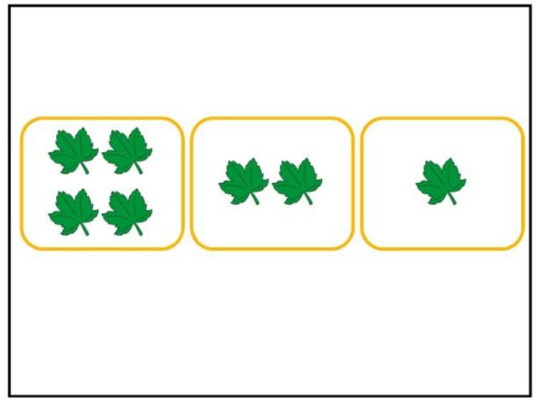
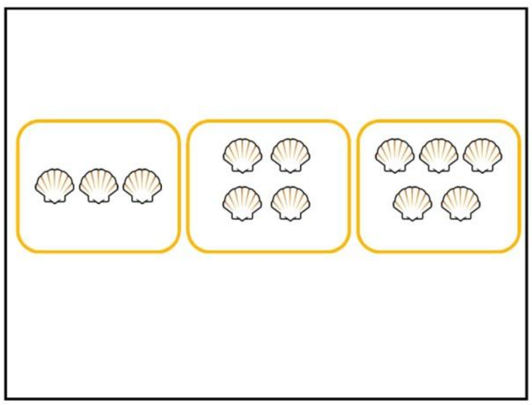
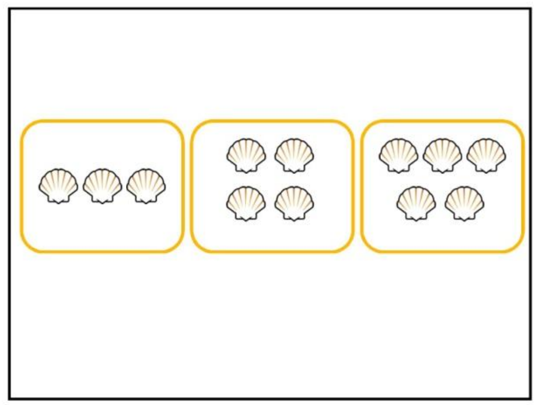




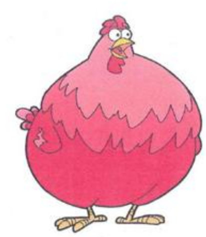




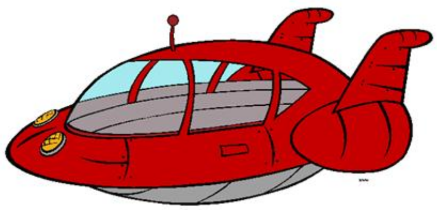





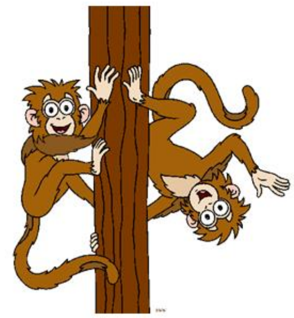
Appendix E. *Program Familiarity Assessment Images*

 **Dora the Explorer: Benny the Bull**	 **Dora the Explorer: Boots**
 **Dora the Explorer: Abuela**	 **Dora the Explorer: Dora**
 **Dora the Explorer: Swiper the Fox**	 **Dora the Explorer: Big Red Chicken**

	
Dora the Explorer: Isa the Iguana	**Dora the Explorer: Papi (Dora's Dad)**
	
Dora the Explorer: Tico	**Dora the Explorer: Mami (Dora's Mom)**
	
Dora the Explorer: Backpack	**Dora the Explorer: Grumpy Old Troll**

 Dora the Explorer: Fiesta Trio	 Dora the Explorer: Senor Tucan
 Dora the Explorer: The Map	 Dora the Explorer: Click
 Little Einsteins: Leo	 Little Einsteins: June

 **Little Einsteins: Quincy**	 **Little Einsteins: Annie**
 **Little Einsteins: Rocket**	 **Go Diego Go: Diego**
 **Go Diego Go: Baby Jaguar**	 **Go Diego Go: Alicia**

 **Go Diego Go: Rescue Pack**	 **Go Diego Go: Bobo Brothers**
 **Blue’s Clues: Blue**	 **Blue’s Clues: Steve**
 **Blue’s Clues: Joe**	 **Super Why!: Super Why**

 **Super Why!: Princess Presto**	 **Super Why!: Wonder Red**
 **Super Why!: Alpha Pig**	

Appendix F. *Parent Survey*

Child's ID: ________ Please Leave Blank

Annenberg School for Communication
University of Pennsylvania

Children's Learning from Educational Television: A Research Project

PARENT SURVEY

Please Fill-In

Your Child's Name:	
Your Name:	

Thank you for allowing your child to participate in the educational television project at your child's school. As part of this project, we are asking parents to complete this brief parent survey.

As you will see, the questions in this survey are designed to help us learn more about the type of television that your child watches as well as help us describe your family.

When you have completed the survey, please return it to your child's teacher using the attached envelope.

If you have any questions about this survey or the project, please contact the Project Director (Jessica Taylor Piotrowski) at 215-746-5429 or via email at jtaylor@asc.upenn.edu.

As a thank you for completing this survey, you will receive a $20 gift card. The director of your child's school will notify you when the gift card is available for pick up.

Page **1** of **7**

Child's ID: ________

Section 1: Your Child & TV

The following questions address particular television shows that your child may or may not watch at home.

	Q1. Has your child ever seen this television show? *(please circle)*		**Q2.** If yes, how many days per week does your child watch this show? *(please fill in)*	**Q3.** Do you own a DVD/VHS copy of this program for your child to view? *(please circle)*	
a) Blue's Clues	YES	NO	_____ days per week	YES	NO
b) Blue's Room	YES	NO	_____ days per week	YES	NO
c) Dora the Explorer	YES	NO	_____ days per week	YES	NO
d) Little Einsteins	YES	NO	_____ days per week	YES	NO
e) Go, Diego, Go!	YES	NO	_____ days per week	YES	NO
f) Super Why!	YES	NO	_____ days per week	YES	NO

	Q4. How much does your child like this show? Would you say he/she .... *(check one option for each television show)*				
	Strongly Likes	Somewhat Likes	Somewhat Dislikes	Strongly Dislikes	Has Never Seen Show
a) Blue's Clues					
b) Blue's Room					
c) Dora the Explorer					
d) Little Einsteins					
e) Go, Diego, Go!					
f) Super Why!					

Child's ID: ________

Section 2: Weekly Media Activities

The following questions help us understand the type of media that your child typically uses at home.

	Q5. Please **circle** how many **weekdays** (Monday-Friday) your child does each of the following activities:						Q6. How many **minutes**, on average, per weekday?
a) Watch Television (not including videos/DVDs)	Never	1	2	3	4	5	______ minutes
b) Watch Videos or DVDs	Never	1	2	3	4	5	______ minutes
c) Play Video Games (e.g. Xbox, Playstation, or VSmile)	Never	1	2	3	4	5	______ minutes
d) Play Handheld Video Games (e.g. Nintendo DS)	Never	1	2	3	4	5	______ minutes
e) Read or look at books alone or with someone else	Never	1	2	3	4	5	______ minutes
f) Use the Computer, no Internet	Never	1	2	3	4	5	______ minutes
g) Go online	Never	1	2	3	4	5	______ minutes
h) Watch TV Shows Online (e.g. streaming TV episodes)	Never	1	2	3	4	5	______ minutes

	Q7. Please circle how many **weekend days** (Saturday and Sunday) your child does each of the following activities:			Q8. How many **minutes**, on average, per weekend day?
a) Watch Television (not including videos/DVDs)	Never	1	2	_______ minutes
b) Watch Videos or DVDs	Never	1	2	_______ minutes
c) Play Video Games (e.g. Xbox, Playstation, or VSmile)	Never	1	2	_______ minutes
d) Play Portable / Handheld Video Games (eg. Nintendo DS)	Never	1	2	_______ minutes
e) Read or look at books alone or with someone else	Never	1	2	_______ minutes
f) Use the Computer, no Internet	Never	1	2	_______ minutes
g) Go online	Never	1	2	_______ minutes
h) Watch TV Shows Online	Never	1	2	_______ minutes

Child's ID: _________

Section 3: Your Child's Favorites

The following questions are about your child's favorite media products. Please write-in your response.

Q9. What is your child's favorite television show right now?	
Q10. What is your child's favorite video right now?	
Q11. What is your child's favorite book right now?	
Q12. What is your child's favorite video game right now (<u>not</u> a computer game)?	
Q13. What is your child's favorite computer game right now?	

Section 4: About Your Family

The following questions help us describe the children and parents that participated in the project.

Q14. Including yourself, how many adults are currently living in your house?
________________ number of adults

Q15. How many children are currently living in your house?
________________ number of children

Q16. Is your child a boy or girl?
☐ Boy
☐ Girl

Q17. What is your child's date of birth?
_____ / _____ / ________
MM DD YYYY

Q18. Does your child have any special needs that interfere with his/her learning? If yes, please describe.
☐ No
☐ Yes → If yes, please describe: ____

Q19. How would you describe your child's race? *(select all that apply)*
☐ White
☐ Black or African American
☐ Native American / American Indian or Alaska Native
☐ Asian
☐ Native Hawaiian and other Pacific Islander
☐ Other race (please specify) __________

Child's ID: ________

Q20. Is your child of Hispanic, Latino, or Spanish origin?
- ☐ No, not of Hispanic, Latino, or Spanish origin
- ☐ Yes

Q21. How would you describe your relationship to your child?
- ☐ Child's mother
- ☐ Stepmother
- ☐ Child's father
- ☐ Stepfather
- ☐ Other (SPECIFY) __________

Q22. What is your current marital status?
- ☐ Married
- ☐ Living as married
- ☐ Divorced
- ☐ Separated
- ☐ Widowed
- ☐ Never married / single

Q23. What is the last grade that you completed in school?
- ☐ Didn't go to school
- ☐ Less than 8th grade
- ☐ 8th grade
- ☐ Some high school
- ☐ High school diploma / GED
- ☐ Some college, no four year degree
- ☐ Vocational degree or trade school
- ☐ Bachelor's Degree (B.S., B.A., or other four year degree)
- ☐ Master's Degree (e.g. M.S., M.A.)
- ☐ Ph.D, M.D., J.D., etc.

Q24. What is your current employment status? *(select all that apply)*
- ☐ Employed full time
- ☐ Employed part time
- ☐ Self-employed
- ☐ Homemaker
- ☐ Student
- ☐ Retired
- ☐ Disabled
- ☐ Unemployed

Q25. What is your date of birth?

_____ / _____ / ________
MM DD YYYY

Child's ID: ________

Q26. Is there an additional parent/guardian that helps take care of your child?
- [ ] No → Skip to Question 32
- [ ] Yes→ Continue to Question 27

Q27. What is the relationship of this parent/guardian to <u>your child</u>?
- [ ] Child's mother
- [ ] Stepmother
- [ ] Child's father
- [ ] Stepfather
- [ ] Other (please specify) ________________________________

Q28. What is the relationship of this parent/guardian to <u>you</u>?
- [ ] Spouse/unmarried partner
- [ ] Ex-husband
- [ ] Ex-wife
- [ ] Other (please specify) ________________________________

Q29. What is the last grade that this parent/guardian completed in school?
- [ ] Didn't go to school
- [ ] Less than 8th grade
- [ ] 8th grade
- [ ] Some high school
- [ ] High school diploma / GED
- [ ] Some college, no four year degree
- [ ] Vocational degree or trade school
- [ ] Bachelor's Degree (B.S., B.A., or other four year degree)
- [ ] Master's Degree (e.g. M.S., M.A.)
- [ ] Ph.D, M.D., J.D., etc.
- [ ] I don't know

Q30. What is the current employment status for this parent/guardian? *(select all that apply)*
- [ ] Employed full time
- [ ] Employed part time
- [ ] Self-employed
- [ ] Homemaker
- [ ] Student
- [ ] Retired
- [ ] Disabled
- [ ] Unemployed
- [ ] I don't know

Q31. What is the date of birth for this parent/guardian?

_____ / _____ / ________
MM DD YYYY

- [ ] I don't know

Child's ID: ________

Q32. What was your family's **yearly** income, that is, **before taxes** for 2008? Your best guess is fine.
$______________

Q33. What language do you speak most at home now?
- ☐ English
- ☐ Spanish only
- ☐ English and Spanish equally
- ☐ English and another language equally
- ☐ Another language (please specify) ____________________

Thank you for completing this survey. Your responses will help us better understand how young children learn from educational television. Please return this survey to your child's teacher using the enclosed envelope.

Your compensation for completing this survey (a $20 gift card) will be delivered to your child's school. When you collect your gift card, you will be asked to sign a form that indicates you have received the compensation. The director of your child's school will notify you when the gift card is available for pick up.

Appendix G. *Participants' Favorite Media Products*

<u>Favorite Television Show</u>

Arthur, Backyardigans, Ben 10, Caillou, Curious George, Dora the Explorer, Drake and Josh, Elmo, Go Diego Go, Hannah Montana, iCarly, Johnny Test, Josh and Jake, Little Einsteins, Martha Speaks, Max & Ruby, Maya & Miguel, Mickey Mouse Clubhouse, Ni'hao Kailan, Phineas & Ferb, Power Rangers, Scooby Doo, Sesame Street, Sid the Science Kid, Special Agent OSO, Speed Buggy, Spiderman, Sponge Bob Squarepants, Suite Life of Zack and Cody, Super Why!, Thomas the Train, Wonder Pets, Wonder Pets, Word Girl, Wow Wow Wubzy, X-Men.

<u>Favorite Video</u>

Alvin and the Chipmunks, Annie, Are We There Yet?, Barbie, Barney, Bee Movie, Blue's Clues*, Bolt, Bugs Bunny, Cars*, Cat in the Hat, Charlie and Lola, Charlotte's Web, Cinderella, Dinosaurs, Disney Princess, Dora the Explorer*, Elmo's World, Finding Nemo, Go Diego Go, The Grinch, Hello Kitty, High School Musical, Horton Hears a Who!, Home Alone 2, Ice Age, Incredibles, James and the Giant Peach, Justice League, Kung Fu Panda, Lion King, Little Einsteins, Little Mermaid, Looney Tunes, Madagascar, Mary Poppins, Michael Jackson, Miley Cyrus, Monsters Inc., Mulan, Pokemon, Power Rangers, Princess movies, Sandlot, Scooby Doo, Sesame Street, Shrek the Third, Sleeping Beauty, Snow White, Sonic, Spiderman, Sponge Bob Squarepants, Superman, Thomas the Train, Tinkerbell, Toy Story 2, Transformers, Underdog, Wall-E, Willy Wonka, Winn Dixie, Wizard of Oz.

Favorite Book

A Fly Went By, Aladdin, Backyardigans, Barbie books, Batman, Blue's Perfect Present, Bunnies Are Not in Their Beds, Caillou, Can You See What I See?, Cars, Cat in the Hat, Chicken Jane, Chicken Little, Children's Bible, Cinderella, Clifford's Puppy Days, Curious George, Daddy Dance Me, David Gets in Trouble, Diego, Dinosaurs, Disney Bedtime Favorites, Disney Books, Dora the Explorer Books, Dr. Seuss books, Fancy Nancy, Five Little Ducks, Gingerbread Man, Go Dogs Go, Green Eggs and Ham, Guess How Much I Love You, Handbag Friends, I am Bunny, I love you the Purplest, I Spy, If You Give a Mouse a Cookie, If You Give a Pig a Pancake, Leap Frog Books, Little Mermaid, Max & Ruby, Miss Smith's Incredible Storybook, Monster Pictionary, Never Ever Shout in the Zoo, Olivia, One Fish Two Fish Red Fish Blue Fish, Peter Rabbit, Pinkalious, Pokemon, Sesame Street, Skippy John Jones, Snow White, Sounds of Laughter, Spiderman, Sponge Bob Squarepants, Strawberry Shortcake, Ten Apples Up on Top, The Cars Book, The Cat in the Hat, The Cow Who Clucked, The Incredible, The Little House Hotel, The Three Little Bears, Thomas, Thumbalina, TinkerBell, Transformers, What Makes A Rainbow, Who Am I, Winnie the Pooh Bedtime Series, Yellow and Yummy.

Favorite Video Game

Barbie, Cars, Cooking Mama, Cyberpocket Mathematics, Disney Princess, Dora the Explorer, Dragon Ball Z, Finding Nemo, Get Puzzled, Hot Wheels, Leap Frog, Leapsters, Lego Batman, Lightning McQueen, Littlest Pets, Mario Brothers, Mario Kart, Pac Mac, Power Ranges, Princess Aura, Sonic, Spiderman, Sponge Bob Squarepants, Star Wars Lego, Super Mario, Tea Time, Teenage Mutant Ninja Turtles, Tinkerbell, Transformers, V-Motion, Wall-E, Wii Sports Resort, Winnie the Pooh.

Favorite Computer Game

Barbie Dress Up, Blue's Clues, Bratz, Caillou, Cars, Curious George, Clifford, Cooking Mama, Counting Down Numbers with Elmo, Diego, Disney.com, Donut Shop, Dora the Explorer, Feeding Frenzy, Finding Nemo, Gingerbread Man, Goodnight Show, I Spy, Jay Jay the Jet Plane, Jump-Start Advanced Preschool Learning System, Jumpstart, Leap Frog, Little Einsteins, Memory, Mickey's Paint Shop, Mickey Mouse Clubhouse, Muppets Air, Nick Jr.com, Nickelodeon.com, Noggin.com, Pajama Sam, PBS Kids, PBS Sprout Online, PlayhouseDisney.com, Power Rangers, Race Car games, Reader Rabbit, School Zone Math, Sesame Street, Sponge Bob Squarepants, Star Falls, Super Why!, Thomas and Friends, WebKinz, Y8.