

NEUROPSYCHOLOGY FOR KIDS: CONCUSSIONS

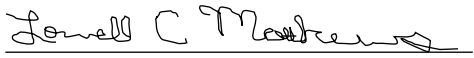
By
Fallyn Hippert

A thesis submitted to the University Honors Program at Southern New Hampshire University to
complete HON 401, and as part of the requirements for graduation from the University Honors
Program

Manchester, New Hampshire
April 2020

Approved by:

(Faculty Mentor)



(University Honors Director)

Abstract

The overall objective of this Southern New Hampshire's honors thesis is to create and solve a problem or project that incorporates a topic that challenges the individual but also works to make a difference in the world, no matter how big or small. Specifically in engaging in a course at this University, I have found myself in very challenging classes based on difficult topics. In the spring of 2019 I was taking a biopsychology class and a lifespan development class that tend to overlap sometimes in topics. I found various topics and subtopics in biopsychology to be hard to understand, apply, and explain myself. Therefore I have created a project that involves explaining biopsychology topics in a children's book for the ages including in Piaget's concrete operational stage, which is ages 9 to 12 years old, which incorporates what I have learned from lifespan development courses (Cherry, 2019). In this stage children can think logically and perform mental operations about concrete events. However, conceptual, theoretical and speculative thoughts have not developed in children so far. Based on a study measuring the ability of children in the concrete operational categories ability to understand Chemistry, Biology, and Physics to some extent in learning general science (Ghazi & Ullah, 2015). Therefore this study shows that children in the concrete operational stage have the ability to understand topics related to biopsychology to some extent but not fully. Therefore I believe creating a children's book about these topics, in a language and in pictures that are easy to follow for their age can help to better the ability to understand such concepts. Concepts that even college students and adults struggle to fully understand.

Keywords: Concussion, Biopsychology, Lifespan development

Introduction

Over the past few years, communications about concussions have multiplied in popular media in an attempt to help parents understand this condition. However, important misunderstandings and misinformation are often found, making it hard for parents and sports coaches to explain to children what exactly is a concussion. Reports have shown that there are MILLIONS of concussion in the United States each year (Simon, H. B., & Bernstein, H. H.). One group especially at risk for concussions, children aged 10-19, may benefit greatly from revised information presented in a format that is enjoyable and easy to understand (Blue Health Intelligence, 2016). Therefore, the objective of this project is two-fold. First, We collected information and data about mild traumatic brain injuries or (concussions). This content was then adapted in a book format at a level of understanding for children aged 9-12 (Cherry, 2019). We then put the information into book format in hope to be able to teach children about concussions. Then, using a survey administered through Qualtrics, we will collect feedback from parents recruited from Southern New Hampshire University and affiliates with New Hampshire Youth Sports Programs who may have children in the target age group. This survey will ask questions regarding specific aspects, such as information about the reader, book details and formatting, and what, if any, information have they learned. Data analyses will include both quantitative and qualitative approaches in order to inform us on what aspects of the book parents liked most. This will help us equip parents to communicate more easily with their children about this popular topic.

The Book

The book itself is about 30 pages with short passages per page. Each page holds important information pertaining to concussions in general as well as their risk, parts of the brain, prevention, treatment, symptoms, and signs. The book follows the storyline of Jack, a kid who gets a concussion and what to learn more about it and understand concussion with the help

of a doctor, Dr. Brain. The images below are taken directly from the book “Neuropsychology for Kids: Concussions” By Fallyn Hippert.

You or one of your friends have probably hit your head before. Most of the time you feel okay afterwards. Sometimes it may be more serious because some head injuries are worse than others.

This leads us to the topic of concussions (con-cush-shn). A *concussion* is an injury to your brain. Concussions occur more often than people think. Just ask Jack about his story.

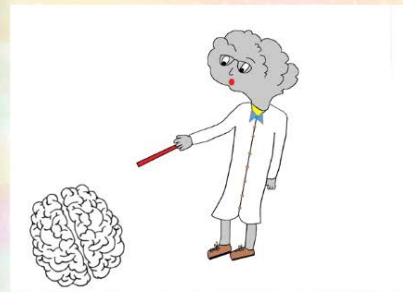
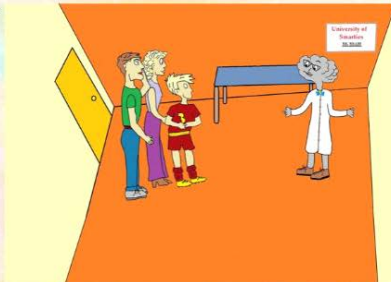


This is Jack, who is a star at soccer. But one game, the ball hit him on the head and he fell down. When his coach came to check up on him, Jack said his head hurt. His coach tried to ask Jack what day of the week it was and where he lived but Jack could not remember. Jack also said his vision was weird. When his coach held up two fingers, Jack said he saw four fingers. Jack's coach then realized it was probably a concussion and he let Jack's parents know right away.



Since the injury happens inside your head, it is hard for Jack, his parents or his coach to be sure of what is happening. He would need to see to a doctor to get looked at.

Jack and his parents then went to the doctors to get a little more information about concussions. That is when they met the famous Doctor Brain.

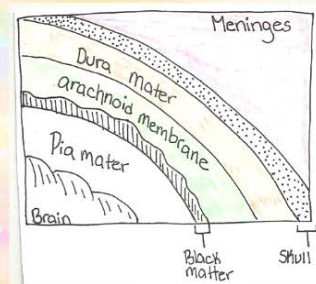


Doctor Brain explained to Jack and his parents that a concussion is a trauma (tra-ma) induced injury that can change how you think and feel. It can also make you feel confused and cause you to lose your memory. (Simon and Bernstein, 2019)

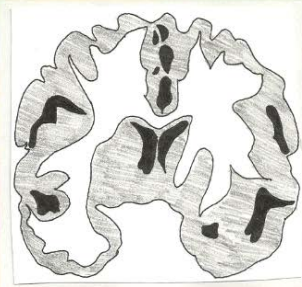


Jack isn't sure he understands what happens *inside* his head. So, Doctor Brain tells Jack "You already know of the big bone that covers our brains, called the skull. But the skull is not the only thing protecting your brain. Actually, your brain is bathing in a substance that looks like jelly that we call *cerebrospinal* (ser-re-bro-spinal) *fluid*. Both your brain and the jelly are kept inside your *meninges* (men-in-g-es). This is a protective tissues that surround the brain and spinal cord that runs down your back." This was all new information for Jack and he couldn't wait to learn more about his own brain.

Jack asked Doctor Brain "You say meniiliings. How many do we have?". Doctor Brain said, "Well, there are three different layers: the *dura mater*, the *arachnoid membrane* (ar-rack-noid mem-brain) and the *pia mater*. The *dura mater* is the tough solid layer. The *arachnoid* layer is a web of fibers that covers the brain. And the *pia mater* is a sac or bag that is flexible to hold fluids."



Doctor Brain pointed out that our brains are pinkish and squishy, but that the brain also has different types of matter that we can see on a test called an MRI. It has *grey matter*, *white matter*, and *black matter*. In the MRI, anything that appears black is the jelly-like liquid we talked about earlier. What appears to be grey is like the bark to a tree. It is what is on the outside. What you see as white, is similar to the inside of a tree.



The parts that are white are like millions of cables that help us connect our brain to the rest of our body. Like a T.V. to a cable box.

Jack asked "What are all those curves in the brain that make the brain look like a crazy roller coaster?"

Doctor Brain responds "When you are at the top of a roller coaster, we call this the *brain gyrus (ji-rus)*. It is the top fold of the brain. When you are at the bottom of a roller coaster it is called the *sulcus*. When you get a concussion, the force of the ball hitting your head will travel down from the gyrus deep into the sulcus."



Jack was on a roll he couldn't stop asking questions: "What about the cables? Are they only in my head? Or are these like my nerves all over my body?"



Doctor Brain told Jack about his nerves and tracts. He said "imagine that you stubbed your toe on your bed. Your nervous system would take the sensation of pain (ouch!!) and send a message along your nerves. These are like highways that send information from your body to your brain. When the information gets in your brain, it will travel along tracts to different parts of your brain. One part might know that you stubbed your right foot. Another part might tell you that there is pain there. Yet another part might tell you that you don't like pain. All these parts are connected by the tracts in your brain."

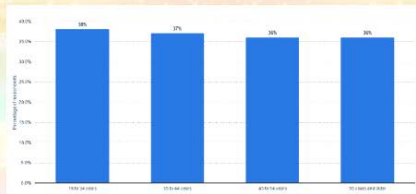
Jack tried to imagine a bunch of highways circling around in his head. That is when Doctor B said "In your brain you also have *Neurons (ner-ons)* and *glial (gle-al) cells* that are also a part of the central nervous system. Neurons are the main cells in the nervous system (which is your brain and spinal cord together). They are responsible for collecting sensory information, processing information, and sending appropriate output. There are more glial cells than there are neurons. They are responsible for maintenance, supporting the activity of the neurons and modulating the activity." Jack could not believe how much went on in his brain.



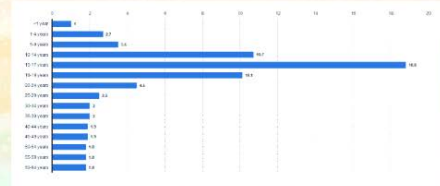
Jack looked at Dr. B for a minute. Then he asked: "So, what does my brain do? Is it true that we only use a portion of it?" Doctor Brain chuckled and said: "The brain is like our control center that also helps with simple things like seeing, or smelling breakfast in the morning. Our brain helps us with everyday activities. Like doing a puzzle, playing sports, reading books. Our brain also can help us think and have feelings like happiness or sadness. It is always "on" and working. All of it!"



Jack continued, "I bet with all this information people must know a LOT about concussions". Doctor brain said, "Actually no, many people do not know enough about concussions". Then doctor brain shared a graph with Jack.



After showing Jack the graph Doctor Brain explained what it meant. "From the graph above you can see that there are a few different bars. The higher bars are people who are more confused about what a concussion is. At the bottom of the graph you can see what ages of people find concussions the most confusing". (Statista)



Doctor B went on to show Jack a second graph. Doctor B said, "in this graph, Kids like you, between the ages of 10-19, get the most concussions. Getting a concussion at your age can be very harmful to your brain! It makes it harder for your brain to develop when it keeps getting hurt. Like how hard it is to get better at soccer if you keep hurting your foot" (Statista).

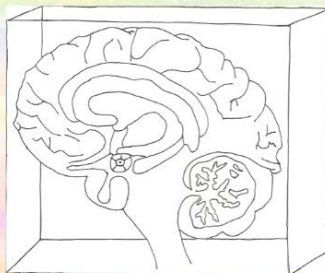
Jack did not realize so many other people were confused about concussions. Jack turned to Doctor Brain and asked, "So, how often do people hurt their heads?" Doctor B shared with him that "reports have shown that there are MILLIONS of concussion in the United States each year" (Simon, H. B., & Bernstein, H. H.). Jack was shocked, he had never heard such a high number!



Doctor brain tried to explain to Jack more about concussions themselves. He said that "concussions are not like getting a light bump on the head. Doctors, like me, used to think that it was like a bruise, but on your brain. It turns out, it's more complicated than that. You remember those tracts in the white matter of your brain, the cables between the tv and the cable box? When you get a concussion, these big cables stretch and bend and twist in a way that's bad for them."



But Doctor Brain explained to Jack that a concussion is not only the stretching of cables but that it is also the way your head moves from the impact of whatever hit his head. Doctor B then said, "Your brain inside your skull is like having your brain in a little box. There is some room for it to move around but not too much. Doctors like me use to think concussions were because your brain would hit the sides and edges of the box. But after some research Doctors think concussions could be because of the rotation of your head".



Jack, thinking about what Doctor Brain said then asked, "Well does it matter which way your head moves?" Doctor Brain the exclaimed that "Through research scientists noticed that head rotation from left to right is more dangerous than a front to back motion."





Jack rubs his head and asks Dr. Brain about his weird vision. "Why did I see four fingers instead of two? Does every person who gets a concussion see things weirdly like me?"

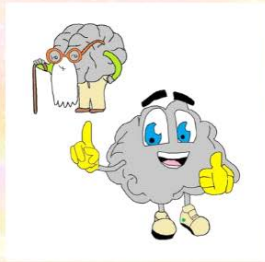
Dr. B explains that not all people get the same symptoms. He also said that "we can't predict which one of the tracts, or cables, will stretch the most. We know that these tracts all pass through a deeper part of the brain called the corpus (core-pus) callosum (cal-los-um). This is a big bridge that connects the left side of your brain to the right side. That means when you get hit on the head, not every cable will be injured. So while Jack may be confused and having a hard time seeing things clearly, his friend Sarah may vomit and have a hard time talking".



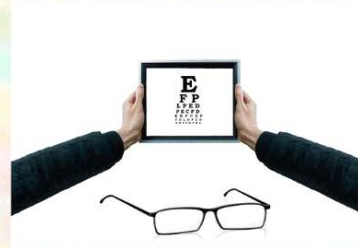
Jack, still a little confused, asks, "What kind of other things do people feel when they get a concussion?" Dr. Brain tells Jack that "Some signs that you have a concussion could be having headaches, dizziness, being tired, having trouble seeing, being confused, not being able to sleep, or maybe light and sounds bother you. You may also have a hard time with talking or listening. Other symptoms could include you just feeling a little funny. You may be more emotional than before like maybe you're cranky or sad. You could even vomit because of a head injury (YUCK!)".



Doctor Brain then reminded Jack, "Remember when I told you that millions of people get concussions a year in the United States?" Jack responded "Yes". Doctor B continued, "Many concussions happen when you play games or sports with your friends, like you got playing soccer. Reports show that about 300,000 people get mild concussions from playing sports every year". Jack was as stunned by this as he was hearing that millions of people get concussions each year.

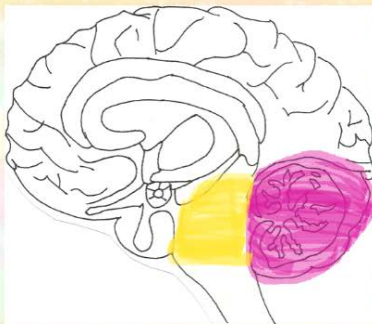


After all this, Jack had a drink of water. Then he asked: "If you can't see my brain, how do you know I have a concussion?" Doctor Brain answered: "I can perform a variety of tests to examine your balance, vision, and memory, coordination, and sensation. I can especially look at regions and parts of the brain affected by these functions".

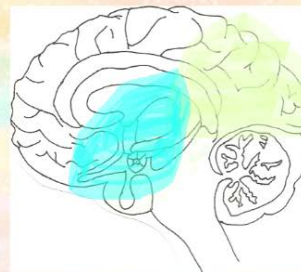


Jack then asked, "Do only kids get concussions then?" Doctor B said "No, concussions can also happen to your grandma or grandpa. Many times it happens to older people because they fall. Or anyone could get a concussion from a car if you get into an accident, so be safe and always wear a seatbelt!"

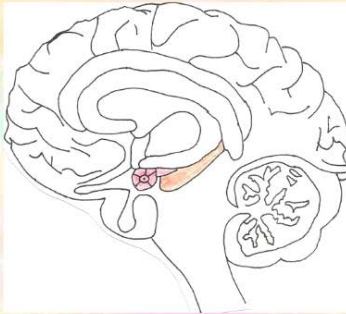
Doctor Brain explained that he could perform these tests to look at your cerebellum (ser-a-bell-um) or pons, which are responsible for learning and coordinating movements.



Or he may be looking at your occipital (oc-sip-it-tal) lobe and temporal (temp-or-al) lobe that have some partial responsibility in vision.



Or he could even look at your *hippocampus* (hip-po-camp-us) or *amygdala* (am-ig-da-la) which are involved with memory and emotion.



Jack then questioned, "Does everyone have to take the same kind of tests?"



Doctor Brain told Jack, "Many famous athletes like my favorites Joel Embiid and Serena Williams, have to take a "base test" where they do fun memory and balance test while their brain is healthy so that if they do hurt their heads they can know how badly". Doctor Brain also told Jack that he could have them take a CT or MRI which helps doctors to get a better look at the brain itself.

Jack finally asked Dr. B, "So how can I get better?" Doctor brain told him "The best way is to rest because healing like for a bruise takes time and to spend limited time looking at screens, anything up close, and to wait until he feels better to play with his friends again."



Doctor Brain goes on to tell Jack, "Symptoms must be resolved before returning to physical activity. Slow return allows the brain to heal" (Schafer, 2019).

With all that Jack has learned so far about the human brain and concussions, he asks, "Well, how do I prevent myself from getting another concussion if I still want to play soccer and play with my friends?"



Doctor B. responds, "Scientists believe that it may be possible to prevent a concussion if it were possible to get the brain moving in the same direction as your head instead of in the opposite direction".

Doctor Brain also tells Jack that "Researchers in a country called Sweden have created a neck collar with sensors to detect when you are likely to fall, like an airbag like a car" (Camarillo, 2016).

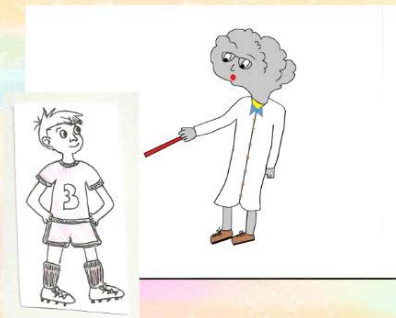


Scientists also believe that better test standards for testing safety products may help in prevention. At the moment, bike helmets and average standard football helmets only prevent skull injuries not concussions. Whether you are out riding your bike with your friends or playing sports, better helmets could help in preventing a brain injury (Camarillo, 2016).



To help prevent concussions some sports like football and soccer have changed the rules. Now kids play flag football until a certain age. In soccer you can not head the ball until a certain age. This is so that you don't accidentally hit your head while playing with your friends.

"Now that I know how much a concussion can hurt my brain, I will definitely be more careful. After all this my brain is pretty spectacular!" Jack and Dr. Brain laughed.



Glossary:

Amygdala- is involved in learning and expressing emotions

Black Matter- is another name for the cerebrospinal fluid present around the brain

Central Nervous System- include the brain and spinal cord, which together mediate behavior

Cerebellum- is a major brainstem structure specialized for learning and coordinating movements and assists the cerebrum in generating many behaviors

Cerebrospinal Fluid- a jelly like liquid that the brain bathes in, it is also one of the protective layers of the brain

Concussion- an injury to the human brain where brain tissue is stretched

Glial Cells- outnumber the neurons, and are responsible for maintenance, supporting the activity of the neurons and modulating the activity

Grey Matter- is a section of the nervous system composed of cell bodies and capillaries

Gyrus- is the top folds of the brain

Hippocampus- is involved in memory formation, memory retrieval, and stress regulation

Meninges- are layers of protective tissue that encases the brain and spinal cord

Nerve- A large collection of axons coursing together **outside** the central nervous system

Neurons- are the primary cells of the nervous system, responsible for collecting sensory information, processing information, and sending appropriate output

Occipital Lobe- is responsible for visual functions

Pons- a small part of the brain the helps to coordinate basic movement and posture

Sulcus- is the inside folds of the brains

Temporal Lobe- is responsible for visual, auditoral, and gustatory functions

Tract- a large collection of axons coursing together **in** the central nervous system

Trauma- a physical injury

White Matter- is a section of the central nervous system composed of fatty never fibers connecting regions of the central nervous system

References:

Camarillo, D. (April, 2016). Why helmets don't prevent concussions- and what might. [Video File].

Retrieved from

https://www.ted.com/talks/david_camarillo_why_helmets_don_t_prevent_concussions_and_what_might?language=en

Robinson, R., & Davidson, T. (2016). Concussion. In Gale (Ed.), *Gale encyclopedia of children's health: Infancy through adolescence* (3rd ed.). Farmington, MI: Gale. Retrieved from <http://ezproxy.snhu.edu/login?url=https://search.credoreference.com/content/topic/concussion?institutionId=943>

Concussion and traumatic brain injury (TBI) in the U.S. In Statista- The Statistic Portal. Retrieved September 24, 2019, from <https://www.statista.com/study/45170/concussion-and-traumatic-brain-injury-in-the-us/>

Schafer, E. D., PhD, & Bull, A. W. D. A. (2019). Concussion. *Magill's Medical Guide (Online Edition)*. Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site>

Simon, H. B., & Bernstein, H. H. (2019). Protect your brain from a concussion. In Harvard Health Publications (Ed.), *Harvard Medical School commentaries on health*. Boston, MA: Harvard Health Publications. Retrieved from http://ezproxy.snhu.edu/login?url=https://search.credoreference.com/content/entry/hhphoh/protect_your_brain_from_a_concussion/0?institutionId=943

Pixabay free photos

Drawings by Lori Hippert and Alyssa McCarthy

Survey and Results

After the book was completed, I created a survey, approved by the IRB, to ask parents with kids in New Hampshire Youth programs and staff and faculty at Southern New Hampshire University various questions about themselves, the book, and their demographics. Questions from the survey that I thought were important to pay attention to included 15 out of 36 questions.

These questions included:

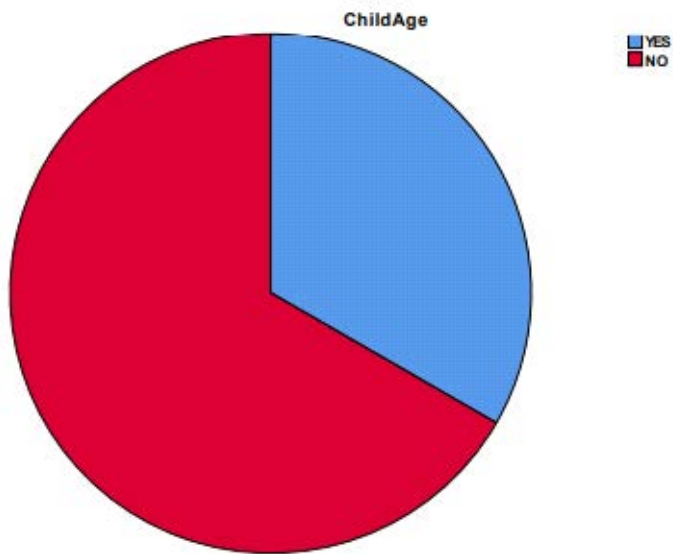
- My child is within the target age group of 9-12
- My child is currently engaged in some type of sport or activity
- My child has had a concussion before
- I am worried about the effects of concussions
- I am aware of resources regarding concussions
- I feel comfortable talking to my child about concussions
- Does your child express any interest in the human brain?
- Would you read this book with your child?
- Do you think your child would enjoy reading this book?
- Do you think your child would learn something from reading this book?
- The analogies given in the book helped explain what is going on in the human brain
- The analogies in the book made sense to me
- I would purchase this book for my child
- I would recommend this book to a child or another parent
- From reading this book I learned (Check all that apply):

Number 15 had 8 possible boxes you could check off to explain what each individual person has learned from reading this book. The 8 responses included:

- About symptoms that are related to concussions
- About parts of the human brain
- About what protects my brain from being injured
- About how parts of my brain work
- That concussions are not a bruise on the brain
- How someone can treat a concussion
- How someone can prevent a concussion
- Other (with the ability to add in what the “other” is to the reader)

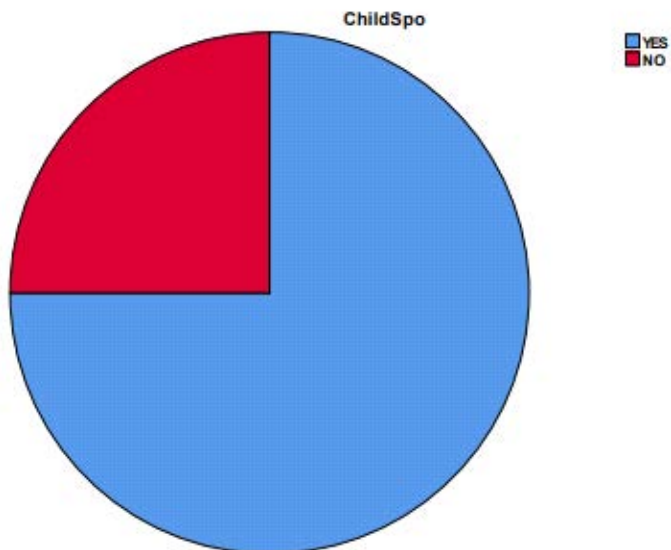
The results of each question goes as followed

Question 1:” My child is within the target age group of 9-12”



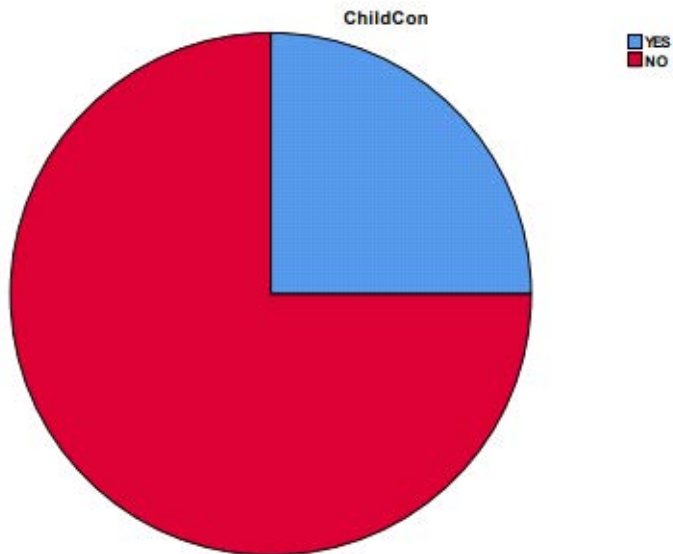
This pie chart showed that most participants in the surveys did not have a child within the target age group of 9-12. Only 4 out of 12 participants had a child between the ages of 9 and 12.

Question 2: “My child is currently engaged in some type of sport or activity”



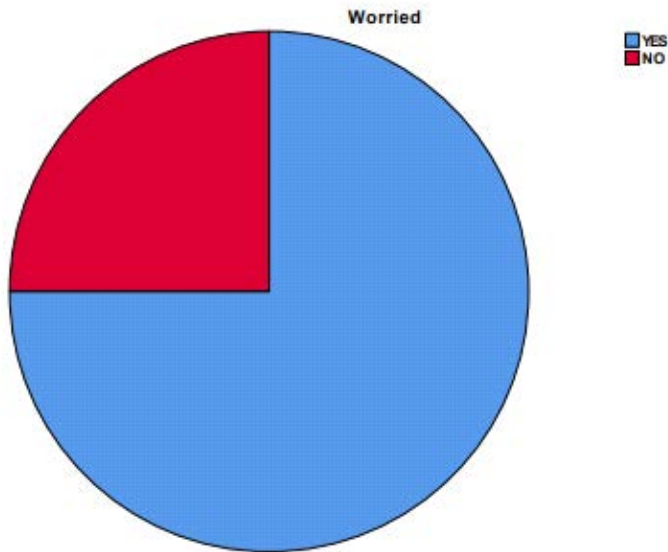
This pie chart shows that most people had a kid who played in some type of sport. More specifically, 9 out of 12 participants answered yes.

Question 3: “My child has had a concussion before”



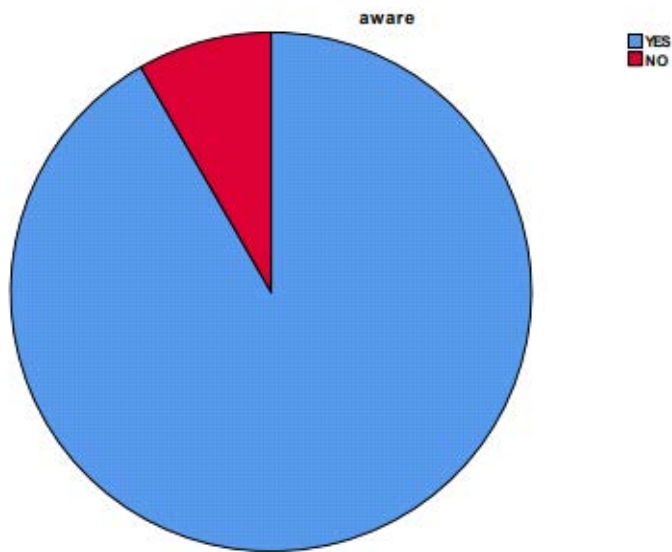
The chart above shows that many children of the participants (9 out of 12) had *not* had a concussion before

Question 4: “I am worried about the effects of concussions”



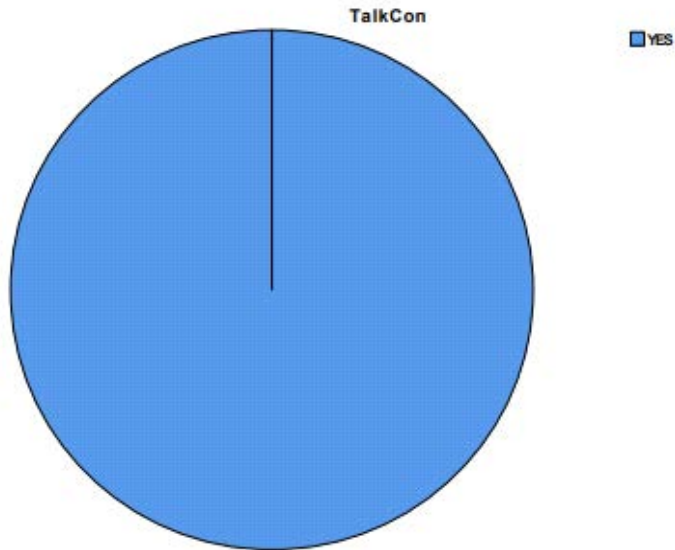
Question four pie chart shows that at least three of the participants were not worried about the effects of concussions but majority of 9 are worried about what conclusion can do to the brain,

Question 5: “I am aware of resources regarding concussions”



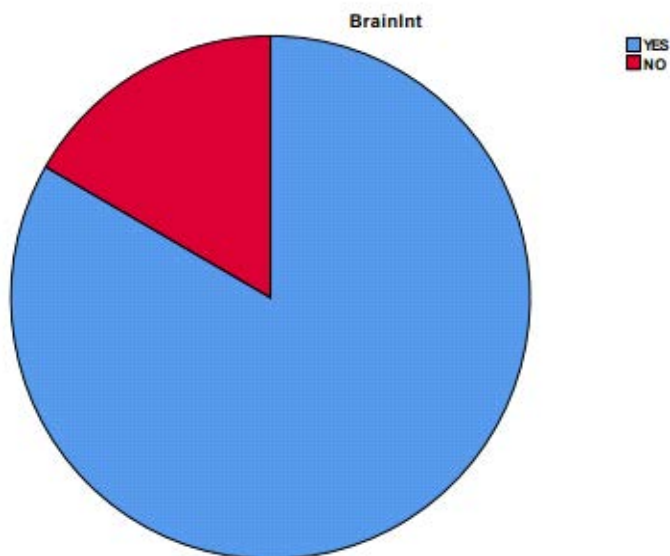
Almost every participant said that they are aware of resources that obtain information concerning concussions.

Question 6: “I feel comfortable talking to my child about concussions”



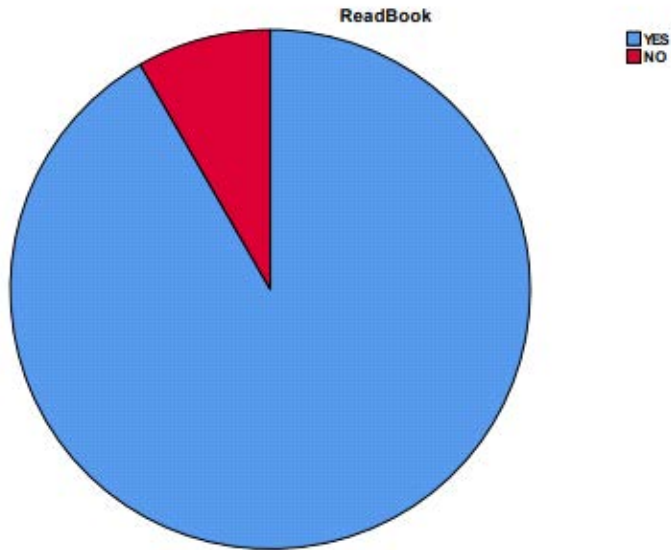
Every single participant answered that they were comfortable talking about concussions with their child.

Question 7: "Does your child express any interest in the human brain?"



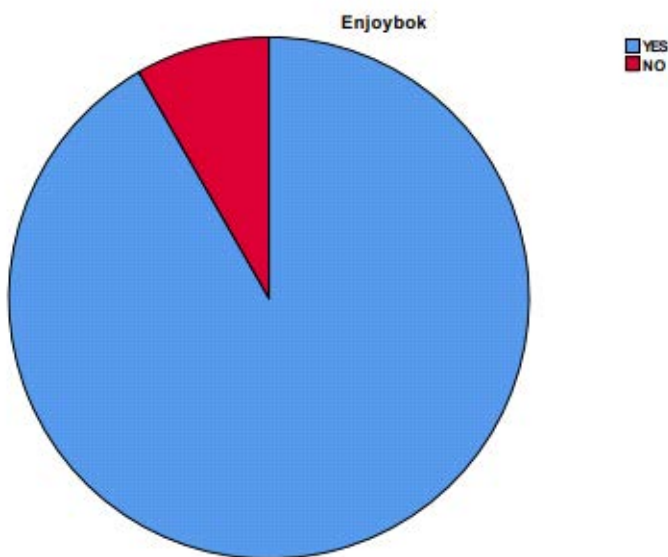
Most participants, 10 out of 12, said that their child had expressed some interest in the human brain.

Question 8: "Would you read this book with your child?"



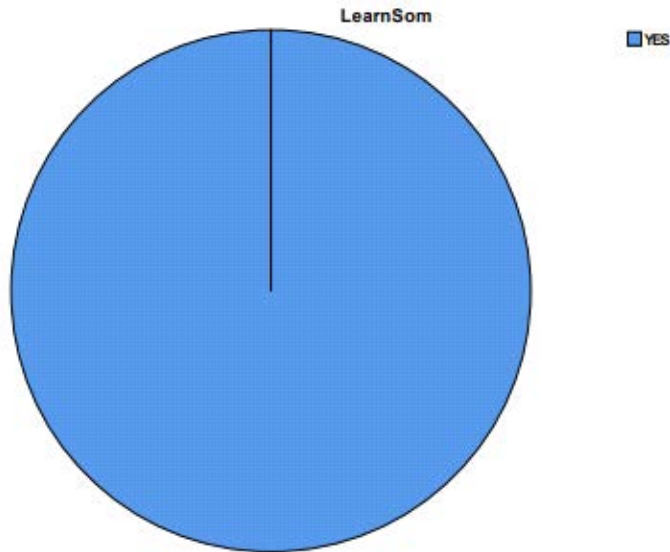
Only 1 participant of his survey said that they would not read this book with their child, however the other 11 participants said that they would.

Question 9: “Do you think your child would enjoy reading this book?”



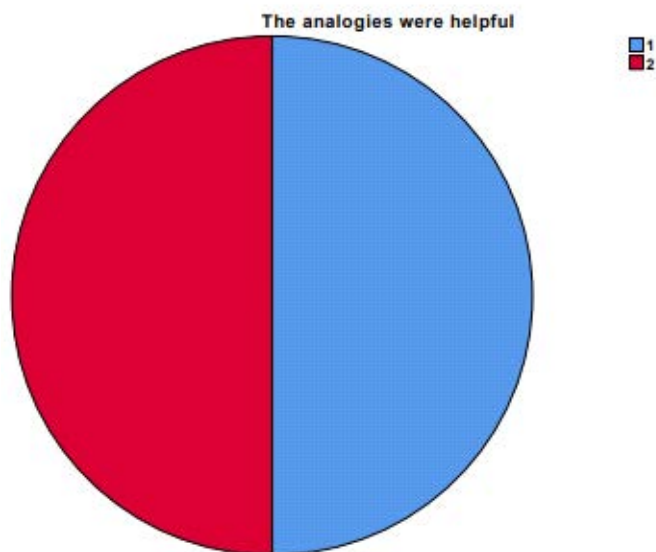
Almost every participant except for 1 had said that their child would enjoy reading this book.

Question 10 “Do you think your child would learn something from reading this book?”



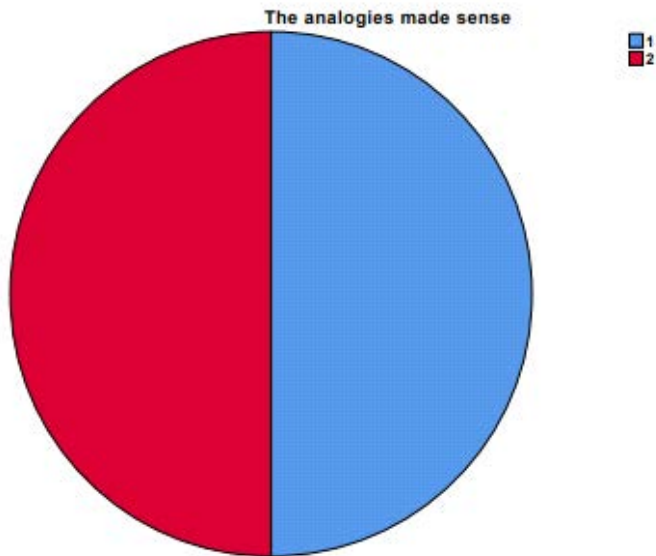
Every participant in this survey answered that their child would learn something from reading this book.

Question 11: "The analogies given in the book helped explain what is going on in the human brain"



In this section of the survey, participants could respond to the question by a scale. This scale reads as followed, Strongly agree = 1; Agree = 2; Somewhat agree =3; Neither agree or disagree =4; Somewhat disagree = 5; Disagree = 6; Strongly disagree = 7. In the pie chart above you can see that half the participant strongly agreed that the analogies were helpful and the other half agreed that the analogies were helpful

Question 12: “The analogies in the book made sense to me”



In the pie chart above you can see that this question had the same results as the other question about the analogies in the book. Half the participants strongly agreed that the analogies made sense and the other half agreed that the analogies made sense.

Question 13: “I would purchase this book for my child”



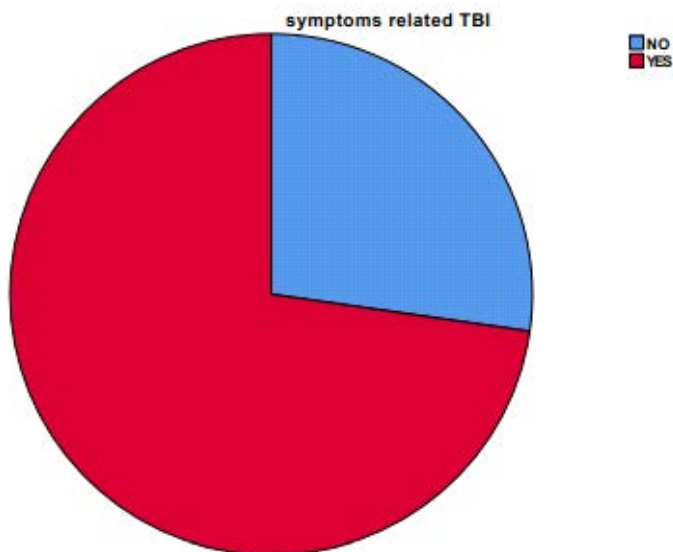
Question 14: “I would recommend this book to a child or another parent”



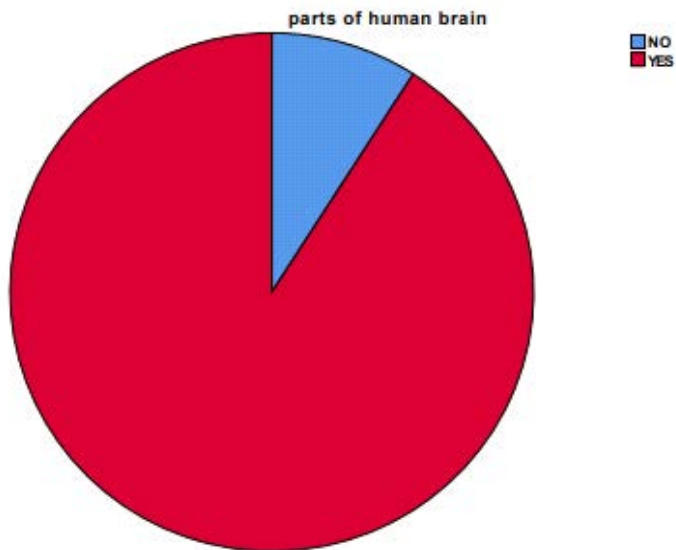
Question 15 “From reading this book I learned (Check all that apply):”

Number 15 had 8 possible boxes you could check off to explain what each individual person has learned from reading this book. The 8 responses included however no one ever checked the box for the option “other” therefore there is no pie chart for the answer. The other possible boxes to check are as followed with the respective pie charts:

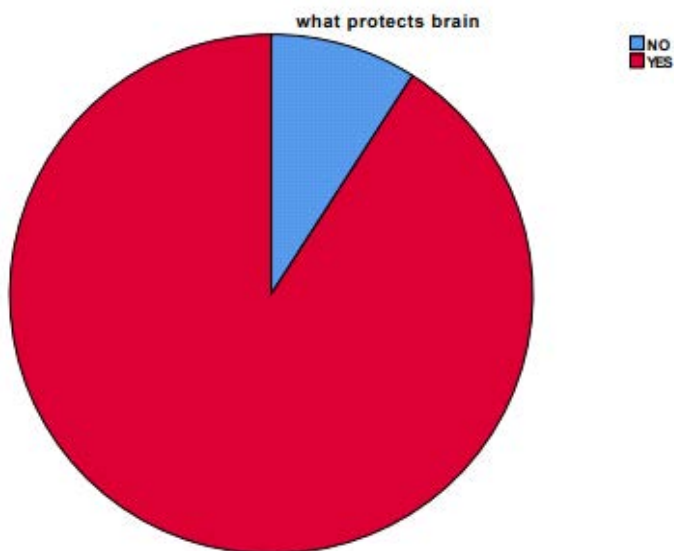
About symptoms that are related to concussions: 8 of 12 checked off the box saying they learned about the symptoms related to concussions while 3 did not check this box and 1 response was missing



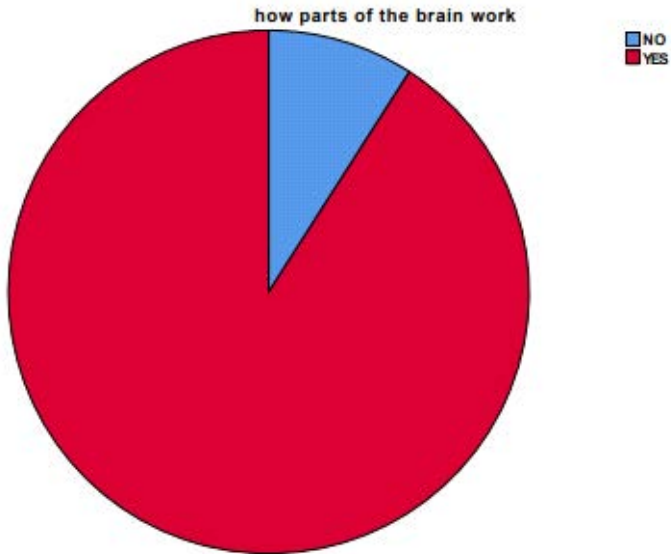
About parts of the human brain: 10 of 12 checked off the box saying they learned about parts of the human brain while 1 participant did not check off this box and 1 response was missing



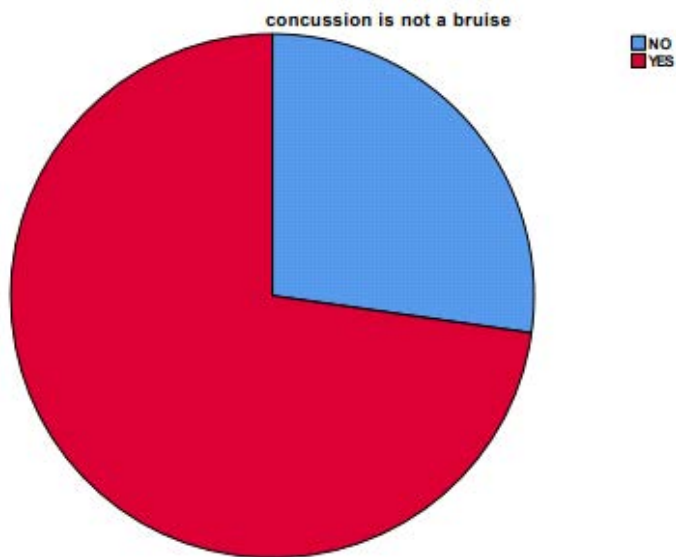
About what protects my brain from being injured: 10 of 12 checked off the box saying they learned about what protects the human brain from being injured while 1 participant did not check off this box and 1 response was missing



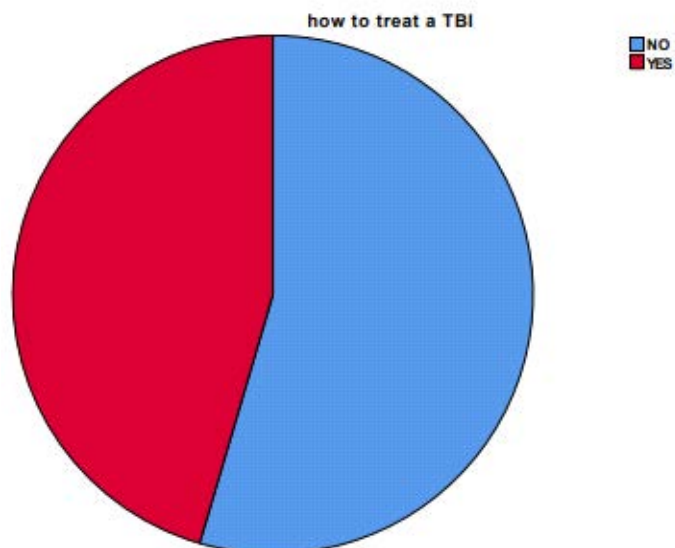
About how parts of my brain work: 10 of 12 checked off the box saying they learned about how parts of the human brain work while 1 participant did not check off this box and 1 response was missing



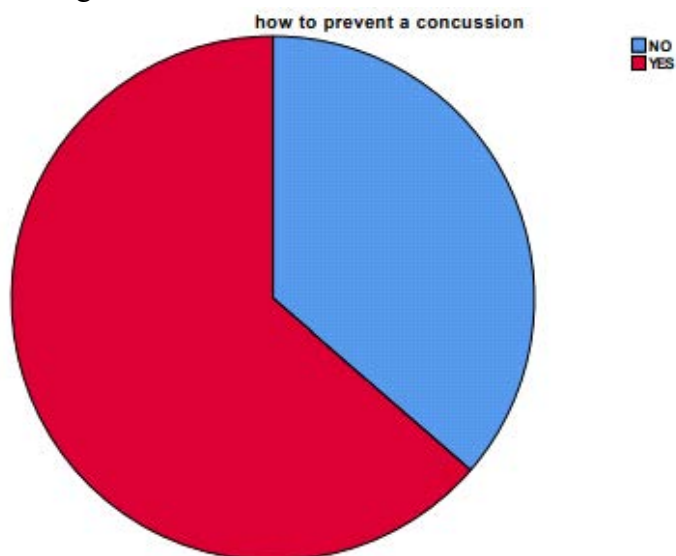
That concussions are not a bruise on the brain: 8 of 12 checked off the box saying they learned that a concussion is not a bruise on the brain while 3 did not check this box and 1 response was missing



How someone can treat a concussion: 5 out of 12 checked off the box saying they learned about how they can treat a concussion while 6 did not check off this box and 1 response was missing



How someone can prevent a concussion: 7 out of 12 checked off the box saying they learned about how they can prevent a concussion while 4 did not check off this box and 1 response was missing



Then I decided to see if there was any connection to answers due to demographics. So I looked at and compared education, income, ethnicity, age, and gender. I wanted to see if I had a diverse population or not. I also thought it was important to see if the demographics had any correlation to the results and how the questions were answered.

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	29	1	8.3	10.0	10.0
	32	1	8.3	10.0	20.0
	41	1	8.3	10.0	30.0
	42	1	8.3	10.0	40.0
	45	1	8.3	10.0	50.0
	48	1	8.3	10.0	60.0
	51	1	8.3	10.0	70.0
	53	1	8.3	10.0	80.0
	55	1	8.3	10.0	90.0
	56	1	8.3	10.0	100.0
	Total	10	83.3	100.0	
Missing	System	2	16.7		
Total		12	100.0		

Income				
		Frequency	Percent	Valid Percent
Valid	0	2	16.7	16.7
	4	3	25.0	41.7
	5	2	16.7	58.3
	6	5	41.7	100.0
	Total	12	100.0	100.0

Edu				
		Frequency	Percent	Valid Percent
Valid	0	1	8.3	8.3
	5	3	25.0	33.3
	6	6	50.0	83.3
	7	2	16.7	100.0
	Total	12	100.0	100.0

Recommendations

Since completing the project, I noticed a few things I would have liked to change or redo if given the chance. First of all, the survey population was too small. I would have liked to get about 30 at the minimum for collecting data about my book. I would have also liked to have more illustrations in the book that were more cartoon like and where originally made. I think that would have given the book a better look. More original illustrations would have made “Neuropsychology for Kids: Concussions” look and feel like a book instead of a project. I also would have liked to open up the population to be more than just to ask parents with kids in New Hampshire Youth programs and staff and faculty at Southern New Hampshire University. I think

the variety would have shown me different results and different connections from the results.

Lastly, I believe that time was my friend. The more time I had, I could have collected more data to use in analyzing each part of my book.

Conclusion

What I wish to accomplish by creating this book is to educate children and their parents about concussions. The book includes a lot of information about concussions including its possible symptoms, parts of the brain and how they work, how to prevent concussions, how to treat them, or that a concussion is not a bruise of the brain like many have been told believed in the past. Millions of concussions occur per year in the United States alone (Blue Health Intelligence, 2016). Concussions can affect any age or gender or ethnicity. I believe it is important for people to truly understand concussions and what happens during a concussion. The human brain is truly a magnificent organ that we need to learn to protect and take care of.

References

- Ghazi, D. S. R., & Ullah, K. (2015). Concrete Operational Stage of Piaget's Cognitive Development Theory: An Implication in Learning General Science. *Gomal University Journal of Research*, 31(1), 78–89. Retrieved from <http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site> HYPERLINK
- ["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site) HYPERLINK
- ["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site) HYPERLINK
- ["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site) HYPERLINK
- ["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site) HYPERLINK
- ["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site) HYPERLINK
- ["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site) HYPERLINK

["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site) & HYPERLINK
["http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site"](http://ezproxy.snhu.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=112329453&site=eds-live&scope=site)scope=site

Blue Health Intelligence. (27 Sep. 2016.). Rate of concussion in the U.S. from 2010 to 2015, by age (per 1,000 members). In *Statista - The Statistics Portal*. Retrieved April 27, 2020, <https://www.bcbs.com/sites/default/files/2016-09/BCBS-HealthOfAmericaReport-Concussions.pdf>

Cherry, K (2 May, 2019). The Concrete Operational Stage of Cognitive Development. *VeryWell Mind*. Retrieved on April 27 2020 from <https://www.verywellmind.com/concrete-operational-stage-of-cognitive-development-2795458>

Concussion and traumatic brain injury (TBI) in the U.S. In Statista- The Statistic Portal. Retrieved September 24, 2019, from <https://www.statista.com/study/45170/concussion-and-traumatic-brain-injury-in-the-us/>

Simon, H. B., & Bernstein, H. H. (2019). Protect your brain from a concussion. In Harvard Health Publications (Ed.), *Harvard Medical School commentaries on health*. Boston, MA: Harvard Health Publications. Retrieved from http://ezproxy.snhu.edu/login?url=https://search.credoreference.com/content/entry/hhpho/h/protect_your_brain_from_a_concussion/0?institutionId=943

Camarillo, D. (April, 2016). Why helmets don't prevent concussions- and what might. [Video File]. Retrieved from https://www.ted.com/talks/david_camarillo_why_helmets_don_t_prevent_concussions_and_what_might?language=en

Robinson, R., & Davidson, T. (2016). Concussion. In Gale (Ed.), *Gale encyclopedia of children's health: Infancy through adolescence* (3rd ed.). Farmington, MI: Gale. Retrieved from <http://ezproxy.snhu.edu/login?url=https://search.credoreference.com/content/topic/concussion?institutionId=943>

Schafer, E. D., PhD, & Bull, A. W. D. A. (2019). Concussion. *Magill's Medical Guide (Online Edition)*. Retrieved from [HYPERLINK](#)
["https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site"](https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site)[HYPERLINK](https://search.ebscohost.com/login.aspx?direct=true)
["https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site"](https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site) & HYPERLINK
["https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site"](https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site)db=ers HYPERLINK
["https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site"](https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site) & HYPERLINK
["https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site"](https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site)AN=86194009 HYPERLINK
["https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site"](https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site)

live&scope=site"& HYPERLINK

"https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site" site=eds-live HYPERLINK

"https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site"& HYPERLINK

"https://search.ebscohost.com/login.aspx?direct=true&db=ers&AN=86194009&site=eds-live&scope=site" scope=site