Screen Time Effects on Pediatrics

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Abstract

The purpose of this research is to examine the positive and negative effects of technological screen use by children ages zero to eighteen. The literature reviewed for this research covered the following topics; screen time effects on children ages zero to five years, screen time effects on children ages six to twelve years, screen time effects on children ages thirteen to eighteen years, type of technology type, progression of technology, and purpose of technology. Most of the literature examined for this research involved the comparison of positive and negative effects of screen use over various time frames. No conclusions were drawn in determination whether screen time use is detrimental or beneficial to the child. Conclusions were drawn for recommendations for parents and caregivers of pediatrics in regard to screen time use.

Acknowledgements

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Introduction

In today's world, the world population is surrounded by technology. Technology is continually growing, developing, and emerging. New devices are being created for almost every need one could ever encounter in a lifetime. Technology has advanced in ways that the human brain has a hard time comprehending, from the very first light bulb, to the first telephone, to massive computers, and now the ability to speak into a box that can tell you anything you want to know. If someone were to ask scientists and engineers hundreds of years ago about the idea of a computer that one could wear on a wrist, some strange looks would probably accompany the question.

Everyday at some point, a person comes across some technological device that helps one get through the daily task they want to perform. Scientists have spent the time and energy imagining a world of tomorrow, where all problems could be simplified by their inventions. While the technological advances of today have certainly aided in the simplification of life, there must be a downfall as well.

Spending time in front of a screen must have effects on the human body for adults. Human adults have fully developed and the effects can be limited. But, what about pediatrics and those not yet fully developed? What about the young children that are placed in front of a screen? They are just beginning and are developing every single day. What are the effects that technology screens have on pediatrics in today's world?

I. Pediatric Development

According to doctors, pediatrics develop in five main stages: Cognitive, Social/Emotional, Speech and Language, Fine Motor Skills, and Gross Motor Skills (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Every child will begin these stages from birth, mastering the components of each one, and then moving to the next stage (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). All children develop at different rates and use different techniques to learn (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

Cognitive development consists of a child’s ability to problem solve and to learn various tasks (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). This method can be seen in babies that are opening their eyes and looking around, or in an elementary school student learning in the class room (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

Social and emotional development is described as a child’s ability to develop relationships with other people (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). The emotional aspect can be described as a child learning to recognize and control their emotions (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). This developmental stage can be seen within smiling, laughing, crying, saying good-bye, and making friends (“Not just little adults”:

qualitative methods to support the development of pediatric patient-reported outcomes”).

Speech and language development can be described as a child learning how to comprehend the language surrounding them, as well as learning how to use it properly (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Seeing this stage comes a little later in the development of a child, when their first words are spoken (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). It can also be seen in the proper pronunciation of words, or using the correct word in a sentence (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

Fine motor skills aid in the ability for children to use the small muscles within their body to perform tasks (“Motor skill performance and physical activity in preschool children”). These muscles typically involve the muscles within the hands and fingers (“Motor skill performance and physical activity in preschool children”). The development of fine motor skills can be see when children hold spoons to feed themselves, pick up toys, point to things they see, and learn how to write (“Motor skill performance and physical activity in preschool children”).

Gross motor skills aid in the ability for a child to learn how to use the large muscles within their body (“Motor skill performance and physical activity in preschool children”). The large muscles are considered to be the large muscles within the legs, arms, torso, and other large areas of the body (“Motor skill performance and physical activity in preschool children”). The development of gross

motor skills can be seen within children learning to walk and run, babies learning to stand up, and children learning how to throw a ball (“Motor skill performance and physical activity in preschool children”).

As stated previously, all children develop at different speeds and in different ways (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Although, there are developmental milestones that allow parents to recognize if their child has a set-back (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). The development of cognitive and emotional stages are slowly becoming more noticeable from birth to the first few months of life (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).Within the first three months of life, a baby should be able to focus on objects, follow objects with their eyes, recognizing different body parts (such as hands, fingers, feet, and toes), and laugh a lot more than they were previously (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

By age one, the child will be much more curious about the world around them, and will be able to perform small tasks on their own (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). A child will be able to move around without the help of a parent (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Crawling, standing up, and possible walking with help are all gross motor skills that can be seen at this stage (“Not just little adults”:

qualitative methods to support the development of pediatric patient-reported outcomes”). Fine motor skills are also able to be noticed for children who can hold a cup by themselves, pick things up by themselves, and feed themselves finger foods with supervision (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

By age two, walking and talking are very predominant and should be noticeable (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Full sentences are still difficult, but learning individual words is very common in the developing language stage (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Children should also be able to recognize what or where an object is when asked (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). For example, when asking a child “show me your fingers!”, they should be able to hold up their hands to show you.

At age three, a child is now referred to as a toddler. Gross motor skills are really coming into play, for the child should be able to run and walk without much stumbling (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Stairs are also a feat that a child should conquer at age three (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Speech and language development will be very prominent at age three, for the child will learn almost 75% of clear speech patterns (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). If a new person is listening to

the child speak for the first time, they should be able to recognize between 40 to 50% of what is being communicated (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

By age five, a child is becoming much more adventurous with the world around them. Cognitive development in children is being put to the test by the child being able to answer more complex questions, identifying shapes and colors, remembering an event and being able to explain it to another person (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Emotionally, a child should be able to interact with friends and get along fairly well without problem, such as fighting or arguing (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). A child at this age will be very good at pronouncing words, but some may struggle with the “L” and “R” sounds (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

After age five, a child should be able to be more self-sufficient (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Five year olds are now writing, reading, speaking clearly, and developing their problem solving strategies (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”). Being in school will also help view these milestones at this age, as well as develop in ways that can be difficult at home - such as learning to be responsible for oneself and how to speak to a new person (“Not just little adults”: qualitative methods to support the development of pediatric patient-reported outcomes”).

None of these developmental stages could be possible without the development of the organs of the human body. Organ development is vital for the progression of life and growth. The most important organ within the entire body is the brain. The development of the brain does not only contain the necessities for normal bodily functions to perform, but also for personal growth as well. In order for an individual to grow, the brain must develop as well.

II. Brain Development

The human brain is a complex organ that controls all functions within the body (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”). The brain is also the organ that creates individual personality, the center for decision making, and intellectual capacity (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”). Unlike any other organ, the brain develops and matures throughout the lifespan of a human being.

There are three main sections of the brain - the cerebrum, the cerebellum, and the brainstem (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”). The cerebrum is the most substantial section of the brain, composed of the left and right hemispheres (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”). The cerebellum is inferior to the cerebrum and is much smaller in size (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”). The final section, the brainstem, serves as a connection port between the cerebrum, cerebellum, and the spinal cord (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”).

The cerebrum is divided into varying lobes within the brain (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”). These lobes are sectioned off and serve different functions for the human body (“Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion”). The frontal lobe, located at the front of the skull,

holds the information regarding personality, emotions, and behavior ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion"). Intelligence, speech, as well as concentration are all functions located within the frontal lobe of the brain ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion"). Body movements are also controlled by this section ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion").

The occipital lobe, located at the back base of the skull, controls vision for individuals ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion"). The way one views the movement of objects, color, and varying extremities of light are processed in this lobe ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion"). The temporal lobe, located just below the lateral fissure, functions in memory, hearing, and understanding spoken languages ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion"). The parietal lobe interprets language and individual words, as well as receiving signals from all of the senses ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion").

Infant brains undergo tremendous changes during development and growth ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion"). As infants grow from birth to one year, the white and grey matter of the brain change due to the alterations in the apparent diffusion coefficients that correspond to modify to cellular water ratios within the brain ("Study

of pediatric brain development using magnetic resonance imaging of anisotropic diffusion"). Examples of scans that physicians use to examine the white and grey matter of the brain can be seen in Figure 1 on page 15.

As can be seen in Figure 2 on page 16, researchers, physicians, and scientist use magnetic resonance imaging (MRI) scans to view the brain of infants and to determine the changes found when comparing the scans side by side ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion").

The brain develops physically throughout the course of life, but it also allows for cognitive growth as well. The brain will develop in ways that allow for critical thinking, emotional recognition, and the ability to learn faster. The development of cognitive thinking can begin at the earliest of ages, but never fully stops growing. As we are always capable of learning more.

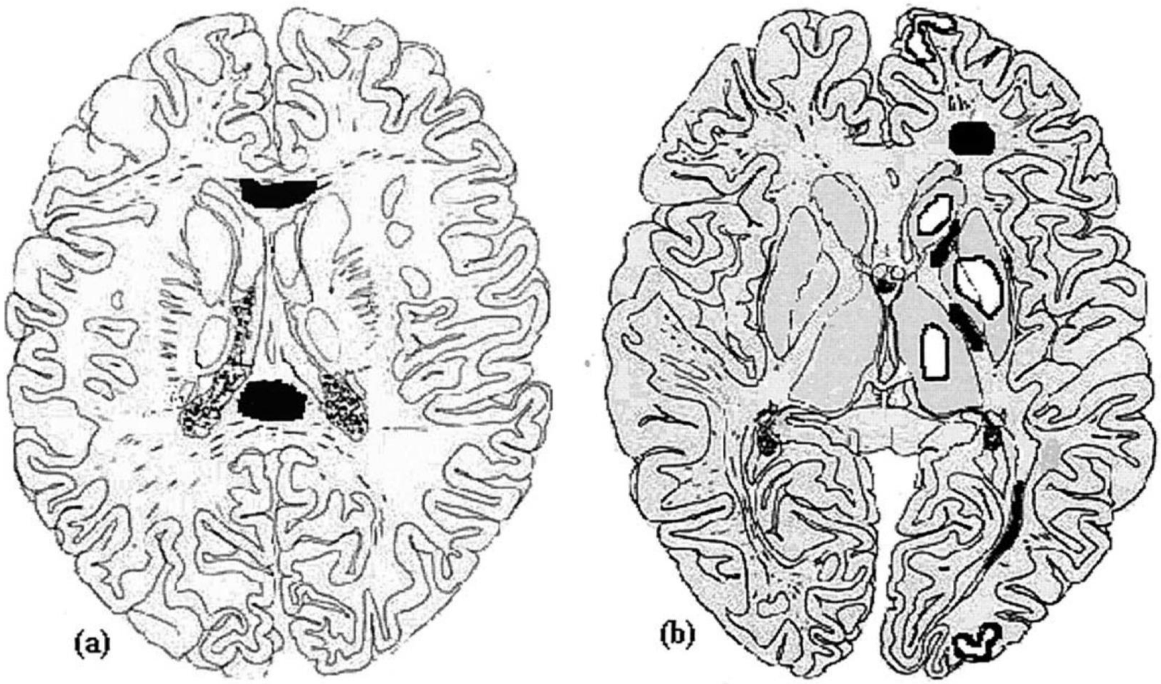


Figure 1: Hand drawing of white matter and gray matter within the brain ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion").

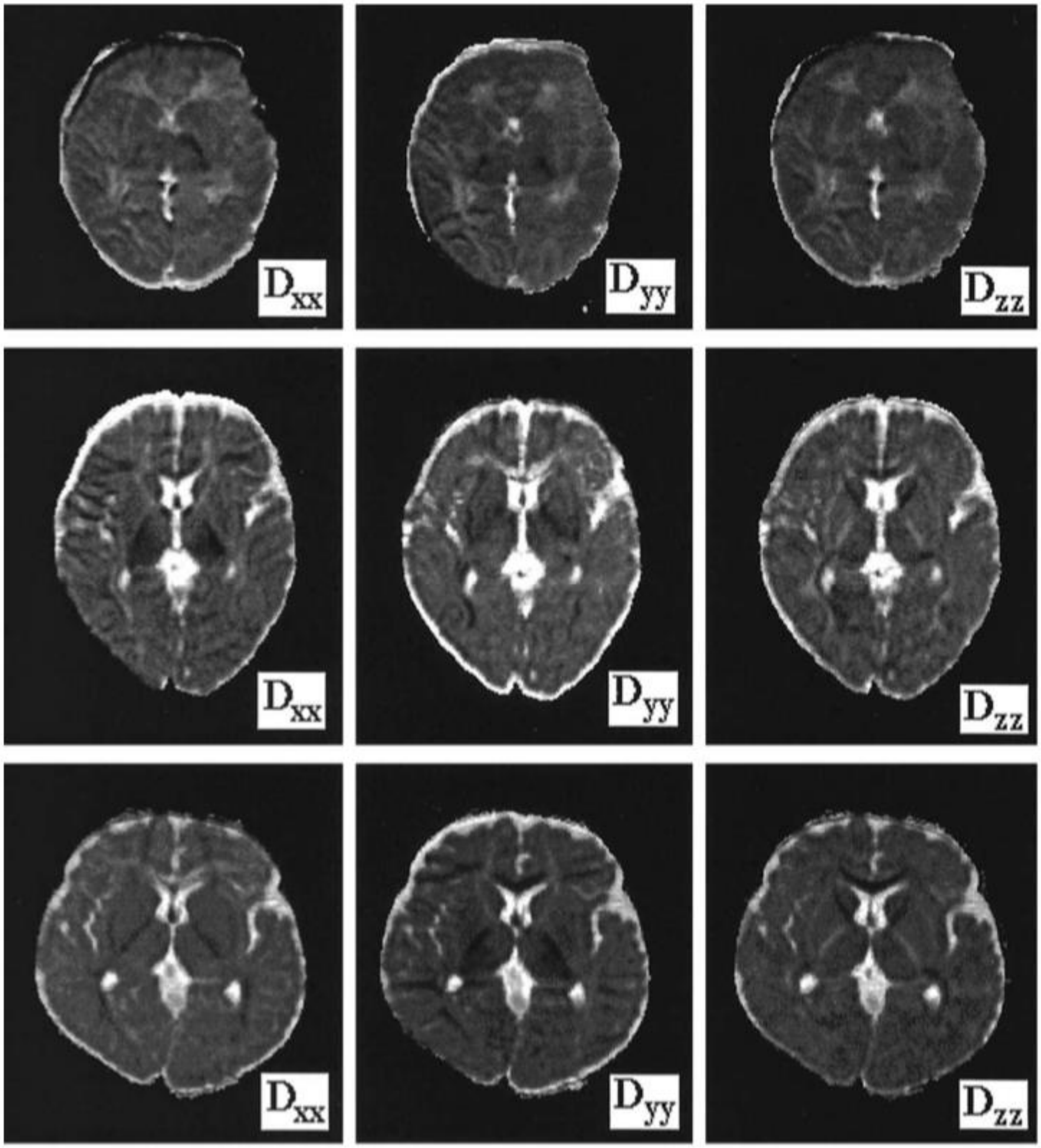


Figure 2: Scans of an infant brain beginning at five days old, five months old, and 10 months old - each row corresponds to the age ("Study of pediatric brain development using magnetic resonance imaging of anisotropic diffusion").

III. Cognitive Development

Cognitive development is the development of sections of the brain in terms of language learning, information processing, problem solving, and other various aspects that relate back to cognitive thinking ("Family Resources and Parenting Quality: Links to Children's Cognitive Development Across the First 3 Years"). Researchers have found that quality parenting has long lasting positive effects on children's ability to learn and grow for educational readiness, as well as life circumstances ("Family Resources and Parenting Quality: Links to Children's Cognitive Development Across the First 3 Years"). There are three features that have been acknowledged to promote positive outcomes for younger children ("Family Resources and Parenting Quality: Links to Children's Cognitive Development Across the First 3 Years"). These features can be promoted by parents or guardians of children in early stages of development: sensitivity, cognitive stimulation, and warmth, also known as positive regard or positive affect ("Family Resources and Parenting Quality: Links to Children's Cognitive Development Across the First 3 Years").

The term *parenting sensitivity* relates to the awareness of guardians to the specific cues given off by children ("Family Resources and Parenting Quality: Links to Children's Cognitive Development Across the First 3 Years"). The cues refer to emotions, interests, and the child's general capabilities ("Family Resources and Parenting Quality: Links to Children's Cognitive Development Across the First 3 Years"). Parenting sensitivity relates to a child's need for balance within parental

support and their need for independence (“Family Resources and Parenting Quality: Links to Children’s Cognitive Development Across the First 3 Years”).

The term *cognitive stimulation* refers to instructional parental acts in order to enrich language and cognitive development (“Family Resources and Parenting Quality: Links to Children’s Cognitive Development Across the First 3 Years”). These acts engage young children in learning activities that promote language-rich environments that stimulate the temporal lobe of the brain (“Family Resources and Parenting Quality: Links to Children’s Cognitive Development Across the First 3 Years”).

Parental warmth, or also known as *positive affect,* refers to the parental or guardian expression of affection toward the child (“Family Resources and Parenting Quality: Links to Children’s Cognitive Development Across the First 3 Years”). Expression of affection also include respect to the fact that the child requires an essential amount of love (“Family Resources and Parenting Quality: Links to Children’s Cognitive Development Across the First 3 Years”). These states can include support in mastery of skills, a sense of security, a sense of independence, as well as learning to be self-efficient as a human being (“Family Resources and Parenting Quality: Links to Children’s Cognitive Development Across the First 3 Years”).

According to a study of cognitive development and learning, it was proven that younger children learned better from a peer or teacher, rather than in front of a screen (“Two are better than one: Infant language learning from video improves in the presence of peers”). Two different infants were tested in separate rooms, one

alone with a tablet screen to learn from, and the other with a tablet screen and a friend or parent present (“Two are better than one: Infant language learning from video improves in the presence of peers”). The infant accompanied by a another person showed results of faster and more effective learning (“Two are better than one: Infant language learning from video improves in the presence of peers”). This type of learning is called “video deficit”, which was proven with a study involving phonemes with a partner rather than a nonsocial environment (“Two are better than one: Infant language learning from video improves in the presence of peers”).

Other studies concluded that language learning in younger children develop better from live human interaction than it does from screen-time use (“Two are better than one: Infant language learning from video improves in the presence of peers”). A study presented shows that toddlers ages 2.5 to 3 years old began watching video clips from an educational program called *Sesame Beginnings* (“Two are better than one: Infant language learning from video improves in the presence of peers”). Only about half of the children who watched the video showed active learning, whereas a more significant number of children presented more knowledge learned from watching the video, as well as learning from a social partner (“Two are better than one: Infant language learning from video improves in the presence of peers”).

Studies have concluded that children who learn alongside a partner have a greater chance of retaining information and faster learning (“Two are better than one: Infant language learning from video improves in the presence of peers”). Giving a child a video or interactive game to learn from can be very beneficial, but

the addition of social interaction can take the learning process to a higher level for the child ("Two are better than one: Infant language learning from video improves in the presence of peers").

Having a well-developed educational source of technology, as well as an interactive partner for a child to develop efficiently is not always an enough. There can be other factors that contribute to the disruption of development in children. These factors can range from environmental factors, such as having a television in a bedroom disrupting a sleep schedule, to physical factors, such as a sedentary lifestyle.

IV. Possible Disruptions in Pediatric Development

Considering that there are various factors that can effect the development of a child, the two main focuses are environmental factors and physical factors ("A comparison of symptoms after viewing text on a computer screen and hardcopy"). Environmental factors are the elements that can have an effect on the development of a pediatric within the surrounding area ("A comparison of symptoms after viewing text on a computer screen and hardcopy"). These factors can either be positive, also known as beneficial factors, or negative, also known as detrimental factors ("A comparison of symptoms after viewing text on a computer screen and hardcopy"). Researchers have surveyed and studied multiple children ranging in early development ages, with the consent of the parents and/or guardians, to determine what environmental factors play a role in the effect of development ("A comparison of symptoms after viewing text on a computer screen and hardcopy").

A study was conducted to observe the impact that entertainment and communication devices have on the sleep schedule of children when used at specific times of the day, more concentrated on the hour before bedtime ("The use of entertainment and communication technologies before sleep could affect sleep and weight status: a population-based study among children"). A survey was sent out to approximately 2,334 children in the fifth grade which asked the time they went to bed and the time that they woke up in the morning ("The use of entertainment and communication technologies before sleep could affect sleep and weight status: a population-based study among children"). The survey was also sent to the guardians of the children that included the child's sleep patterns, snoring levels,

times woken up during the night, feelings during the following day, and initial wake-up feelings (“The use of entertainment and communication technologies before sleep could affect sleep and weight status: a population-based study among children”). The environmental factor of having a television, computer, telephone, or other device with a screen in the bedroom were taken into consideration as well. Concluded in the study, there were confirmed increases of sleep problems and reduced sleep duration (“The use of entertainment and communication technologies before sleep could affect sleep and weight status: a population-based study among children”). In use of television before bedtime, 54% revealed sleep problems; 51% revealed from tablet use; 51% from video game use (“The use of entertainment and communication technologies before sleep could affect sleep and weight status: a population-based study among children”). This is the conclusion of using varying types of electronic screens within one hour before bedtime (“The use of entertainment and communication technologies before sleep could affect sleep and weight status: a population-based study among children”). As stated by the authors of the study, “Youth should be advised to limit or reduce screen time exposure, especially before or during bedtime hours to minimize any harmful effects of screen time on sleep and well-being” (“Screen time and sleep among school-aged children and adolescents: a systematic literature review”).

According to Olds et.al, technological screen-time has dominated much of the time budgets of children in a way that no other radio, television, telephone, or other type of technology has throughout time (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian

children”). There was also evidence that concluded the decrease of children’s participation in sports when television was first introduced (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). There are various types of screens within a household that can be environmental factors effecting the development in children (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). Children having access to these types of screens make it considered an environmental factor (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). Different types of screens are television screens, video games, computer screens, telephones, and tablets (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). There are many other types of screens that can be considered factors, but the ones listed are the main types that are studied (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”).

A group of adolescents ranging in age from ten to thirteen, also referred to as “screenieboppers”, were specifically studied due to the sudden decrease in physical activity around this specific age (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). Also, the use of media and electronic screens reach an all-time peak during this peri-pubertal time in children (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). This specific study describes and demonstrates the distribution, magnitude, components and

time-distribution of allotted screen-time in “screenieboppers” (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”).

Approximately 1,039 “screenieboppers” in grades five through seven participated in this study (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). The median number of minutes that each child was watching television were recorded (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). The median numbers included one day of school and one holiday, such as a weekend (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). As shown in Figure 3 on page 25, the numbers were split into specified days and the gender of the child (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”).

	Boys	Girls	All children	
School days	165	120	135	F=83.2 *p*<0.001
Non-school days	195	165	180	
All days	179	145	160	
	F=28.4, *p*<0.001			

Figure 3: Table of median minutes children spent in front of a screen on school days and holidays ("Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children").

Olds et al. concluded that the median time spent watching television in a single day was 160 minutes (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). It was also concluded that boys spent more time in front of a screen than girls, which resulted in 179 minutes versus 145 minutes (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). It can be seen in Figure 4 on page 28 that the television viewing time was increased on non-school days than on days with school, which was 180 minutes versus 135 minutes (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). Overall, it was concluded that 73% of all screen time was spent in front of a television (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). This comparison can be visualized in Figure 5 on page 29 (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). It was concluded that for “every extra hour of screen time was associated with a decline of about 10 minutes in sleep time” (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”).

Recommendations can be made for encouraging earlier bedtimes for “screenieboppers”, as well as other children, and reducing the overall screen time (“Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children”). If an 8pm curfew for all screen use were imposed, this would reduce the total daily screen time by 23%, as well as

reducing the median screen time by 45 minutes ("Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children"). Recommendations can also be made to limiting access to a screen and finding alternative entertainment for children ("Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children").

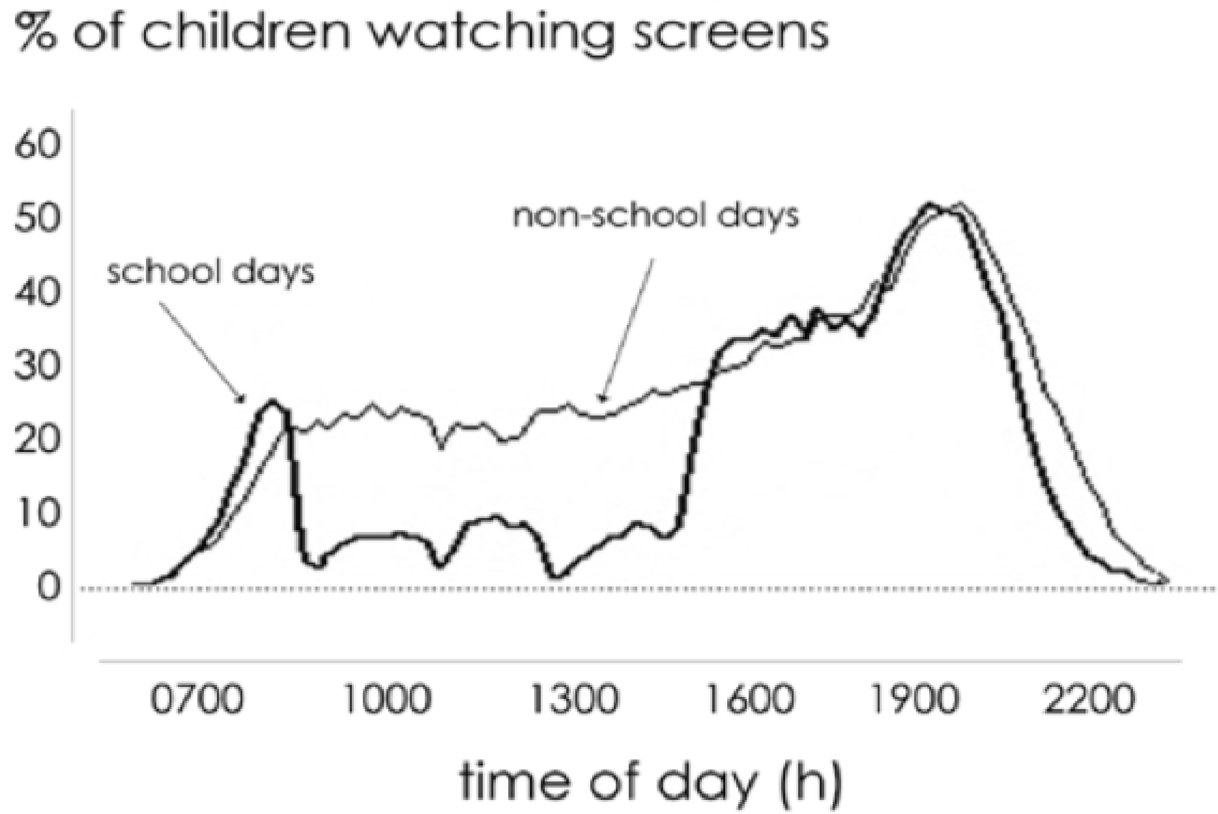


Figure 4: Percentages of "screenieboppers" using screens on school days versus non-school days ("Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children").

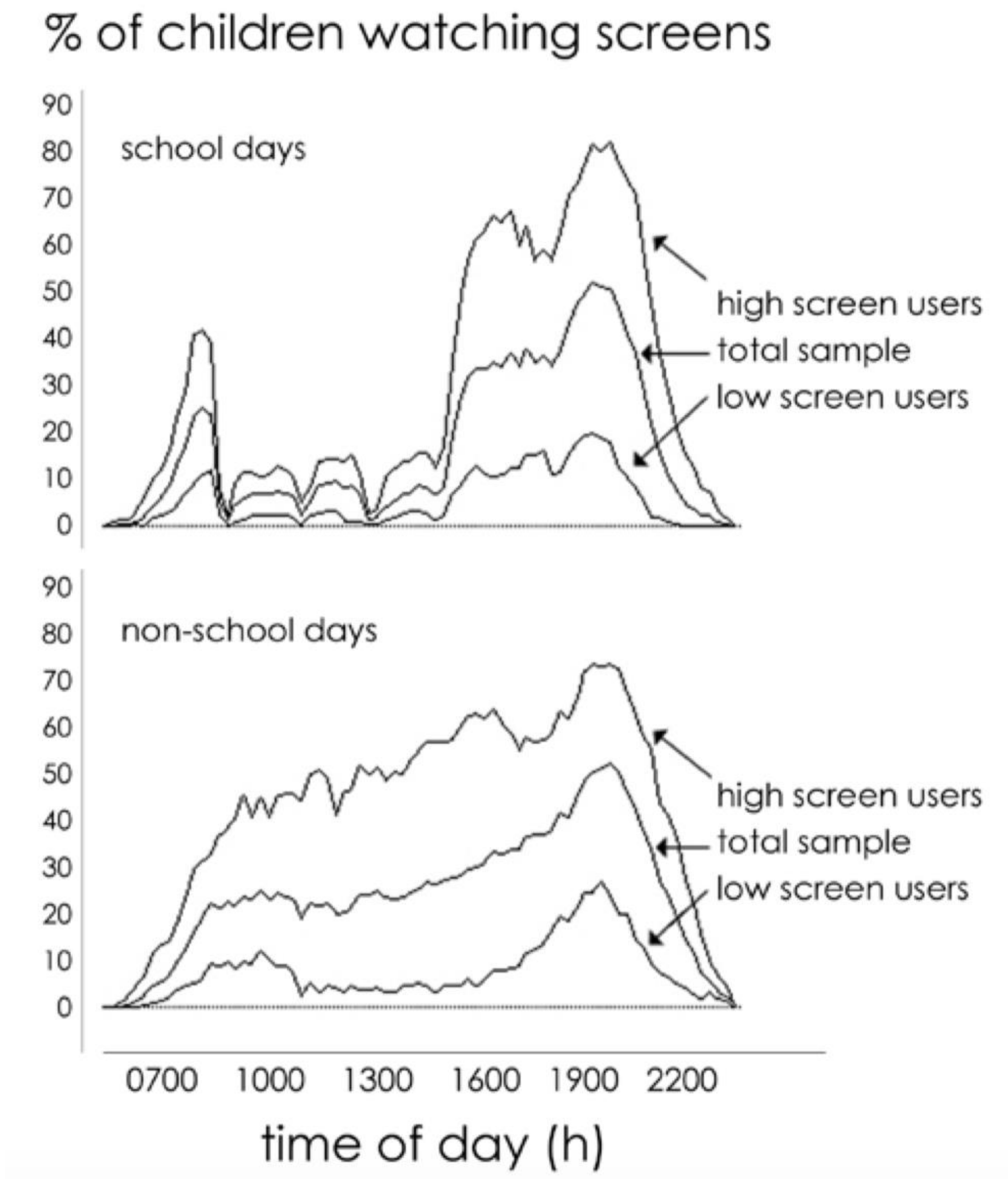


Figure 5: Percentages children having screen time on school days (thick black line) as compared to non-school days (thin black line) ("Screenieboppers and extreme screens: the place of screen time in the time budgets of 10-13 year-old australian children").

Physical factors are the elements that can have an effect on the development of a pediatric within the human body and its functions (“Computer vision syndrome: a review”). One common issue within the human body that occurs as a result of excessive screen time use is eye problems (“Computer vision syndrome: a review”). In today’s society, computers have become a large part of our everyday lives and routines (“Computer vision syndrome: a review”). More and more individuals, adults and children, are experiencing ocular problems as a result of using screens (“Computer vision syndrome: a review”). Ocular problems that occur after excessive computer screen use is known as Computer Vision Syndrome (CVS) (“Computer vision syndrome: a review”). Symptoms of this condition include, but are not limited to, tired eyes, redness, eyestrain, irritation, blurred vision and double vision (“Computer vision syndrome: a review”). “Computer vision syndrome may be the cause of ocular (ocular-surface abnormalities or accommodative spasms) and/or extraocular (ergonomic) etiologies” (“Computer vision syndrome: a review”).

According to Blehm et al. – the researchers and authors of the cited article - the visual effects of the display characteristics within a computer screen are the leading effects of the eye problems (“Computer vision syndrome: a review”). These can include glare, lighting, quality of the display, rates of refresh, and radiation from the computer (“Computer vision syndrome: a review”). A list of vision problems and ocular irritations can be seen on page 31 in Figure 6.

Symptom Category	Symptoms	Diagnosis
Asthenopic	Eyestrain	Binocular vision
	Tired eyes	Accommodation
	Sore eyes	
Ocular surface–related	Dry eyes	
	Watery eyes	
	Irritated eyes	
	Contact lens problems	
Visual	Blurred vision	Refractive error
	Slowness of focus change	Accommodation
	Double vision	Binocular vision
	Presbyopia	
Extraocular	Neck pain	Presbyopic correction
	Back pain	Computer screen location
	Shoulder pain	

Figure 6: Computer screen-related vision problems and related common diagnoses ("Computer vision syndrome: a review").

It has been proven that children spend many hours a day in front of a screen ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). Many corporate industries plan their marketing strategies around an audience that they know can have a beneficial influence on their sale incomes ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). Targeting the younger generations with marketing techniques that have appeal to them can have a great positive impact on the sales brought in for that specific company ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). More specifically, food marketing targets the children to have a greater impact on their sales, as well as the child's individual diet ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs").

In a study conducted in 2014 by Kraak et. al, five electronic databases were used to observe experimental studies as to how food companies caught the attention of children with mascots and entertainment methods ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). A list of these mascots can be found on pages 36 and 37 in Figures 7 and 8. All of the children that participated in the study were under the age of twelve ("Influence of

food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). The research included specific cartoon characters that children would see daily and the influence that these characters had on the diet of that specific child ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). The measurements of the study were categorized into twelve possible outcomes: seven cognitive outcomes (character recognition, character trust, brand recall, character association, appetite, character preference, and taste preference), four behavioral outcomes (food choice, request for purchase, product intake, and quality of food), and finally one health outcome (Body Mass Index) ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs").

It was found that the high recognition of brand characters was ranging from 60 to 90% of the subjects questioned ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). Studies proved that children gravitated toward a familiar media character that was used to market "junk" food when given the option with an unknown character ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). A study was also proven that if the same marketing character, or one similar, was used to market a healthy food instead of an unhealthy one, the children would gravitate toward the

familiar character, regardless of the food it promoted (“Influence of food companies’ brand mascots and entertainment companies’ cartoon media characters on children’s diet and health: a systematic review and research needs”).

Children were found to make more of a request for specific brands of foods when the character on the packaging was familiar (“Influence of food companies’ brand mascots and entertainment companies’ cartoon media characters on children’s diet and health: a systematic review and research needs”). A specific study showed that the character had a great influence over the diet of the children who were viewing the advertisements (“Influence of food companies’ brand mascots and entertainment companies’ cartoon media characters on children’s diet and health: a systematic review and research needs”). For example, it was found that *Elmo* “branding of apples significantly increased children’s intake over three days” as well as *Elmo* branding with a cookie (“Influence of food companies’ brand mascots and entertainment companies’ cartoon media characters on children’s diet and health: a systematic review and research needs”).

Using the media to market to children during screen-time use is an excellent way to increase sales for specific food companies (“Influence of food companies’ brand mascots and entertainment companies’ cartoon media characters on children’s diet and health: a systematic review and research needs”). Depending on the product that the marketing is done for, the effect could be positive or negative for the child consumer (“Influence of food companies’ brand mascots and entertainment companies’ cartoon media characters on children’s diet and health: a systematic review and research needs”). As quoted in the cited study, “Media

character branding may be a promising strategy to increase children's preference for, purchase request, choice and intake of fruits and vegetables compared with no character branding" ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). Although, one in five pediatrics between the ages of five and seventeen are considered to be overweight or obese ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs"). The screen-time use by children can be a way to help fight childhood obesity by using the media characters as tools to build good nutritional behaviors early in life ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs").

Figure 7: Lists of various media characters used to market brands within the US Children's Food and Beverage Advertising Initiative ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs").

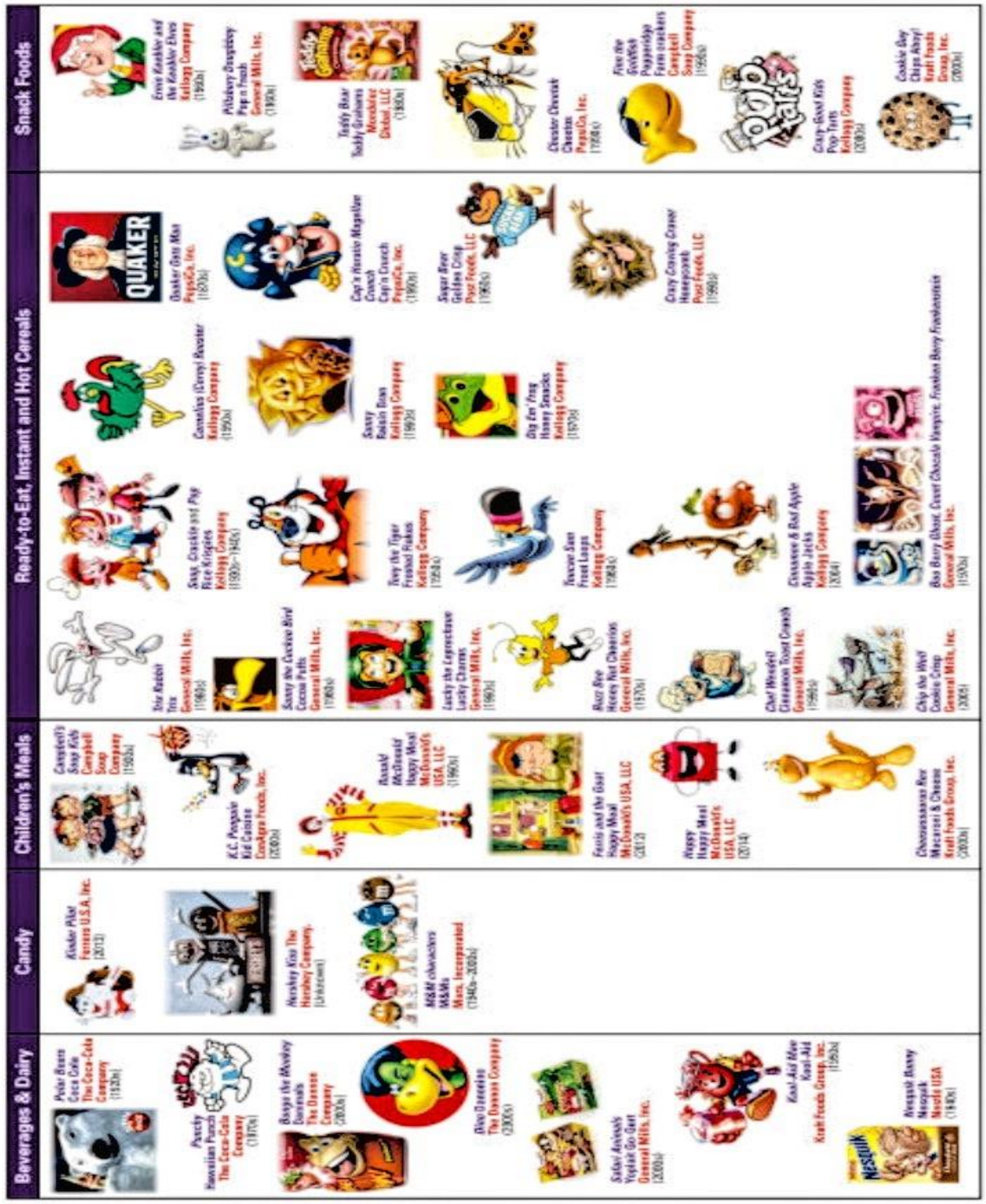
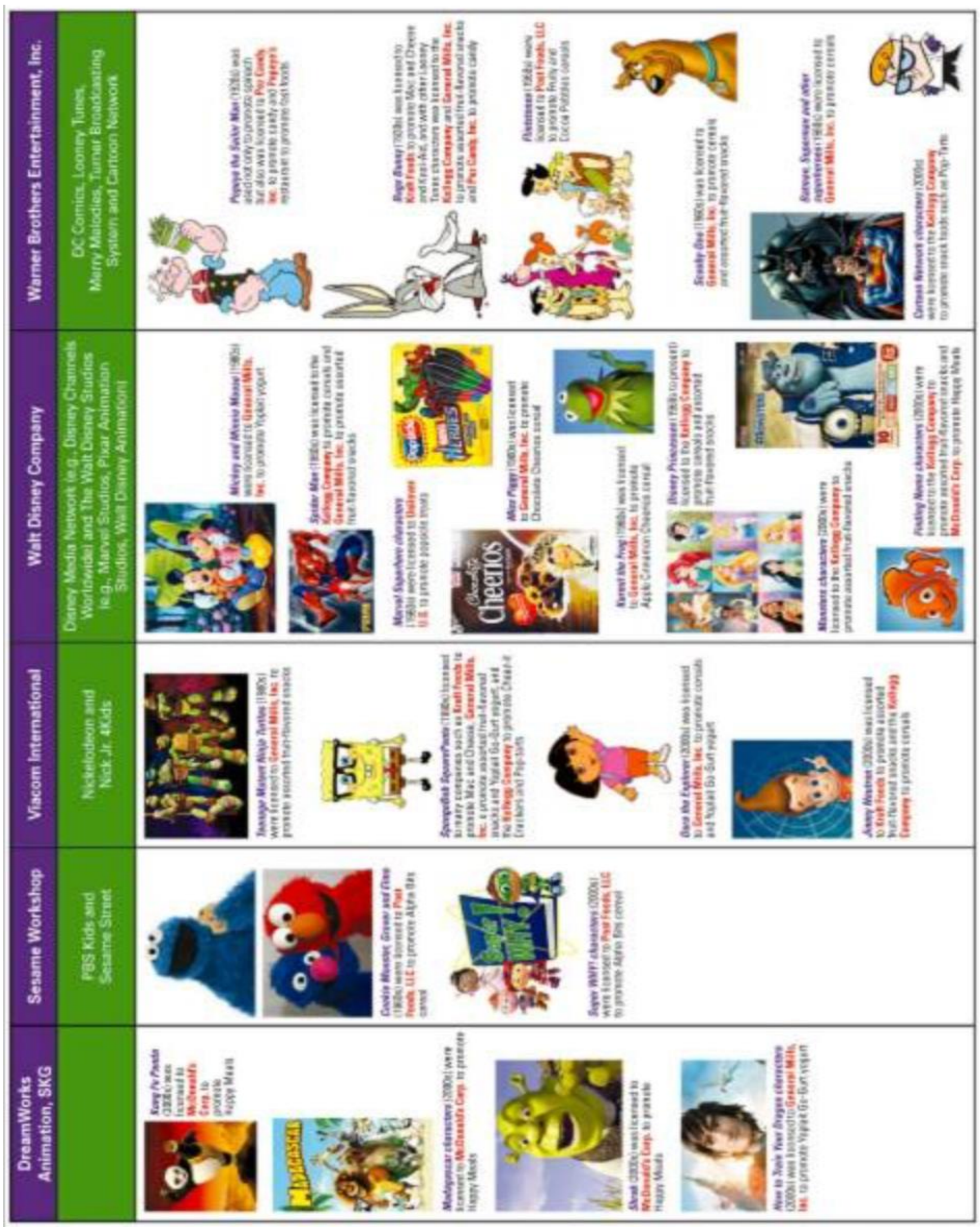


Figure 8: Lists of various media characters within entertainment companies that have been licensed to promote food and restaurant companies to American children ("Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs").



Children that are exposed to various technological screens and are allowed to have excessive amounts of screen-time per day are more likely to develop health problems in the future (“Associations between factors within the home setting and screen time among children aged 0–5 years: a cross-sectional study”). According to a study completed by researchers, it has been found that excessive amounts of screen-time during the day can lead to more sedentary lifestyle habits and limit the physical activity needed for normal pediatric development (“Associations between factors within the home setting and screen time among children aged 0–5 years: a cross-sectional study”). Having this “set back” of a sedentary lifestyle opens doors for children to become more susceptible to diseases and overall health problems - including, but not limited to, diabetes, cardiovascular problems, and obesity (“Associations between factors within the home setting and screen time among children aged 0–5 years: a cross-sectional study”).

Having a sedentary lifestyle provokes overall health problems for later on in life (“Youth screen-time behavior is associated with cardiovascular risk in young adulthood: the European youth heart study”). A study confirmed that “total screen time was significantly associated with BMI, WC, triglycerides, and metabolic syndrome z-score” (“Youth screen-time behavior is associated with cardiovascular risk in young adulthood: the European youth heart study”). These health problems occur from the misuse of screen time at a young age, limiting physical exercise and increasing chances of cardiovascular problems, diabetes, and becoming overweight at a young adult age (“Youth screen-time behavior is associated with cardiovascular risk in young adulthood: the European youth heart study”).

Computers and other technological devices have the ability to limit positive growth in individuals. On the other hand, they have the potential to serve as positive reinforcement for learning. If technology and screen time use are used efficiently and responsibly, they have the capability to open doors for growth that generations before could not have even imagined.

V. Positive Effects of Computers to Pediatrics

With electronic devices becoming a common household item in today's world, children have the equipment for endless knowledge and learning possibilities at their little fingertips ("Empowering children with adaptive technology skills: careful engagement in the digital information age"). The cited article quotes, "Since children feel inquisitive and would always like to inquire, and to reflect on what to do with information acquired, there is a need to provide considerable guidelines on technology use so as to support them their potential and capacities" ("Empowering children with adaptive technology skills: careful engagement in the digital information age"). Giving a child access to a tablet, computer, educational video, or other type of electronic device, opens up doors for the child to learn and enhance their developing brain ("Empowering children with adaptive technology skills: careful engagement in the digital information age").

There are countless educational services behind technology screens that enable children to enhance their skills, as well as build their critical thinking abilities in almost any subject taught in schools ("Empowering children with adaptive technology skills: careful engagement in the digital information age"). Math specifically is a widely adored subject by pediatrics across the world ("Empowering children with adaptive technology skills: careful engagement in the digital information age"). Educational industries have created games and fun videos that hold the attentions of children, entertaining them as well as teaching them basic math skills that will aid them further in life ("Empowering children with adaptive technology skills: careful engagement in the digital information age").

It has also been proven by the researchers and authors of the cited scientific article that children given a smartphone to occupy them, have developed incredible thinking skills, as well as the capability to absorb information given to them (“Empowering children with adaptive technology skills: careful engagement in the digital information age”). Huda et. al stated in the written scientific research, “Providing children with tools which may assist them on the use of technology as a creative substance can help their development in the digital age” (“Empowering children with adaptive technology skills: careful engagement in the digital information age”). Researchers have discovered that as long as children have parental or guardian supervision while using technological devices, the potential that children naturally have at retaining information can be utilized well with digital devices (“Empowering children with adaptive technology skills: careful engagement in the digital information age”).

Conclusion

Technology has grown and advanced in more ways than we are capable of wrapping our heads around. The development of devices that aid us in our everyday lives is just incredible to see and the public can only imagine what future devices lie in store for future generations. But, as much as these devices help us, they also can do quite the damage to the young, developing mind.

Having access to a technological device is a wonderful way for children to grow and to learn, since a world of knowledge lies at their fingertips. If a supervised child is allowed to explore educational games, websites, videos, and movies on a tablet or computer, a world of possibilities can open up for them that our ancestors could never even dream of. Children exposed to learning games can learn and develop at a faster rate than those who are not given those opportunities.

On the other hand, there are many risks and problems that accompany technology use in pediatrics. Giving an unsupervised child access to the internet can be a dangerous place for adult websites, scary images and inappropriate things for a developing child. Even allowing unlimited time to the devices can cause many problems including a habitual sedentary lifestyle — which can lead to various health problems later in life. Eye problems, social problems, developmental problems, and so many other things can be a problem for unlimited screen-time use.

Being able to have access to technology devices is a blessing and a curse all at once. Having the ability to access endless amounts of knowledge, entertainment, task specific help, and so many other things can really be beneficial to those with developing minds. Although, having this amazing opportunity to learn and grow can

be used in detrimental ways as well if not used properly. If able, children should have the opportunity to learn from the advanced educational tools of our time, but should always remain supervised in the process while experiencing the world around the small screen.

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