

THE PORTRAYAL OF SCIENCE IN CHILDREN'S TELEVISION

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ABSTRACT

Scholars argue that a scientifically literate public is a requirement for a democracy. Children are watching television more today than ever before, and studies have shown that children learn academically educational content from television. The Children's Television Act of 1990 requires broadcasters to provide educational and informational content for children. This study qualitatively evaluated a sample of 38 children's television programs to obtain a description of the scientific content contained in children's television. The study yielded a large quantity of scientific content, yet the quality of the content left much to be desired. Based on the findings of this study, science in children's television can be divided into two categories: *exposures* and *lessons*. Scientific content contains both fact and fiction, and a mixture of the two. Science is generally looked upon favorably in children's television; it's just not brought up enough. The major scientific topics covered were life sciences and earth and space sciences; other topics were mentioned at a much lower rate. In comparing the number of programs containing scientific content, the cable channels outperformed the networks. Possible remedies are discussed, as well as the limitations and possible further research.

CHAPTER 1 INTRODUCTION

Why are there seasons? How do the oceans work? How do our bodies grow? Science has the capacity to help us answer many questions about the world. A public informed about science is better able to make sound decisions in a democratic society (Gregory & Miller, 1998). Without a literate public, advances in science may be misunderstood and further research may be blocked. Forms of mass media have the potential for contributing to public understanding of science.

American children between the ages of two and 18 spend on average 5.5 hours per day with some form of media (Valkenburg, 2004). If, over a lifetime, the average American spends 2.5 hours daily watching television and gets eight hours of sleep each night, they will spend seven years of approximately 47 waking years watching television by the age of 70 (Van Evra, 1998).

Television has been described as a window on the world. This is particularly true for children. Children's lives are confined to the small area of the world they inhabit. They are a veritable blank slate when it comes to the social reality of the world (Swan, 1998).

With this in mind, Congress created the Children's Television Act of 1990. This act requires network broadcast stations to provide at least three hours per week of educational and informational programming (Federal Communications Commission, 1996). The stations are responsible for reporting to the Federal Communications Commission which programming they are using to fulfill these requirements.

In developing the Children's Television Act of 1990, Congress found "television can assist children to learn important information, skills, values, and behavior, while entertaining them and exciting their curiosity to learn about the world around them" and "as part of their

obligation to serve the public interest, television station operators and licensees should provide programming that serves the special needs of children” (Children’s Television Act, 1990).

According to predictions made in the 2007 U.S. Census Statistical Abstract, the overall amount of time Americans are spending with television is growing from 1,467 hours in 2000 to 1,555 projected hours in 2007, which equates to 65 days over the course of the year (Statistical Abstract of the United States, 2006). The abstract also notes the amount of time Americans are spending watching broadcast television is declining from 793 hours in 2000 to 678 projected hours in 2007, while cable and satellite is increasing from 674 hours in 2000 to 877 projected in 2007 (Statistical Abstract of the United States, 2006). According to the report, the number of hours Americans spent watching cable and satellite television surpassed the amount of time spent watching broadcast television in 2002. The Children’s Television Act does not apply to cable channels because they do not have license renewals as broadcast stations do.

Statement of Purpose

Scientific literacy on the part of the public is important to society. Children watch a great deal of television (Van Evra, 1998; Valkenburg, 2004). Children often learn from what they see on television (Swan, 1998; Calvert, 2001; Clifford et al., 1995). Therefore, television has the potential to help children become more scientifically literate. Is television providing the necessary information to educate children?

This study qualitatively evaluated the scientific content in children’s television programming. A sample of 38 children’s television programs from network broadcast stations and cable channels was utilized. The study sought to answer what information is presented, who presents it and how is it presented. Additionally, the study sought to determine whether the information provided is educational with respect to science.

This study fills a gap in the literature. There have been studies on violence, racism, and social interactions in television, but there have not been any studies on the scientific content in children's television. Children are the most vulnerable audience when it comes to learning from television as they lack the skills to examine programs themselves (Swan, 1998).

CHAPTER 2 LITERATURE REVIEW

Theory

This project will be grounded in cultivation and social cognitive theory. These theories will provide the theoretical framework for the rationale for this project.

Cultivation Theory. Cultivation theory is one of the stalwarts of media effects theories. Gerbner (1969) claims that after viewing television for a long time, people tend to have an altered view of reality. Heavy television viewers, for example, are more likely to believe that the world is closer to the image portrayed on television than reality suggests.

While most cultivation theory has focused on violence and racism, the theory has also been used to analyze other television content. Hetsroni and Tukachinsky (2006), for example, studied portrayals of the elderly, and Swan (1998) studied portrayals of ageism and sexism in children's programming.

There is evidence cultivation theory could explain how children learn from television as well. Shrum (2004) discusses the different ways to categorize the dependent variables used in analysis of cultivation theory. According to Shrum (2004), *first-order* measures refer to blanket statements of fact provided on television, while *second-order* measures refer to the values people attribute to those statements. In this way, a child may see several representations of science on television, a *first-order* dimension, and from those representations the child will make determinations on the value and worth of science, a *second-order* judgment. Shrum (2004) goes on to explain that in order for these two *orders* of cultivation to occur, there must be two different types of information processing at work: on-line processing as the information is viewed, and memory-based processing after reflection on the information (Shrum, 2004).

Hetsroni and Tukachinsky (2006) say that most researchers are skeptical about the cause of second-order effects, either television viewing directly or stemming from first-order effects. Still, they write, “there is no dispute over the fact that even if some viewers do not intend to use television programs for learning, they still incidentally learn few facts from the programs they watch” (Hetsroni & Tukachinsky, 2006, p. 134). Hetsroni and Tukachinsky (2006) set out to determine if, as according to cultivation theory, television is biasing the public’s estimation of violence in the real world or if, alternatively, the public has a skewed estimation of the violence portrayed in television, therefore negating a television influence.

The Hetsroni and Tukachinsky (2006) study revealed five different classes of television viewers, with three different levels of cultivation possible. *Simple cultivation* occurs when people give the television answer for both the television world and the real world. *Overcultivation* describes those people who gave exaggerated television estimates to both the television and real world. People who experience *double distortion* give the over-television response to the television world and the real-television answer to the real world. There are also two levels of non-cultivation. Viewers who gave the correct answer for both the television and real worlds are called *simple no cultivation*. The final group, *distorted no cultivation*, has a distorted view of television and a non-cultivated view of the real world. These groups varied systematically according to the amount of television viewed, with heavy viewers experiencing overcultivation and light viewers experiencing distorted no cultivation. This shows that with the varying degrees of exposure to television, there are varying degrees of cultivation.

Gentles and Harrison (2006) explored the mainstreaming process of cultivation in a study of the influence of body image in television on African American adolescent girls. This effect of cultivation influences people into believing that everyone in society should share certain

characteristics. In this particular study, the commonality influenced is an ideal-body size. By being perpetually presented with the same body size, people subconsciously begin to believe that others around them expect them to have the same body size, which is interpreted as an ideal. The researchers ran regressions on the participants' perceived peer opinions of their own body with self-reported levels of exposure to 33 television series that had been coded for the presentation of ideal body shape and the participants' own body mass index. Gentles and Harrison (2006) found that larger African American adolescents believed they should be smaller, consistent with data on European Americans, but smaller African American adolescents believed they should be larger, divergent from data on European Americans. Previous data had shown that African American women were unaffected by media-promoted ideal body images (Gentles & Harrison, 2006). By separating the participants by body mass index, Gentles and Harrison (2006) were able to show a mainstreaming effect as predicted by cultivation theory.

Another facet of cultivation theory is "zones of relevance" (Bilandzic, 2006). Bilandzic (2006) explores two different ways in which a person can perceive the distance they are from the information portrayed on television. According to Bilandzic (2006), experiential closeness is the relevance the television situation has to one's own personal history, and mediated closeness is the extent to which one is immersed in the television narrative. "Different individuals have different subjective relevance structures that influence whether television information will be remembered and used in judgments about social reality" (Bilandzic, 2006, p. 349). In this way, Bilandzic (2006) suggests, there is another dimension that influences how well cultivation can influence one's opinions and outlooks.

Social Cognitive Theory. "Seen from the sociocognitive perspective, human nature is a vast potentiality that can be fashioned by direct and observational experience into a variety of

forms within biological limits” (Bandura, 2001). Albert Bandura (1986) developed the social cognitive theory as a means of integrating how we learn from television with regard to personal choices. According to Bandura (2001), personal determinants, behavioral determinants, and environmental determinants interact with one another to affect an individual’s thoughts and actions. Environmental determinants include symbols and the observation of others. Through the presentation of educational information in a way conducive to learning, television programs can have a profound impact. Social cognitive theory can be used as a theoretical framework explaining how people learn from watching television.

In order for a viewer to duplicate a behavior presented through television, four elements must be met (Tan, Nelson, Dong & Tan, 1997). The behavior must be presented repetitively and consistently. The behavior must be simple enough to duplicate easily. The viewer must be rewarded, or believe he or she will be rewarded, for duplicating the behavior. And finally, the viewer must believe he or she has the ability to reproduce the behavior (Tan et al, 1997). The behavior regarding this study is the internalization of information presented through television. Through the repetitive presentation of scientific information that is broken down for children to understand, and in such a way that they believe they will be rewarded for internalizing the information and feel they have the ability to learn and utilize the information, children will learn the information vicariously through the enjoyment of watching television.

Social cognitive theory has been used as a foundation for several studies on the content of television programs. One recent study by Smith, Smith, Pieper, Downs, Yoo, Bowden, and Ferris (2005) was a content analysis of acts of altruism on television. The study used social cognitive theory as a rationale for the importance of the presentation of altruistic actions on television. The study claims that if children view characters closely resembling themselves

committing acts of altruism, the viewers will be more likely to act in altruistic ways in their own lives (Smith et al, 2005). As this was a content analysis, no data is available on the actual effects of the presentation of altruistic acts on television.

Stern and Mastro (2004) and Mastro and Stern (2003) also used social cognitive theory for the framework of their content analysis of gender portrayals (Stern & Mastro, 2004) and representations of race (Mastro & Stern, 2003) in prime-time broadcast commercials. Of most importance for these two studies is the element of social cognitive theory which states that people will learn from actors whom they perceive to be most like themselves (Stern & Mastro, 2004; Mastro & Stern, 2003). Again, because these studies were content analyses, no data is available on the actual effect on viewers.

Tan et al.'s (1997) study explored how Anglo American, Native American and Hispanic adolescents internalize and adopt values presented through television. In Tan et al's (1997) study the quantity of television viewed was not a determinant of how much the adolescents learned, rather it was the acceptance of the information and/or values as being functional in their lives. More specifically, it was the level of acceptance that the value was important to "being successful" (Tan et al, 1997). If scientific information is presented in such a way that children perceive that it is important to their lives, and indeed important to being successful, it is more likely that the children will internalize the information.

Both of these theories are important to this study, not because they provide explanations of the content of children's television, but because they provide explanations of how children learn from television. The ability of children to learn from viewing television creates a cause for concern about what children are learning from television.

Science Literacy

There are many reasons to advocate a public understanding and literacy of science. The benefits of a scientifically literate society affect not only science, but also national economics, national power and influence, individuals, democratic government and society, as well as intellectual, aesthetic and moral beliefs, among others (Gregory & Miller, 1998).

Because of the democratic nature of the United States, “Informed voters are supposed to be able to exert pressure through the ballot box and by lobbying. Informed consumers exert their pressure by buying or boycotting” (Gregory & Miller, 1998, p. 14). Being informed includes understanding the scientific and technological underpinnings of political and economic choices.

Based on a 1989 American Association for the Advancement of Science report on the literacy goals in science, math and technology, Laugksch and Spargo (2000) created a Test of Basic Scientific Literacy to determine basic literacy levels. Subtests on the nature of science, scientific content knowledge, and the impact of science and technology on society comprise the TBSL (Laugksch & Spargo, 2000).

Most Americans receive formal education in seven categories of scientific knowledge. They are science as inquiry, physical science, life science, earth and space science, science and technology, personal and social perspectives of science, and the history and nature of science (National Academy of Sciences, 1996). This study sought to determine whether these categories appear in children’s programming.

Children’s Learning from Television

Scholars agree that much of what children learn from television has to do with what they bring with them to the set: background knowledge and interests, socio-economic status, concentration, and attention (e.g. Clifford et al., 1995; Gunter & McAleer, 1995; Van Evra,

1998). “These viewers are not passively incorporating content uniformly; rather, they apply their own experience to the content” (Van Evra, 1998, p. 7).

In some studies older children score better on recall tests than younger children (e.g. Van Evra, 1998) suggesting that as children age, they have more general background knowledge and information-processing skills allowing for better attention, recall, and comprehension. Other studies, Clifford et al (1995) for example, found that older and younger children learned at the same rate. Scholars have also speculated about the rates at which boys learn from television compared to the learning rates of girls – especially in terms of science. Clifford et al. (1995) found there was no gender gap. Girls learned and were interested in science at the same rates as boys.

Also central to the argument of learning from television is whether children are active or passive television viewers. According to Buckingham (1998), “Children are seen here as vulnerable and impressionable, mere passive victims whose minds are irresistibly molded by the negative messages that are seen to bombard and manipulate them” (p. 26). But that idea is changing says Valkenburg (2004), “Children are active and motivated users of media, who critically evaluate what they are shown” (p. 8). According to Valkenburg (2004), both critical and psychological researchers consider children to be active media consumers.

This debate is important because of the implications on the cognitive processes of attention, comprehension, and retention. Van Evra (1998) says that children constantly monitor the comprehensibility of programs they watch. If a program is too difficult a young child will stop watching, regardless of initial investment, while older children will try harder to understand. Those who watch educational programming appropriate for their age-level, or view with parents, are more likely to attend more closely (Van Evra, 1998).

Gunter and McAleer (1995) say that children's motives have a great effect on whether or not they learn from the screen. If children watch television with the intention of amusement, they will learn little. But if they are motivated to learn, either out of curiosity or parental prodding, they will learn more. Parental involvement also assists children in their quest to understand what they see on television.

Swan (1998) found that children often believe that television portrays reality. In her research, 8- and 9-year-olds "find the characters, situations and story lines depicted in Saturday morning cartoons realistic" (p. 88). Cartoons are made in such a way that children can follow and internalize the stories more easily than other programs. The characters portrayed are "iconic images [that] simplify reality" (Swan, 1998, p. 90). This simplification of reality makes it easier for children to internalize the ideas portrayed.

The manner of presentation also has an impact on the recollection of material from television programs. Calvert (2001) found that children remembered more educational and informational content from spoken presentations than songs. She also found that children relied on concrete visual depictions to make sense of what they heard. These findings support the idea that the best way to present learning material to children on screen is through visuals and spoken words.

Welch and Watt (1982) studied the impact of visual complexity on children's memory of presented materials. They found that visually simple sets with low to moderate levels of activity helped the children learn the most. If the information to be presented can be presented visually, it should.

Who presents the information is also important to children. Hoffner's (1996) study found that children identify with child characters, and the sex of the character was also vital. Hoffner

(1996) found that boys relate more to male characters, while girls relate to both sexes equally. The question for this study is who most often presents the scientific information given in television programs.

Educational and Informational Programming

Congress recognized the amazing power television has over children when they enacted the 1990 Children's Television Act. In keeping with the idea that television stations must serve the public interest, this act requires each broadcast television station to provide educational and informational programming for children.

The Federal Communications Commission regulates stations' adherence to the act by implementing specific rules. Programs fulfilling the requirements of the Children's Television Act must air between the hours of 7 a.m. and 10 p.m., be 30 minutes in length, and be a regularly scheduled weekly program. Stations designate the programs they are using to fulfill these criteria as "core programming" and on air the programs are designated by an E/I symbol on the screen (Federal Communications Commission, 2006a). The Children's Television Act does not apply to cable stations.

The programs in the target area designated as "core programming" can be found in the Appendix. One will note that almost all of the listings air on Saturday mornings. FOX is the only network in the study area that splits its hours up over the span of the week (Federal Communications Commission, 2006b). According to Swan (1998) "Saturday morning is the only block of programming time devoted exclusively to children" (p. 88).

A potential problem with Congress's definition of educational programming, and the Federal Communications Commission's regulation of it, is the very broad definition of educational and informational. According to the Federal Communications Commission's 1996

Report and Order, “Educational and informational television programming is defined as any television programming that furthers 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” (p. 21). This definition encompasses not only traditional academic lessons but also social skills. According to Jordan (2004), “The broad definition may satisfy the competing interests [between industry and governmental expectations], but the question of whether prosocial programming can impart valuable lessons to young audiences remains” (p. 105). Because of this definition, programs which impart the slightest bit of a social lesson can be included in the “core programming.”

Jordan (2004) studied three episodes each of 41 “core” programs during the years 1999 and 2000 to determine how much of the programming addressed social/emotional lessons, physical well-being, or traditional academic lessons. While most of the programming was prosocial, 40.7% of the programs contained traditionally academic topics. Which topics, however, was not determined.

Some broadcasters argue that children can tell the difference between programming designed to entertain and programming designed to educate, children do not find academically educational television shows appealing, and therefore children choose to watch entertainment more than education (Fisch, Yotive, McCann Brown, Garner & Chen, 1997). Fisch et al. (1997) conducted experiments with children to determine the validity of such statements. Children found *Cro*, the educational program, just as appealing as the *The Flintstones*, the non-educational program. In a test of free recall, the children determined that both programs contained scientific content, but when asked for examples of the science they had seen, the real science examples

given were from *Cro*, while the examples given from *The Flintstones* portrayed “pseudo-science.”

Research Questions

Bearing in mind the aforementioned issues, the following research questions were proposed. The first task is to determine how science is presented in children’s programming:

RQ1: How can the science portrayed in children’s television programming be described?

RQ2: Is the science portrayed factual or science fiction?

RQ3: In general, is science portrayed positively or negatively?

RQ4: What types of science are covered?

RQ5: Is the information presented verbally, in song or in graphics?

RQ6: Who presents scientific information in children’s television programming?

Since the Children’s Television Act only applies to network television stations, it will be interesting to compare the content provided by the networks to those cable channels who provide children’s programming, though not necessarily educational, as part of their niche programming.

RQ 7: Which channels provide more mentions of science: the networks or the cable channels?

CHAPTER 3 METHOD

The importance of a scientifically literate public and regulations regarding the availability of educational programming provide justification for this project. Due to the exploratory nature of the study, a qualitative evaluation of a cross section of children's programming available at any given point in time was the best method of examination.

Sample

This study utilized a sample of children's programming from December 2006 through March 2007. The sample both reflects the requirements of the Children's Television Act of 1990 and provides a comparison to cable stations that are not required to comply with the Children's Television Act.

The Federal Communications Commission requires network stations to file reports of programming used to comply with the Children's Television Act. The sample for the ABC, CBS, FOX, and NBC network affiliates in the Baton Rouge market was determined by the networks' reports to the Federal Communications Commission (Federal Communications Commission, 2006b). The networks each provide three hours of educational programming per week in accordance with the Children's Television Act. For ABC, CBS, and NBC these three hours were contained during their Saturday morning lineups, notably "the only block of programming time devoted exclusively to children" (Swan, 1998, p. 88). FOX instead spread the three hours throughout the week with three different programs at 7 a.m. Monday through Saturday.

Programming from the Public Broadcasting Service (locally Louisiana Public Broadcasting) and two cable channels primarily targeted to children, Disney and Nickelodeon, were also included in the study to provide a comparison between stations required by law to

provide educational programming and those not required by law. PBS provides educational programming for children between 6 a.m. and 5:30 p.m. (Public Broadcasting Service, 2006). The three-hour afternoon lineup was selected because it contained programs for children of all ages. This block also includes a program sponsored in part by a grant from the National Science Foundation, *Cyberchase*.

Disney provides pre-school programming in the morning and programs for older children in the afternoons (Disney, 2006). The after-school lineup includes the same programs contained in ABC's Saturday morning programming. Instead of duplicating programs already included in the ABC sample, programs from morning and afternoon were utilized to produce a more representative sample of the programming available from Disney. For this study, ABC and Disney were treated as separate organizations.

Nickelodeon plays many of the same programs throughout the day, and, like Disney, provides pre-school programming in the morning and programming for older children in the afternoons (Nickelodeon, 2006). Programs from both programming segments were selected to provide a more representative sample of the programming available from Nickelodeon.

Swan's (1998) study contained a sample of two episodes per program; Jordan's (2004) study had three episodes each. This study utilized three episodes each of 38 programs across seven broadcast stations totaling 114 episodes. Table 1 lists the programs used for this study.

Observation

The researcher began with a list of each airing of each program noting the network and date of airing. The researcher viewed each episode making notes of any scientific content in the episode. Verbal presentations were noted verbatim, while visual presentations and general

attitudes were described. These portrayals were compared to reference materials to determine the veracity of content.

Table 1: Programs Included in the Study

<i>Channel</i>	<i>Program</i>	<i>Day(s)</i>	<i>Time</i>
ABC	The Emperor's New School	Saturday	8:00 a.m.
	The Replacements	Saturday	8:30 a.m.
	That's So Raven	Saturday	9:00 & 9:30 a.m.
	Hannah Montana	Saturday	10:00 a.m.
	The Suite Life of Zack & Cody	Saturday	10:30 a.m.
CBS	Madeline	Saturday	8:00 a.m.
	Sabrina the Animated Series	Saturday	8:30 a.m.
	Trollz	Saturday	9:00 a.m.
	Horseland	Saturday	9:30 a.m.
	Cake	Saturday	10:00 a.m.
	Dance Revolution	Saturday	10:30 a.m.
Disney	Little Einsteins	Monday through Friday	7:00 a.m.
	Handy Manny	Monday through Friday	8:00 a.m.
	Lilo & Stitch	Monday through Friday	11:00 a.m.
	Little Mermaid	Monday through Friday	11:30 a.m.
	Timon & Pumbaa	Monday through Friday	12:00 p.m.
	Proud Family	Monday through Friday	1:30 p.m.
FOX	Inspector Gadget's Field Trip	Monday & Tuesday	7:00 a.m.
	Sabrina's Secret Life	Wednesday & Thursday	7:00 a.m.
	Archie's Weird Mysteries	Friday & Saturday	7:00 a.m. (F); 11:00 a.m. (S)
NBC	VeggieTales	Saturday	9:00 a.m.
	Dragon	Saturday	9:30 a.m.
	3-2-1 Penguins!/Larryboy Stories	Saturday	10:00 a.m.
	Babar	Saturday	10:30 a.m.
	Jane & the Dragon	Saturday	11:00 a.m.
	Jacob Two-Two	Saturday	11:30 a.m.
Nickelodeon	Wonder Pets	Monday through Friday	10:00 a.m.
	Dora the Explorer	Monday through Friday	10:30 a.m.
	Blue's Clues	Monday through Friday	11:30 a.m.
	The Backyardigans	Monday through Friday	12:00 p.m.
	Spongebob Squarepants	Monday through Friday	1:30 p.m.
	Jimmy Neutron	Monday through Friday	2:00 p.m.
PBS	Clifford the Big Red Dog	Monday through Friday	2:00 p.m.
	Bob the Builder	Monday through Friday	2:30 p.m.
	Cyberchase	Monday through Friday	3:00 p.m.
	Arthur	Monday through Friday	3:30 p.m.
	Maya & Miguel	Monday through Friday	4:00 p.m.
	Postcards from Buster	Monday through Thursday	4:30 p.m.

Each portrayal was then labeled by the type of science portrayed: *science as inquiry*, *physical science*, *life science*, *earth and space science*, *science and technology*, *personal and social perspectives of science*, or *history and nature of science*. Science as inquiry means the processes and experimentation of science. Physical science includes physics and chemistry.

Life science includes biology, zoology, botany, and anthropology. Earth and space science includes astronomy, oceanography, geology, and meteorology. Science and technology includes engineering and innovation. Personal and social perspectives of science includes personal accounts of science and its impact on society. History and nature of science means the history of science as well as how science works, how it is discovered, and its processes.

Finally, the demographics of the character presenting the material were also noted. Many characters in children's television are not human requiring a variable to determine the "humanness" of the character: *human*, *anthropomorphized character* (for those inanimate objects given human qualities), *animal*, and *other*. Age was coded as *young*, *adolescent*, *adult*, *old*, and *none* (for those characters, such as animals, that have no readily apparent age). Gender of the character was coded as *female*, *male*, and *neutral* (for those characters with no readily distinguishable sex, such as gender-neutral animals). And characters were coded for ethnicity: *black*, *white*, and *other*.

The information gathered was then entered into a database and descriptives were run on the presentations and presenters.

CHAPTER 4 RESULTS

In order to describe the scientific content of children's television, this qualitative study observed 114 episodes, three episodes each of 38 programs. Programs were selected from network educational programming filings with the Federal Communications Commission, as well as a purposive sample of the cable and PBS stations for comparison.

The study yielded a large quantity of scientific content, yet the quality of the content left much to be desired. Based on the findings of this study, science in children's television can be divided into two categories: *exposures* and *lessons*. Scientific content contains both fact and fiction, and a mixture of the two. Science is generally looked upon favorably in children's television. The majority of the scientific topics covered were life sciences and earth and space sciences; other topics were mentioned at a much lower rate. The predominant method of presentation was verbal, with songs filling the pre-school programs. Visuals were limited, usually text over video. Young characters present most of the information provided in the sample. In comparing the number of programs containing scientific content, the cable channels outperformed the networks. This chapter seeks to answer the research questions posed in Chapter 2 and will address them each individually.

How Can the Science Portrayed in Children's Television Programming Be Described?

Based on the findings of this study, science in children's television can be described by a continuum with *exposures* and *lessons* at opposite ends. Exposures are brief representations of science fact, or fiction, providing little substance briefly and quickly forgotten. Lessons are lengthy presentations that explain several facets of a scientific concept.

The majority (60.1%) of scientific content in children's television lie on the exposure end of the continuum. Most children's programming is entertainment, and scientific content seems

to be an afterthought. For example, in *Spongebob Squarepants* on Nickelodeon, Spongebob's friend Bubble Buddy is served a cheeseburger. Spongebob says, "Bubble Buddy is lactose intolerant. He can't eat cheese. What should we do?" Children are introduced to the term *lactose intolerant* and told lactose intolerants can't eat cheese. They aren't told that lactose intolerant means he can't digest the sugar in milk, and most people who are lactose intolerant can eat cultured milk products, such as cheese, without any difficulty (Kestler, 1993).

Another example of an exposure comes from the program *Timon and Pumbaa* on Disney. Timon is a meerkat and Pumbaa is a warthog. The two animals are constantly eating small insects, roots, berries, bark and fungi. This is a correct diet for both animals (Schlitter, 2007a; Schlitter, 2007b), and the exposure subtly teaches these eating habits, but not overtly.

During *The Emperor's New School* on ABC, sloths are mentioned several times, including once in reference to a "Save the Sloths" campaign; however, the meaning of a sloth is never explained to the viewer. This may be a running topic in the program, but there was no explanation in the episodes included in this study. In a later episode, Emperor Kuzco says "Tap water isn't that different from spring water, plus it's fluorinated." Again, it is mentioned in passing, and the audience is not offered an explanation of the benefits or detriments of water fluorination.

In Nickelodeon's *Dora the Explorer*, Dora goes on adventures accompanied by her monkey, Boots. During one episode Dora uses a magnifying glass to view insects on the ground. The audience sees her viewing and naming ants, beetles and caterpillars, but nothing more. The adventure during this episode is helping a "bug-a-bug" find her way home to her "bug-a-babies" so that she can feed them.

Lessons were mostly found in four programs: *Inspector Gadget's Field Trip* on FOX, *Postcards from Buster* on PBS, *Wonder Pets* on Nickelodeon, and *Dance Revolution* on CBS. The best examples of lessons were in *Inspector Gadget's Field Trip*. In each episode, Inspector Gadget explores a different area of the world. Children are introduced to many facets of life and earth sciences through these global destinations. For example, a trip to the Grand Canyon yields this lesson in earth science:

Imagine digging a hole in the ground a mile deep and 280 miles long. Well, you might get something that looks a lot like the Grand Canyon in Northern Arizona. It's the world's biggest hole in the ground! I wonder what they did with all the dirt. Why this canyon is so big, it's grand! Would you believe the Grand Canyon used to be a flat surface? Would you believe a couple of small mounds? How about an ant hill? Anyway, the Colorado River caused the land to erode forming a huge canyon. Someone must have left the water running a long time. According to my bionic dictionary, erode means to wear down.

The last sentence was accompanied by a text graphic: "Erode = to wear down." *Inspector Gadget's Field Trip* provides factual information (Gibson, 2007) through discovery adventures.

The lessons found in *Dance Revolution* on CBS take a slightly different form. *Dance Revolution* is a dance competition among four pairs of young dancers. The dance pairs begin the program with a pre-choreographed dance and are taught new dance moves that must be integrated into their existing routines. Three judges score the dances, and at the end of the episode the pair with the lowest score is eliminated from the competition. Every three weeks, new *Dance Revolution* champions are crowned. Throughout the program, information boxes pop up on screen telling audience members about the contestants' likes and dislikes. "Shauna likes salads, fruits and vegetables for fuel." And, "Kimberley drinks milk because it's good for her bones." Viewers are invited to get up and learn the new dance moves with the contestants, and reminded "Dancing can burn up to 400 calories an hour, so don't forget to hydrate."

Nickelodeon's *Wonder Pets*, Linny the Guinea pig, Ming Ming Duckling and Turtle Tuck, are classroom pets by day and baby animal rescue team by afternoon. Though the main lesson of the program is teamwork, Linny imparts information about the specific animal they are saving during each episode. During "Wonder Pets Save the Dolphin," the Wonder Pets are summoned by a dolphin trapped in a fisherman's net under water. Upon finding her,

Linny: We've got to get her to the top. She needs some air.

Ming Ming: At least a drop.

Tuck: Why does the baby dolphin need air, Linny?

Linny: Dolphins need to breathe, just like we do. If we don't get her to the surface, she'll drown!

Dolphins are mammals that need to breathe (Odell, 2007), and the *Wonder Pets* convey this information to children.

Postcards from Buster on PBS features the Buster character from *Arthur* travelling the country with his dad and a rock band. During each episode, Buster sends videos back to his classmates about the people and places he visits. During a stop in Encinitas, California, Buster joins a beach cleanup. Buster asks, "How did all of this trash get here?" The man running the cleanup effort replies:

The trash washes out of the river when it rains, so all that trash washes out into the sea, and it comes back to the beach. So we're cleaning it up off the beach so that it doesn't hurt all the wildlife – all the sea birds and sea turtles and the whales that are off our beach.

Raul, the man's son, continues that litter is a product of people's laziness, and it is very harmful to the animals that live on the beaches.

Is the Science Portrayed Factual or Science Fiction?

Both fact and fiction are found in children's television. Many children's programs are based on fantasy, including science fantasies. There are examples of fact, fiction, and a blending of the two.

In the program *Horseland* on CBS, adolescents care for and train their horses. In one episode, Alma, a young Hispanic female, feeds apples to her horse saying, “Apples are a healthy snack for you – high in potassium and so good for your muscles.” It is mentioned in passing, but is factual (Marini, 2007) and informative.

Little Einsteins on Disney go on search and rescue missions around the world. During a mission to find Annie’s Christmas present, the group goes to the Himalayan Mountains. Upon sighting the mountain range, Leo exclaims, “The Himalayan Mountains are in Nepal. Mt Everest is the tallest mountain in the world. It’s almost impossible to get to the top.” After this viewing, children will have been exposed to some facts about the Himalayan Mountains (Hafner, 2007).

At the other extreme are false statements presented as truth. In an episode of *The Replacements* on ABC, Todd fakes an injury so that his “bench buddy” Shelton can play in the baseball game. He says he pulled his epidermis – something that would not prevent one from playing baseball (Lynfield, 2007). His father says, “Youch, I’ve done that before.” Shelton plays in the game, and the team wins. During the post-game celebration, as Todd excitedly jumps up and down, his sister says, “Interesting. Your epidermis got better real fast.” The writers presented the perfect opportunity to explain the faked injury was virtually impossible to make. Instead, Todd shrugs it off.

In *Sabrina* on CBS, Sabrina (the teen-aged witch) goes on a school-sponsored camping trip. Her bewitched cat, Salem, hides away in her knapsack, making an appearance when he eats her food. “This freeze-dried camping food is da bomb!” Salem exclaims. “You just add water,” he says as he adds a drop of water. “Mmmm, insto-tuna!” Salem exclaims as his tiny cube of freeze-dried fish pops into a full-size fish. This is not how freeze-dried food works (Schwartz,

2007), but children watching this program will be left with the impression that freeze-dried food will assume its former shape when water is added.

Then there are the statements that are half true and half false. In Nickelodeon's *The Adventures of Jimmy Neutron, Boy Genius*, Jimmy is constantly creating new inventions, such as hypno-rays, shrink rays, and a "de-evilizer." In one episode, he uses an electro-shock therapy "dance machine" to teach Sheen kung fu. The power source of the dance machine breaks, and Jimmy must find a viable substitute. On seeing Libby wearing a ruby, Jimmy exclaims, "Rubies are an aluminum oxide mineral! It'd make the perfect conductor chip for the dance machine!" Jimmy is half right. Rubies are indeed an aluminum oxide mineral; however, they are insulators not conductors (Hess, 2007).

Another example of the blending of fact and fiction comes from *Archie's Weird Mysteries* on FOX. In one episode of this program, based on the *Archie* comic books, Riverdale is taken over by a Giant Potato. Archie and Dilton discuss how the potato is controlling the zombie-like residents of Riverdale:

Dilton: "He must be behind the microwave transmissions I detected with my lab equipment."
Archie: "Microwave transmissions?"
Dilton: "Right, and if we can stop the microwave transmissions, the potatoes should return to normal. Only, we don't know where the transmissions are coming from."
Archie: "Yes, we do. The TV station. They gave Jughead a potato."
Dilton: "They broadcast their programming with a microwave dish!"

Television stations do indeed broadcast by microwave (Tripathi, 2007). Later, to defeat the Giant Potato, Dilton tells Archie to turn up the frequency on the microwave transmitter, which causes the potato to blow up. "When you turned up the frequency, you changed the microwave transmitter into a microwave oven!" Dilton exclaims. Microwaves can only work this way in an enclosed area, which is why microwave ovens are enclosed (Gallawa, 2007).

In General, Is Science Portrayed Positively or Negatively?

Science is portrayed both positively and negatively. Many of the programs do not outright claim the scientific information in their program is fun or boring, but subtly make these impressions known.

Few programs made science seem fun or exciting. *3-2-1 Penguins* on NBC is one show that routinely makes science, particularly space science, seem enjoyable. Jason wishes he were at space camp, becomes excited about a telescope and wants to become an astronaut. Through the program, he explores space with four penguins, and in one episode, they meet an entire planet of people who cut in line to look through a telescope.

In *Postcards from Buster* on PBS, Buster interviews children about their lives, hopes and aspirations. In Encinitas, California, he asks a young Hispanic girl named Aziza what she would like to be when she grows up. Aziza responds that she wants to be a veterinarian, because she likes animals: “lions, cats, orca whales and starfish.” This conveys that science is a career choice that other children are considering.

In the program *Jacob Two-Two* on NBC, Jacob’s school teacher presents an informative lecture on plate tectonics. During the lecture, the students in the class groan, and Jacob is so bored he pulls out a mystery book he checked out from the library. This implies that plate tectonics specifically and Earth sciences generically are boring subjects that do not deserve our attention.

A grant from the National Science Foundation funds one program in the sample, *Cyberchase* on PBS. This program teaches math skills, however, not science facts and skills. In fact, the only reference to science was contained in an episode where the children were making a movie:

Inez: “Matthew, what happened to all the lines we wrote about math and science?”

Matt: “Too many words, Nazy. Film is visual. I needed to liven it up.”

In the only reference to science on a program funded by an NSF grant, science is depicted as boring and lifeless.

Another recurring theme is the “mad” scientist. During an episode of *The Backyardigans* on Nickelodeon, Tasha, a hippopotamus, is a mad scientist who looks like Albert Einstein. Her lab is equipped with “bubbling beakers, jars of brains, lightning flashing through the window pane, bunsen burners and electric brains.” Every time someone says scientist in this episode, it is *mad* scientist; every time laboratory is expressed, it is “la-BORE-uh-TORE-ee.”

In the Disney show *Lilo & Stitch*, the mad scientist is a recurring presence because the evil scientist Jumba created Stitch. “Experiment 133 is the unholy offspring of science and evil,” Jumba says. Jumba often says he prefers to be known as an evil genius.

What Types of Science are Covered?

Each of the types of science taught in America’s schools was presented at least once in the sample. Some types were mentioned more than others were, and some were seldom mentioned.

The majority of the science presented in the sample was life science (50.8%). *Dance Revolution* provided mostly health and nutrition information through the use of pop-up information boxes and female presenters. *Wonder Pets* provides animal science information through the pets’ rescue missions around the globe. Other programs provided snippets of information. In *Madeline* on CBS, the girls at the orphanage go to the doctor for their annual checkups, where the doctor tells them to get lots of sleep, drink milk, eat vegetables and get lots of fresh air so that they can grow tall. In *That’s So Raven* on ABC, Raven goes to a museum and

becomes involved in an exhibit that explains how the human stomach works. These are just a few examples.

Earth and space science (30.9%) are shown most often in *Inspector Gadget's Field Trip* on FOX. Inspector Gadget takes his audiences on trips to the Grand Canyon, California mines, Hawaii and Australia teaching lessons of oceanography, geography and geology along the way. *Bob the Builder* on PBS contained a lesson about how to determine how far away lightning is striking (each second between lightning and thunder equals one mile away). *Little Einsteins* provides aerial views of the Himalayan Mountains, mesas, the Rocky Mountains, the Grand Canyon and Antarctica. *Wonder Pets* also provides earth science by talking about the regions of the world where the animals they rescue are indigenous.

Other topics were covered much less. The physical sciences were mentioned in passing (6.3%). *Timon and Pumbaa* on Disney present a pulley system for getting items up a tree. *Handy Manny's* Phillips screwdriver, Felipe, tells Manny, "Melt me down for scrap metal!"

Science as inquiry was mainly approached through a classroom setting (3.2%). In *That's So Raven*, Raven's friend Chelsea conducts an experiment to determine what happens to the human body after 34 hours of sleep deprivation. In *Jacob Two-Two*, the audience gets a narration of a book Jacob's dad is writing:

Professor Kilowatt immediately put 200 scientists to work. They sent satellites into outer space and shot deep probes into the ground. They traveled from coast to coast studying animal and plant behavior. They took cloud and solid samples. Then, after they had collected 10 tons of data, they put it into a computer large enough to fill a hockey arena.

The other two examples of inquiry were in the classroom: an experiment and a microscope.

Technology was also seldom mentioned (7.1%). There is the microwave example from *Archie's Weird Mysteries* covered above. In an episode of *That's So Raven*, Chelsea's mother arrives on a Segway PT, the two-wheeled, self-balancing transportation device. The other good

presentation of technology was found in *Bob the Builder* on PBS, in a demonstration of automatic door sensors, which appeared in all three of the episodes sampled.

The personal and social perspectives of science took the form of the evil and/or mad scientist or the cool space camp covered above. History and nature of science were also seldom mentioned (1.6%).

Is the Information Presented Verbally, in Song or in Graphics?

The primary method of presentation was verbal. Songs were employed in programs for younger, preschool-aged children, specifically *The Backyardigans*, *Wonder Pets*, and *Little Einsteins*, though *Little Einsteins* didn't provide much scientific content. Only two programs presented information in graphics. *Inspector Gadget's Field Trip* and *Dance Revolution* present information in text boxes.

Who Presents Scientific Information in Children's Television Programming?

The most common presenters of information were humans (51.2%). Of the human presenters, the most common was a white male, regardless of age (62.9%). The second most common presenter was a white female (23.4%), followed by a black male or Hispanic female (each at 4.9%). The least common were black females and Hispanic males (1.2%). Children most often presented the information given by humans (37%), followed by adolescents (35.8%) and then adults (27.2%). When an adult did present information, he or she usually had the role of a teacher and the information was provided in the context of a classroom.

The second most common presenters were animals (25.9%). They were the main characters in *Wonder Pets*, *The Backyardigans*, *Timon & Pumbaa*, *Arthur*, *Postcards from Buster Clifford the Big Red Dog*, and *Babar*. *Inspector Gadget* created cause for another category of presenter, the human/machine (13.9%). Finally, anthropomorphized objects

provided the least amount of science content (6.9%); they were the main characters in *VeggieTales*, *Bob the Builder* and *Handy Manny*.

Which Channels Provide More Mentions of Science: the Networks or Cable?

The most informative program of all was *Inspector Gadget's Field Trip* on FOX. The entire program is intended to inform and does just that. The program with the least scientific information was *Maya & Miguel* on PBS. It was the only program with no scientific content.

Table 2 shows the number of episodes of each program that contain scientific information.

Table 2: Number of Episodes Containing Scientific Content

Channel	Three	Two	One	None
ABC Network	The Replacements	Emperor's New School That's So Raven Suite Life of Zack & Cody	Hannah Montana	
CBS Network	Dance Revolution	Madeline Sabrina Horseland	Cake Trollz	
Disney Cable	Little Einsteins Timon & Pumbaa Lilo & Stitch	Handy Manny Little Mermaid Proud Family		
FOX Network	Inspector Gadget's Field Trip Archie's Weird Mysteries	Sabrina's Secret Life		
NBC Network	Dragon	VeggieTales 3-2-1 Penguins / Larryboy Stories Babar	Jane & the Dragon Jacob Two-Two	
Nickelodeon Cable	Wonder Pets Spongebob Squarepants Jimmy Neutron	Dora the Explorer Blue's Clues	The Backyardigans	
PBS Network	Bob the Builder Postcards from Buster	Arthur	Clifford Cyberchase	Maya & Miguel

The programs on the two cable channels, Disney and Nickelodeon, provided the most exposures to scientific content, each containing three episodes each of three different programs with some scientific content. When adding in channels providing two and three episodes each of scientific content, Disney and Nickelodeon are still in the lead with six and five programs each respectively; ABC, CBS and NBC then each have four programs providing scientific content. The station with the poorest performance looking at number of episodes providing science is PBS. It was the only station to have a program with no scientific content. FOX could not be

compared accurately because the network only specifies three programs as educational and informational, whereas the other stations each designated five or six programs each.

CHAPTER 5 DISCUSSION AND CONCLUSION

The purpose of this study was to describe and evaluate the portrayal of science in children's television programming. The programs studied contained a large quantity of scientific content, yet the quality of that content left much to be desired. This chapter will discuss the relevance of the study's findings, make suggestions for future research endeavors, and conclude.

Findings

The content of the programs under study lead to the categorization of exposures and lessons. By thinking of these two as opposite ends of a continuum, many of the presentations would lie between the two extremes. Though there are two categories, there is still a blending of the two, making it difficult to make a strict determination about some of the presentations. And even though a single instance is an exposure, the accumulation of related exposures can qualify as a lesson. It is prudent to think not of the individual presentations but of the mass of presentations in an episode as a totality.

The information provided by the programs as a whole was insufficient to allow cultivation of opinions favorable to science to occur. Some programs, for example *Inspector Gadget's Field Trip* and *Dance Revolution*, however probably could have a cultivating effect because of the consistent nature in which they present scientific information, as already discussed.

Because of the combination of fact and fiction in the programming, the programs must assume that children learn background material in school or at home or are watching programs with parents who can explain the content. In the epidermis example from *The Replacements*, whether or not a child knows what an epidermis is determines whether or not the exchange is effective. If one assumes that children learn what an epidermis is in school or at home prior to

viewing *The Replacements*, the incident is humorous. If the child viewing this exchange has not been previously exposed to the fact that the epidermis is the topmost layer of skin, however, he or she will not understand the joke.

As mentioned in Chapter 4, some programs presented science much better than others did. One of these programs was *Wonder Pets*. In addition to the dolphin example, in the three episodes included in the sample, children learn that pandas live in China and eat bamboo, sea lions live on rocks by the sea in Alaska and strong winds can pull baby sea lions – who are poor swimmers – out to sea, baby kangaroos are called joeys and live in Australia, and chimpanzees are smarter than monkeys and are sometimes sent into space for experiments. The other animal rescued is a mouse, but little information is offered about him.

But on the other hand, *Wonder Pets* also has some false information as well. Linny, Ming Ming and Tuck talk under water in one scene. To journey to different locations, they construct a “flyboat” from ordinary children’s toys to transport them to the baby animals in danger. When they are rescuing the chimpanzee from space, it becomes a “spaceboat.” The assumption is that children will understand these to be fantasy and that this content will not be detrimental to the greater lessons imparted in the program.

One must also take into account the intent with which certain information is presented. The makers of *The Adventures of Jimmy Neutron, Boy Genius*, give the impression that Jimmy’s ideas and inventions are based on fact, yet some of the ideas are completely unrealistic. In one episode, Jimmy’s clone creates a cloned Earth, including clones of everyone on Earth. This is completely impossible, but Jimmy fervently explains it is possible:

My evil clone must’ve used a flux field to clone a duplicate Earth...your electromagnetic field has been disrupted. You’re starting to fade...It looks like the entire planet’s electromagnetic field has been disrupted...I’ve got about 90 minutes to retrieve the flux field and reverse the process before everyone on Earth fades into oblivion. This counter-

magnet will temporarily solidify the rocket [to transport Jimmy to the cloned Earth to defeat his clone].

Cloning is made possible through genetics, not through electromagnetic fields. Writers fill *Jimmy Neutron* with false information and false explanations.

There were also cases when the fiction presented was obviously fiction. In *3-2-1 Penguins!*, Jason and the penguins journey to Planet Wait-Your-Turn. Planet Wait-Your-Turn is in trouble because the inhabitants were skipping each other in line in order to get to the front of the line to look through a telescope. As a result, the planet skipped in front of the other planets of its solar system. The residents had to stop skipping or the planet would become so close to the sun that the entire planet would catch fire. This is quite obviously fiction, but at the same time it makes a scientific activity, star-gazing, appear to be so enjoyable that everyone would cut in line in order to do it.

Two programs were especially effective at promoting positive portrayals of science. When viewing *Dance Revolution* on CBS, viewers encounter children who place great importance on health, exercise and nutrition. The participants' favorite activities were usually sports and dancing. Only one kid in the sample listed video games as a favorite activity. Several children listed salads, fruits and vegetables as their favorite foods; no one listed fast food or french fries. If the cultivation and social cognitive theories hold true, viewers will identify with multiple exposures of healthy habits and with actors and characters who are similar to themselves which will in turn encourage them to follow a balanced diet and a regular exercise routine. The participants in the dance contest were very diverse. The hosts are a white male and a black female, and the presenters are five females: three white, one black and one Asian.

Inspector Gadget's Field Trip also encourages children to enjoy adventures and exploration. When Inspector Gadget journeyed to the gold mines in California, the audience

learned about the flexibility of gold (“one ounce can be stretched into a wire and stretched 43 miles – from France to England across the English Channel”), the stamp mills used to stamp gold out of quartz and ore, and the weight of gold (visual: “Gold is 19x heavier than water, and 7x heavier than gravel.”). *Inspector Gadget* provides educational information in the context of a fun adventure.

Each type of science was represented in this sample. The subject matter areas (physical science, life science, earth and space science, and science and technology), however, were covered much more frequently than the abstract categories (science as inquiry, science and personal and social perspectives, and history and nature of science). Perhaps concrete ideas are easier to convey through a children’s show than abstract ideas. Research suggests a need for more open discussion of the importance of science to society. If children are shown the connections between science and their lives they will be more likely to take an interest in science and pursue it as a career.

Most of the information in the sample was presented verbally, consistent with Calvert’s (2001) findings that children learn better from simple spoken presentations. The programs that did include songs, or spoken rhymes, were aimed at preschool children. Songs may be used in these programs to attract and hold a child’s attention, but they may not aid in comprehension and retention. Also, Calvert (2001) found that concrete visuals aided recognition, but this study found very few graphic illustrations were employed. This may be because the programs provide mostly exposure to information and not lessons. Concrete science concepts may be more easily depicted in settings rather than graphic illustrations.

While social cognitive theory argues that people learn best from people who are like themselves, this study found a disproportionate number of white males presenting scientific

information. This study's dominance of male presenters is consistent with Hoffner's (1996) findings and perhaps what looks on its face as a problem may actually enhance retention by both sexes of children. When it comes to race, the presenters were overwhelmingly white. This signals a need for re-evaluation of the characters in children's television.

Cultivation theory also points to a need for a variety of presenters not available in children's television. Because of the constant and consistent presence of male characters, children may be cultivated into believing that science is an endeavor only pursued by men. Creators of television programs can make any character present scientific information, yet male dominance continues. Creators need to incorporate more diversity into the characters that influence children's views of the world.

The dominance of cable programs over network programs suggests that the networks can do more to fulfill their obligations under the Children's Television Act. The cable stations provide at least an exposure to science in the majority of their episodes. The addition of exposures to science to many programs would not be difficult.

Perhaps the most interesting finding in this study was the lack of information provided by PBS. Most notably, it was the only channel with a program with no scientific content. It also has a program funded by a National Science Foundation grant that contained very little scientific content. The math lessons contained in *Cyberchase* could have been connected to science lessons but these associations were not made.

Importance of Findings

This study makes substantial contributions to our knowledge about children's television. The scientific content available to children, though more than was expected, is not extensive. This research provides a description of the information to which children are exposed.

One way to improve science in children's television is for members of the scientific community to provide content to the programs. If writers were provided with information from science organizations – such as the National Academy of Science, the American Association for the Advancement of Science, and numerous other associations devoted to specific scientific fields – it would be much easier for them to incorporate scientific information into their programs with a lower error rate. This is especially true for the abstract scientific topics that received very little coverage. If scientific organizations are serious about spreading knowledge, this is an avenue that ought to be explored.

Another alternative is for parents to supplement children's programming with programs that are designed to provide scientific material. Stations devoted to science, such as Animal Planet, Discovery, Discovery Kids, Discovery Health, The Learning Channel, and National Geographic provide programming for both adults and children.

This study has shown significant coverage of scientific concepts in children's television. While more could be done in this area, perhaps a better solution would be to create more children's programs devoted entirely to science. Though the programs under study performed poorly at teaching science, many of them do teach other worthy subjects. *Dora the Explorer* teaches children Spanish, numbers and shapes. *Little Einsteins* teaches music concepts and introduces famous art pieces. *Cyberchase* on PBS teaches math skills and problem solving. *VeggieTales*, *3-2-1 Penguins!*, *Larryboy Stories* and *Jacob Two-Two*, all on NBC, teach moral lessons. *Cake* on CBS teaches homemade arts and crafts, akin to a teen-aged Martha Stewart. *Blue's Clues* teaches problem solving techniques. Educating children in many different subjects, much like a liberal arts education, prepares them to be more well-rounded individuals.

The real problem may be the definition of educational and informational programming given by the Children's Television Act. This rule needs to be strengthened and enforced.

Several of the programs in the study (*Trollz*, *Hannah Montana*, *That's So Raven*, *The Emperor's New School*, and others), despite being entertaining, provide no educational depth. Perhaps the rule should require solely academic educational programming, rather than social lessons.

Limitations and Future Research

This study was hindered by the sporadic previous work in this area. Studies on children's learning are helpful, but very few studies analyzed the programming from which children are learning. More qualitative analyses of children's television content are needed to know to what information children are exposed.

Another potential limitation is the sample size. Though many programs repeat throughout the day, many available programs were not included. In an ideal study, every children's program would be included. A study of the population of children's programming would also allow for a better comparison between broadcast and cable television. Additionally, this study examined programs from December 2006 through March 2007. Future studies could look at programs across more time.

Future research should look at the changes in children's television from 10 or 20 years ago to today. In casual conversation, it is often said that television was much better back then. Was television better then or are we simply nostalgic?

Another study could be done to determine whether or not children learn the science facts presented in these programs. Children's television contains fantastic ideas that children may believe more than reality. It would be interesting to determine which information children remember more readily.

Further study should also be conducted on the totality of educational programming. If more studies produce results similar to these in other subject areas, perhaps the Federal Communications Commission will be forced to better clarify its law and enforce its rules regarding children's programming.

Conclusions

This study has shown that scientific information is indeed present in children's programs. The content ranged from offhanded comments to lengthy lessons throughout an episode. Programs should be commended for their ability to insert exposures into their plot lines; however, the expansion of an exposure into a lesson could provide even more meaningful and educational plots.

Children's programming blurs the line between fact and fiction, but many times the educational intent is clear. Programs that begin with fantastic scenarios can present educational information that is not detrimental to the storyline. If fantasy is a requirement to capturing the attention of children, the insertion of educational content can be done in such a way that the fantasy remains unbroken.

Males and whites were the most common presenters. The diversity of characters in children's programming still needs improvement. As social cognitive theory states, children of all races need characters to whom they can identify. By providing a greater range of character types, more children will learn and retain the information provided in television content.

If future research finds that children's television is not adequately contributing educational content, the Federal Communications Commission needs to more strictly enforce the Children's Television Act. Recently, the Spanish-language channel Univision was under investigation for allegations that it was not fulfilling its duties in providing educational and

informational children's programming (Labaton, 2007). Univision claimed *Complices al Rescate*, a program about twin 11-year-old girls separated at birth who swap places, was educational for children; opponents said the program was nothing more than a Spanish-language soap opera (Labaton, 2007). The FCC agreed with those filing the charges, and the station will be fined \$24 million, the largest fine ever handed down by the FCC (Labaton, 2007). "The penalty is also expected to send a strong signal to broadcasters that they will be expected to meet their required quota of shows that educate and inform children, after years of permissive oversight in this area" (Labaton, 2007, ¶2). Members of Congress also said they saw it as a sign that stricter interpretation of the CTA by the FCC is coming (Labaton, 2007 February 24).

Cable television is providing more education than the networks. Because they are already taking it upon themselves to provide this educational material, there is no reason to extend the Children's Television Act to include cable networks. This also suggests that if the cable channels can provide this programming without economic or programming problems, the networks should also be able to provide quality educational programming.

While there was a large quantity of scientific content, the quality in most of the programs needs improvement. Television viewing needs to be supplemented with outside lessons either in the classroom or in the home. After more comprehensive examination of the educational content in television, the Federal Communications Commission may need to more strictly enforce the regulations it has been charged with upholding.

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APPENDIX
 “CORE” EDUCATIONAL TV PROGRAMS

For the Baton Rouge Area for the Quarter Ended 09/30/06
As provided by the stations to the Federal Communications Commission.

<u>Call Sign</u>	<u>Channel</u>	<u>Title</u>	<u>Air Time</u>
WAFB	CBS 9	MADELINE	Saturdays at 8:00-8:30 a.m.
WAFB	CBS 9	SABRINA, THE ANIMATED SERIES	Saturdays at 8:30-9:00 a.m.
WAFB	CBS 9	TROLLZ	Saturdays at 9:00-9:30 a.m.
WAFB	CBS 9	HORSELAND	Saturdays at 9:30-10:00 a.m.
WAFB	CBS 9	CAKE	Saturdays at 10:00-10:30 a.m.
WAFB	CBS 9	DANCE REVOLUTION	Saturdays at 10:30-11:00 a.m.
WBRZ	ABC 02	THE EMPEROR’S NEW SCHOOL	Saturdays at 8:00-8:30 a.m.
WBRZ	ABC 02	THE REPLACEMENTS	Saturdays at 8:30-9:00 a.m.
WBRZ	ABC 02	THAT’S SO RAVEN	Saturdays at 9:00-9:30 a.m.
WBRZ	ABC 02	THAT'S SO RAVEN	Saturdays at 9:30-10:00 a.m.
WBRZ	ABC 02	HANNAH MONTANA	Saturdays at 10:00-10:30 a.m.
WBRZ	ABC 02	THE SUITE LIFE OF ZACK AND CODY	Saturdays at 10:30-11:00 a.m.
WGMB	FOX 44	SABRINA'S SECRET LIFE	Mondays & Tuesdays at 7:00 a.m.
WGMB	FOX 44	INSPECTOR GADGET'S FIELD TRIP	Wednesdays & Thursdays at 7:00 a.m.
WGMB	FOX 44	ARCHIE'S WEIRD MYSTERIES	Fridays at 7:00 a.m., Saturdays at 11:00 a.m.
WVLA	NBC 33	VEGGIE TALES	Saturdays at 9:00-9:30 a.m.
WVLA	NBC 33	DRAGON	Saturdays at 9:30-10:00 a.m.
WVLA	NBC 33	3-2-1 PENGUINS/LARRYBOY STORIES	Saturdays at 10:00-10:30 a.m.
WVLA	NBC 33	BABAR	Saturdays at 10:30-11:00 a.m.
WVLA	NBC 33	JANE AND THE DRAGON	Saturdays at 11:00-11:30 a.m.
WVLA	NBC 33	JACOB TWO-TWO	Saturdays at 11:30 -12:00 noon

(Federal Communications Commission, 2006b)

VITA

Tristi Bercegeay Charpentier is a native of Gonzales, Louisiana. She received her Bachelor of Arts in mass communication with honors from the Manship School of Mass Communication at Louisiana State University in 2005. As an undergraduate, she served as copy editor for Legacy Magazine and editor of the Sigma Phi chapter of Sigma Alpha Iota. With the idea that she may one day want to teach, Tristi decided to pursue her master's. She plans to pursue a career in editing print media and later decide if academia is right for her.

Her research interests focus on media psychology: why people use, watch and read the media they do. This project grew from a discussion of whether or not children learn inaccurate science from television in Dr. Lisa Lundy's health and science communication class.