

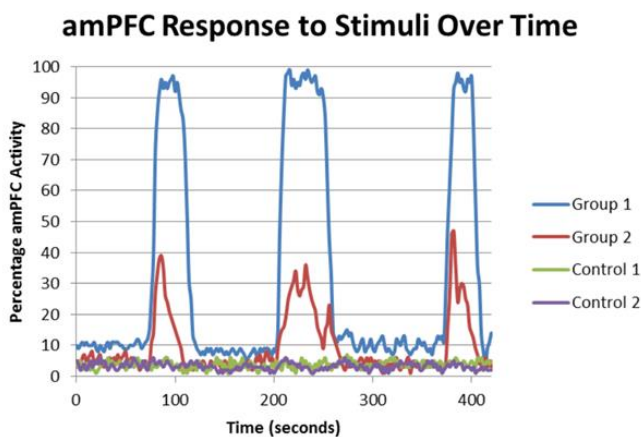
The Effect of Fictional Literature on Empathy in Children

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Graphical Abstract (mandatory)



Abstract

The purpose of this paper is to identify the correlation between reading fictional literature and an increased level of empathy in children. Using an fMRI machine this paper studies the level of empathy that children who read significantly more or significantly less than one another experience while listening to Hans Christian Andersen's *The Ugly Duckling*. The findings concluded that the anterior medial prefrontal cortex in children who read significantly more every week is more active than in children who do not. Children who read significantly more are also more likely to detect a situation for which empathy is the proper response and in turn respond empathetically. The results of this study hold significance for the education system, which in the past 15 years has shifted toward teaching for the purpose of standardized testing scores. As this study shows reading fictional literature increases learning outcomes in children that benefits them into adulthood, in turn, benefitting society as a whole. Therefore, the education system needs to focus on teaching fictional literature accompanied by empathy-based discussion, rather than how to take standardized tests. This will increase learning outcomes in children and benefit society through the development of empathetical adults.

Note: This paper was an assignment for a nursing school General Education Capstone course. The student writer did not conduct a real study; she rather simulated a study to demonstrate writing/research skills, creativity, scientific knowledge, and an understanding of how to generate and analyze data. The corresponding author is the student's instructor, who guided the student on each section of the

	scientific paper, providing feedback on how to “conduct” the study and on how to revise the writing.
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Introduction

Literature Review: Scientific

Empathy is a multidimensional concept found in humans that allows them to cognitively participate in other people's feelings or processes of their mind (Butler, Carlin, & Nickerson, 2009). Empathy develops throughout childhood and, as outlined by Hoffman (1984), progresses through four distinct developmental stages. The first stage is infancy, in which infants do not have the capacity to distinguish themselves from others. Hoffman says, that while infants are not yet developmentally mature enough to empathize, hearing another infant cry will induce crying. The ability to empathize is innate and therefore, precursors such as this can be seen throughout life. The second developmental phase that Hoffman discusses forms when the child is able to recognize him or herself as physically different from others. From ages two to three, children learn that other people also experience feelings that are distinct from their own. As they develop the ability to speak and experience higher cognition thoughts, children also develop the ability to empathize with people who are not present; this is known as perspective taking (Hoffman, 1984). The last level of empathetic development occurs in late childhood, at which point children are able to empathize with people who are not present or who they do not know about ongoing problems (Cress 1998).

Society refers to people who do not develop empathy as psychopaths. According to Anderson and Kiehl (2011) due to their lack of empathy psychopaths commit a disproportionate amount of violent crimes that create significant emotional and financial burden on society. Aharon-Peretz, Harari, Levkovitz, and Shamay-Tsoory (2010) theorize that an impairment in the emotional aspect of theory of mind in psychopaths' accounts for their impaired social behavior. Aharon-Peretz, *et al.* hypothesize that the manifestation of a deficient emotional theory of mind is associated with a dysfunctional orbitofrontal cortex (OFC). In order to test this hypothesis, they compared the theory of mind abilities of criminal offenders who were diagnosed with antisocial personality disorder and high psychopathy features to subjects with localized OFC lesions. The results of this study showed that subjects with psychopathy and those with frontal lobe, specifically OFC, lesions were both impaired in their emotional theory of mind abilities (Aharon- Peretz, *et al.*, 2010). This shows that there is a distinct correlation between brain dysfunction and the lack of empathy that is found in psychopaths. Anderson and Kiehl (2010) also concluded that there is a set of brain regions that are consistently found in correlation to psychopathy. These regions include the OFC, amygdala, and anterior cingulate and adjacent limbic structures (Anderson & Keihl, 2010).

Using technology such as functional magnetic resonance imaging (fMRI), scientists are able to examine the neurological mechanisms behind empathetic responses, giving people further insight into the development and formation of empathy. A study by Nijhof and Willems (2015) localized the cortical motor network and mentalizing network using neuroimaging. Their goal was to examine the response of both networks during an empathetic stimulus. The stimulus used in this study was fictional literature, which has historically been linked to a mentalizing response by the brain. Mentalizing is the brain's ability to understand the thoughts, feelings, and intent of others, i.e. empathy (Nijhof & Willems, 2015). A study by Wallentin and colleagues, that observed both sensori-motor stimulation and mentalizing during the reading of "The Ugly Duckling", found that the visual cortex, for observing visual stimulus, and the section of the brain related to mentalizing were both activated (Nijhof & Willems, 2015). This indicates that not only do people hear literature and mentalize it verbally but they also "experience" it in their minds, indicated by the activation of the visual cortex while performing a verbal activity (Nijhof & Willems, 2015). Therefore, fictional literature can create a scenario that readers experience in a similar way to a scenario they visually observe. Nijhof and Willems' study found that there was a significant response by the anterior medial prefrontal cortex (amPFC) in

reaction to listening to mentalizing- related literature. The right temporoparietal junction (rTPJ), used for mentalizing, and the amygdala, used in emotional learning, were also observed but showed no significant results in this study (Nijhof & Willems, 2015). In 2003 Frith and Frith used neuroimaging to reveal the three-system complex involved in both implicit and explicit mentalizing: the medial prefrontal cortex (MPFC), the temporal poles and the posterior superior temporal sulcus (STS). More importantly, Frith and Frith theorized about the uses of each system individually based on their study. They found that the amPFC is the mechanism that distinguishes between mental state information reception and physical state information reception. The STS is the region involved in the awareness of agency, and the temporal poles in accessing social scripts of past schemas (Frith & Frith, 2003).

Many theories have been proposed for how certain actions, such as reading fictional literature, increase empathy (Beierl, 2012). Simulation theory is the theory that by transposing oneself into the minds of another person one is able to imagine oneself as that person. This would be the equivalent of a naturalist observation study, by putting oneself in another context. By integrating the thoughts of another person into one's own cognition one can experience their thoughts and feelings. This is a necessary aspect of empathy (Beierl, 2012). Schatzki states the occurrence of three major intellectual operations involved in stimulation: reading, inferring, and imagining. By "reading", Schatzki is referring to the act of understanding the mentality of another person, primarily his or her emotions. Inferring is the act of considering specific facts about a person, then drawing conclusions based on those facts. Finally, imagining is when someone considers how the other person sees his or her situation and then determines how he or she will react (Beierl, 2012). Fictional literature plays a key role in the development of empathy through the theory of stimulation. When reading, people follow the same three steps outlined by Schatzki. In doing so they gain ethical agency in the character and the story that helps us to formulate a new ethical point of view (Cress, 1998).

The neurological basis behind the internalization of literature begins the moment the reader receives the information (Beierl, 2012). Iser explains that the aesthetic response, which occurs after beginning to read, is when the reader adjusts his or her own focus and relies on perceptive faculties in order to comprehend the literature. The reader then formulates the meaning of the text based off his or her own imaginative process, therefore arousing motor neurons to generate an empathetic response in order to comprehend the literature from the perspective of the narrator (Beierl, 2012). A study performed by S.A. Lee and colleagues investigated the relationship between certain personality traits and the reading of fictional literature. The study involved having subjects self-identify how much they engaged in fictional literature by a multiple-questionnaire. They then showed the subjects photos of another person's "eye region" and asked a question regarding his or her mental state. Lee and colleagues found that there was a correlation between the amount of fictional literature the subjects engaged in and their ability to properly grade the mentality of the person in the photo (Beierl, 2012).

Literature Review: Cultural

From a cultural standpoint, the ability to properly grade the mentality of a person is important in the development of empathy because to empathize, one must know the other persons' thoughts and feelings, and react accordingly. In order to properly empathize people must be able to understand a person's unique life experiences and decipher how they feel about a situation on the basis of their experiences. Recent research supports fictional literature as a beneficial way to gain new "experiences" in order to positively enhance an ability to understand others. Through simulation, literature gives one the opportunity to immerse oneself in the fictional world of the protagonist (Beierl, 2012). Not only does this give the reader the ability to "see" what the protagonist sees, but also gives them the opportunity to experience what the protagonist experiences from his or her point of view, likely giving readers ethical agency in a new context.

Encouraging reading in children has become increasingly more important for motives other than promoting academic intelligence, as research on the benefits of fictional literature continues to be published. Not only has research linked fictional literature to an increase in empathy, it has also shown that empathetic reading mediates pro-social behavior and a decrease in prejudice. Pro-social behaviors include cooperation, sharing, and other altruistic acts (Feshbach & Feshbach, 2009). The development of empathy encourages pro-social behavior because without the ability to understand how people feel,

think, and react, we are ineffective communicators and cannot fulfill one of human's most innate behaviors as social beings. As Beierl (2012) put it, "There are people who have the capacity to imagine themselves as someone else, [and] there are people who have no such capacity (when the lack is extreme, we call them psychopaths)" (p.34).

The ability to imagine themselves as someone else is also what makes children good readers to begin with. When children are capable of this kind of projection they have a better chance of experiencing what the characters do similarly to the way they experience events that occur in their own lives. This means that they will also feel what the characters describe their feelings to be more realistically. This not only makes reading more enjoyable for children, but it also helps them develop empathy from what they read. For parents who feel that their children are not innately drawn to books or naturally good readers methods are available to help their children become good readers. Former first lady Laura Bush said "As parents the most important thing we can do is read to our children early and often. Reading is the path to success in school and life. When children learn to love books, they learn to love reading" (Spellings, 2000). The best way to encourage children to become readers is to talk and listen to them and to read together with them (Spelling, 2000). This can be made easier by finding books on the topics that interest the child and will peak their creativity and imagination. The more immersed a child is in book the more they will gain from its content. Reading not only benefits the children who learn to read but also society.

Society considers empathy the norm not only because it is innate, but because it encourages people to take a societal approach that benefits the growth of humanity. Prejudice is a problem that often hounds society and is the result of a lack of empathy. An individual who understands the thoughts and feelings of a person who is socially or racially different than themselves is able to empathize with the experiences of this person. A study performed by Doyle and Aboud (1995) showed that children who participate in role-playing activities show an increased level of empathy and decreased level of social prejudice (Feshbach & Feshbach, 2009). The use of role-playing, referred to as "reflection-projection in reverse" by Butler and colleagues, is said to increase empathy because when people "play" another person, what they believe they know about the other persons abilities affects the way in which the person perceives his/her own abilities (Buysse, et al., 2009). This effectively changes the "role-players" perception even after the role is over. Keen states that the reader of fictional literature feels empathy for and with the protagonist and connects to aspects of the fictional world he/she is reading about, despite being able to relate to the historical, cultural, social or economic situation (Beierl, 2012).

Fictional literature is composed in a way that does not tell the reader the "lesson" or purpose of the story, but instead offers the reader an opportunity to decode the meaning of what they have just read (Beierl, 2012). According to Iser, this idea is called "wandering" or "moving". It is the idea that the reader cannot comprehend a text in its entirety at any one time. Instead, when reading people must take in what they can and when finished, come out with a combination of insights. Iser claims that these gaps, which he/she calls "prose" gaps, are a lack of frame by the author that allows the reader to insert agency each time he reads. Each time the text is read it can be interpreted differently, allowing the reader to combine his/her ideas with the author's and "reformulate" the text to be his own (Beierl, 2012).

This topic is also discussed by Holland who also presents literature as an experience for the reader that is shrouded in the layers of meaning contained in one text. For Holland uncovering these layers is a psychoanalytic experience of transforming the fantasy of fiction into the conscious mind of the reader decipherable through conventional interpretation (Beierl, 2012). According to this psychoanalytic view, the associations people make when reading texts are fueled by their conscious mind and the way they interpret texts reflects this. Dewey offers readers the opposite perspective. People do not shape the literature they read to fit their current state but rather the literature shapes them. According to Dewey, reading is the equivalent of experiencing. When reading, people combine their old experiences with the new experiences in the text. Dewey is implying that people's entire thought process is reshaped through their learned experience (Beierl, 2012). The brain is shaped by experiences every day, says Maryanne Wolf. In order to comprehend literature, one must immerse oneself in the text by having agency in the protagonist. By doing so, one is able to gain empathetic agency based off learned literary experience.

Materials and Methods

- A "Reading Frequency" survey (Supplemental Image 1)
- Volunteers age 7-10 (boys and girls of any socioeconomic background)
- fMRI machine (3T whole body scanner with standard head coil)
- Desktop to display fMRI results
- Body pads to secure subject into machine
- Head pad with adjustable plastic strap that secures across the forehead
- Conjoining rooms connected by a glass window allowing researcher to observe subjects
- Speaker attached at head of fMRI machine
- Microphone (in adjoining room) connecting to speaker attached to head of fMRI machine
- Microphone attached to fMRI machine
- Speaker (in adjoining room) connecting to microphone attached to fMRI machine
- *The Ugly Duckling* by Hans Christian Andersen
- The "Empathetical Response" survey (Supplemental Image 2)
- Note: the subject should not have any metal on their persons and there should be no metal in the fMRI machine being as it will interfere with the machine; speakers and microphones should be placed directly outside of the head of the machine

First, we had the guardians of volunteers (age 7-10) complete the reading frequency survey. Based on survey results: we placed three subjects who read 6 or more hours per week into experimental group 1, three subjects who read 6 or more hours per week into control group 1, three subjects who read 3 or fewer hours per week into experimental group 2, and three subjects who read 3 or fewer hours per week into control group 2. We excluded all other volunteers who did not fall into any of these categories.

We then placed the subjects, from the Experimental groups (1 and 2), individually into the fMRI machine beginning with Experimental group 1 and proceeding in randomized order. We secured the subject using body pads to prevent any body movement and a fitted head pad with an adjustable forehead strap to immobilize the head. Once the subject was secure we ran a preliminary microphone/speaker check to assure the subject could hear exactly what was being said to them. The researchers then left the room and proceeded to the adjoining room*. We used the Echo Planar Imaging method (EPI) to collect 2-dimensional transverse images of the brain at resolution $3.4 \times 3.4 \times 4 \text{ mm}^3$ with repetition time $TR=2\text{s}/\text{volume}$ throughout the experiment. After the subject was secure we began by taking a preliminary image of the subject's brain prior to any stimuli. Next, we had one of our researchers** read *The Ugly Duckling* to the Experimental group subjects through the speaker/microphone setup connected to the fMRI. Throughout the story, in 2 second increments, images were taken of the subject's brain. Immediately after the story was finished being read, while the subject was still in the fMRI machine, the subject was read the "Empathetical Response" survey by the researcher and asked to verbalize their answers. Their responses were recorded. The subject was then removed from the fMRI machine and allowed to go.

Next, the Control groups (1 and 2) were individually placed into the fMRI machine beginning with Control group 1 and proceeding in randomized order. The subjects were secured into the machine in the same manner as the Experimental group subjects. The researchers then ran a preliminary microphone/speaker check to assure if necessary the subjects could communicate with them. The researchers left the room and proceeded to the adjoining room*. We used the same fMRI settings that had been used for the Experimental groups to again take 2-dimensional transverse images of the subject's brains. We ran the fMRI machine for 7 minutes taking images in 2 second increments while the room remained completely silent with no stimulus. The subject was then removed from the fMRI machine and allowed to go.

*Note: No one other than the subject was allowed in the room while the fMRI machine was running. Researchers observed from a conjoined room.

**Note: The researcher who read *The Ugly Duckling* remained the same throughout the study in order to generate consistent results.

Results

Experimental group one participant one (E1P1) showed increased anterior medial prefrontal cortex (amPFC) activity at minutes 1.10-1.70, 3.30-4.0, and 6.10-6.50. The activity response was characterized by an 0.86-0.97 increase in blood flow to the amPFC during the time ranges of increased activity. In all cases the response was prefaced by increased cerebellum activity lasting from 1.30-3.60 seconds. It should also be noted that participant one experienced increased limbic activity prior to all amPFC episodes lasting between 0.30-0.56 seconds. Experimental group one participant 2 (E1P2) showed similar results with increased amPFC activity at minutes 1.20-1.50, 3.40-4.40, 6.20-6.60. The response was characterized by an 0.87-0.97 increase in blood flow to the amPFC during the time of increased activity. E1P2 experienced increased cerebellum activity prior to all events lasting from 0.6-1.0 seconds. E1P2 also experienced increased limbic activity prior to all amPFC episodes lasting between 0.32-0.54 seconds. Experimental group one participant 3 (E1P3) showed increased amPFC activity at minutes 1.25-1.80, 3.60-4.00, and 6.21-6.90. The activity response for minutes 1.25-1.80 and 6.21-6.90 showed an average increased response of 0.87-0.94. For minutes 3.60-4.00 the activity response peaked at 0.75 increased blood flow to the amPFC. The amPFC response during minutes 1.25-1.80 and 6.21-6.90 was prefaced by a peak in cerebellum activity lasting 1.41-3.23 seconds. The peak at 3.60-4.00 seconds was prefaced by a cerebellum response lasting 0.78-1.20 seconds. E1P3 showed increased limbic activity in relation to all amPFC activity peaks. See Figure 1.

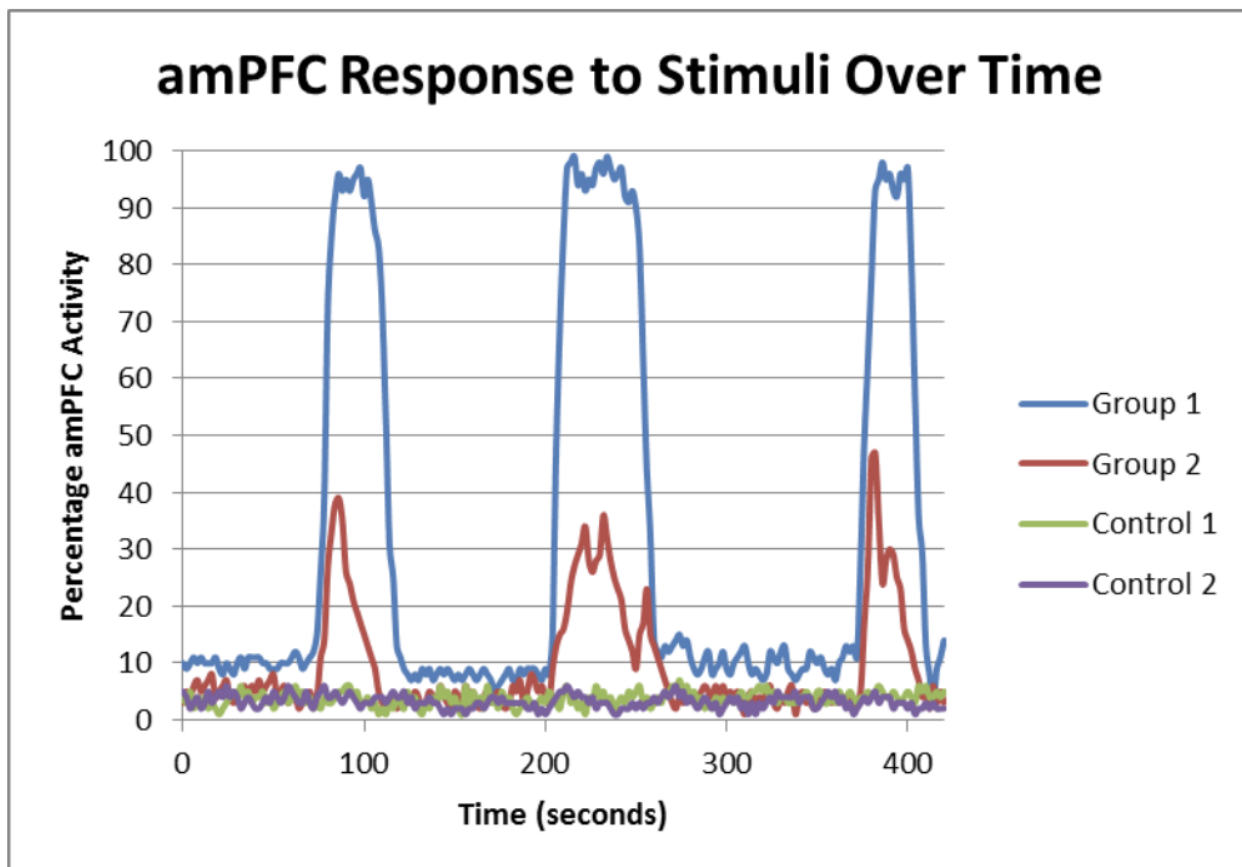


Figure 1: amPFC Response to Stimuli Over Time

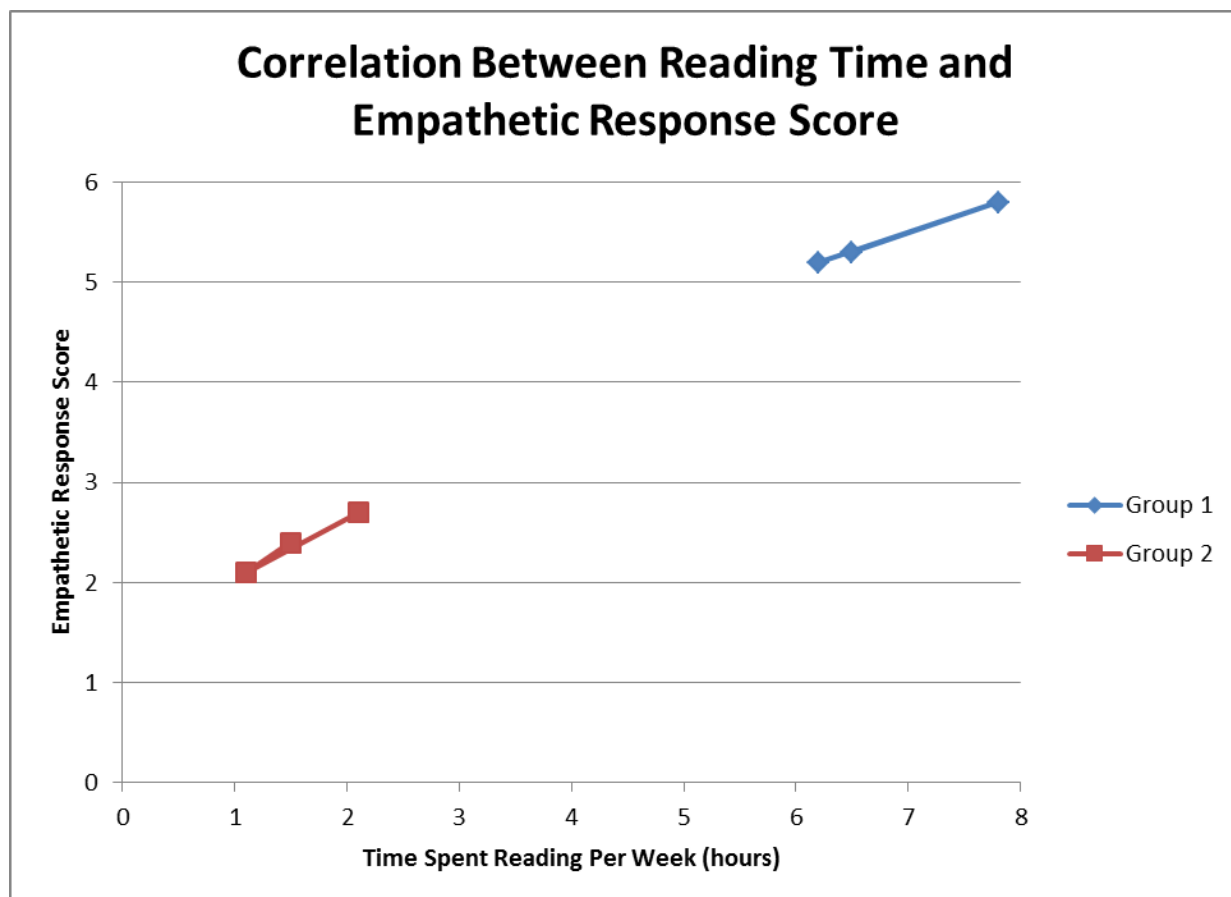
Experimental group two participant one (E2P1) showed increase amPFC activity minutes 1.23-1.80, 3.10-3.98, and 6.04-6.45. The activity response was characterized by a 0.25-0.37 increase in blood flow to the amPFC during the time ranges of increased activity. In all cases the response was

prefaced by increased cerebellum activity lasting 0.34-1.20 seconds. There was no increased limbic activity worth noting. Experimental group two participant 2 (E2P2) showed increased amPFC activity minutes 1.30-1.83, 3.15-3.76, and 6.08-6.32. The response was characterized by a 0.20-0.31 increase in blood flow to the amPFC. E2P3 showed cerebellum activity lasting 0.10-0.23 prior to activity in minutes 1.30-1.83 and 6.08-6.32 but not during minutes 3.15-3.76. There was not notable limbic activity during or prior to peak amPFC. Experimental group 2 participant 3 (E2P3) showed increased amPFC activity minutes 1.31-1.41 and 6.21-6.35. The responses were characterized by a 0.15-0.23 increase in blood flow to the amPFC. E2P3 experienced increased cerebellum activity prior to both events lasting 0.20-0.45 seconds. There was no notable increased limbic activity. See Figure 1.

The participants reading frequency was determined using the "Reading Frequency" survey (see Appendix) given to volunteers prior to participation. The average results for each group are as follows: Experimental group 1: 420 minutes/ week; Control group 1: 400 minutes/ week; Experimental group 2: 140 minutes/ week; Control group 2: 125 minutes/ week. See Figure 2.

The average score of the Empathetic Response survey for Experimental group 1 is 5.33 (5,5, and 6). The average score of the Empathetic Response survey for Experimental group 2 is 2.33 (2,2, and 3). See Figure 2.

Figure 2: The Correlation Between Time and Empathetic Response Score



Conclusions

The result of this study holds significance for the education system as a whole and for individual families with school age children. According to Staff (2011) the annual spending on public education in the United States was \$806.9 billion, that is \$7,743 per child. This amount is a colossal considering that the United States is third to last in math test scores and fourth to last in science test scores (Staff, 2011). When it comes to literacy of children age 15 and up the United States has a 99% literacy rate (Staff, 2011). The current curriculum in the United States focuses largely on how to score well on standardized tests rather than improving learning outcomes. These tests are used to judge

children, teachers and schools in order to delegate spending. Not only is this form of teaching not retained by students, it is not beneficial to their learning outcomes or development. Never before have standardized testing scores had such a prominent role in education (Staff, 2011). According to Khon (2000) the United States is one of the few countries that gives formal exams such as this to children as young as six "despite the fact that almost all experts in early childhood education condemn this practice" (p.1).

The research from this study shows that reading fictional literature is positively correlated to increased empathy in children. Rather than require schools to comply to standardized testing, the government needs to implement a curriculum that supports children's development into autonomous adults. This can be done by adding fictional literature, and empathy focused discussion, into elementary and middle school curriculum. This will not only increase empathy later in life but also help children understand one another thus promoting prosocial behavior. Until this change occurs parents are encouraged to incorporate fictional literature into their children's everyday life through bed time stories or adding it to suggested reading lists. According Margaret Spellings of the U.S. Department of Education (2000), "Other than helping your child grow up healthy and happy, the most important thing that you can do for them is to help them develop their reading skills. It is no exaggeration to say that how well children learn to read affects directly not only how successful they are in school by how well they do throughout their lives" (p. 4).

While this study revealed a large gap in the current public education system in providing children with the education needed to support a healthy development of empathy and into adulthood more supplemental research must be done. This study revealed that reading fictional literature for six or more hours per week increased an empathetical response in children but it was unable to supply a mechanism for this occurrence. Further studies must be done in order to find what aspects of fictional literature specifically induce an increased empathetic response. This can be done by studying how children react to different aspects of the stories. For example, does empathy peak at the part of a story when the character feels guilt for their actions, when they help another character solve a problem, etc. A study such as this would provide more information as to why this phenomenon occurs.

Bullying in the United State is an epidemic. According to Barbara Coloroso (2008) 86 percent of children ages twelve to fifteen are bullied in school "making bullying more prevalent than smoking, alcohol, drugs, or sex among the same age group" (Gourneau, 2012, p. 117). The result of bullying is low self-esteem, body dysmorphic disorders, and adolescent and childhood suicide. A lack of empathy and inability to judge the harm that one inflicts on others is grossly contributing to the epidemic. By teaching children empathy from a young age through literature and empathy-based discussion it is possible to decrease these effects by increasing children's awareness of others feelings. By doing so schools will become a safe environment for all students to foster their education and grow into empathetic adults. This begins by encouraging parents to expose their children to fictional literature and promote reading at home.

In 2000, and again in 2002 and 2005, the U.S Department of Education released a booklet titled *Helping Your Child Become a Reader*. The purpose of this booklet is to teach parents how to foster a curious mind in children and increase interest in reading. In order to do so, Spelling urges parents to promote children's language skills and encourage interest in reading by talking with and listening to one's child, reading with ones' child, helping one's child to learn about books and print, encouraging early writing efforts, and preparing one's child to be successful in school (Spelling, 2000). According to Spelling reading books with children is one of the most relevant activities parents can encourage to promote their children to becomes readers. The government and media need to release more information such as this pamphlet by the Department of Education in order to teach parents about the positive effects of reading as a whole and the positive effects on empathy of reading fictional literature. The government also needs to change the curriculum in public schools to focus less on teaching in order to achieve standardized testing scores and more on education. This involves incorporating more literature and empathy-based discussion. As this study has shown, this will increase empathy in children who partake, and in turn have a positive impact on the development of society.

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Supplemental Images

READING FREQUENCY Survey Supplemental Image 1

Volunteer #:

This survey is to be completed by parents/guardians of volunteers. Please circle the answers below that correspond to your child's reading habits.

1. How many hours per week does your child read at home for school?

1 or less	2-5	6 or more
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2. How many hours per week does your child read at home for pleasure?

1 or less	2-5	6 or more
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3. How many hours total does your child read per week?

(add answers for question 1 and 2)

1 or less

2-5

6 or more

4. Does your child read mostly
fictional or non-fictional literature?

Fictional

Non-Fictional

EMPATHETICAL RESPONSE Survey
Supplemental Image 2

Subject #

Group #

1. How does the Ugly Duckling feel after his brothers and sisters abandon him?
 - a. Indifferent
 - b. Sad
 - c. Angry
 - d. Happy

2. How did it make you feel after the Ugly Duckling's brothers and sisters abandoned him?
 - a. Indifferent
 - b. Sad
 - c. Angry
 - d. Happy

3. How does the Ugly Duckling feel after he finds his new family?
 - a. Indifferent
 - b. Sad
 - c. Angry
 - d. Happy

4. How did it make you feel after the Ugly Duckling found his family?
 - a. Indifferent
 - b. Sad
 - c. Angry
 - d. Happy

5. Do you think the Ugly Duckling's brothers and sisters had a reason to be mean to him?
 - a. Yes
 - b. No

Tell the subject that the Ugly Duckling's siblings made fun of him because someone had also made fun of them and hurt their feelings.

-
6. Do you think that the Ugly Duckling should forgive his brothers and sister?
 - a. Yes
 - b. No