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Students' Change in Math Marks in Response to Taking a Computer Science Course

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Abstract

The question investigated is how would taking computer science in grade school affect high school success in math? The relevance of the experiment revolving around this question lies in Canadian students' math averages compared to the world and the ever-growing importance of technology in modern society. It is recorded that for the past few years average Canadian students' math marks are declining and lower compared to other countries with similar education quality (McMahon, 2014). Also, technology is playing an increasingly important role in present time, so an increase in understanding of it and how it works will give a greater understanding of the world. To find a possible verdict to this question, math marks were recorded of 20 grade 10 students; both their early grade 9 marks and early grade 10 ones. 10 of these students begin taking computer science in their grade 10 year while 10 did not, this will allow for analyzation of what exposure to computer science does. The results of the data collection show that the students who didn't take computer science improved an average of 1.4% in their math marks while the students who did take computer science improved an average of 6.25% in their math marks from last year; the students who took computer science improved 4.85% more than the students who did not on average. The implications of this data can range from many things, but it all stems from one main application; education. Implementing basic computer programming in elementary education would allow for greater understanding in math and improvement in averages across generations since that is what happened to the majority in the group of students' math marks who took computer science.

Introduction

This experiment analyzes the effects on students' math marks when learning/practising computer science. Data collected will be compared to change in math marks of students not learning computer science, both recordings of prior and during their grade 10 years. The purpose of doing this will be to see if learning computer science gives worthwhile benefits to overall logical thinking but specifically adequacy in mathematics. If the effect is negative, it will clear up possible misconceptions that coding involves the same parts of the brain as used in math. However, if the results show positive effects it could give a reason why computer programming should be pushed to be an addition to the education system.

Canadian students' math marks have been declining for the past few years and the curriculum itself

is being blamed for it (McMahon, 2014), so changes need to be made. Implementing computer science to the curriculum could introduce kids to an array of future career opportunities and provide a fun subject that could benefit them. Also because of the ever-growing importance of technology in modern society (Dishman, 2016), it would be logical to prepare the next generations in these useful skills. Therefore because of these reasons, this experiment is investigating how would taking computer science in grade school affect high school success in math? It is hypothesized that if computer science is taken in grade school, then average high school math marks will rise because math proficiency is prominent in good programmers (Parnin, 2014).

This is hypothesized because coding requires use of parts of the brain that handles problem-solving and computational thinking (Missio, 2017) and these skills are used in higher level math. Coding also provides a way to connect math to real-world context, which means students' success in word problems would be likely to increase.

Methods

Give a survey to 24 grade 10 students who take grade 10 enriched math and grade 11 computer science. (see below)

SURVEY

<u>1.) Do you enjoy learning computer science?</u>

a.) Yes, very b.) Not particularly c.) I dislike the course

<u>2.) Do you agree that coding needs you to problem solve critically and logically?</u>

a.) Yes, it makes me think critically and logically

b.) I don't notice any need to think critically during coding

c.) I think less critically during coding than normal

<u>3.) Do you think you're doing better in math compared to last year?</u>

a.) Yes, I've improved b.) No noticeable change

c.) Worse than before

<u>4.) Do you think there are many career opportunities in computer science?</u>

a.) Yes b.) Unsure c.) I don't think so

Once data is collected add up total number of answers for each question to calculate the percentage of students picking each choice/answer.

Get 10 grade 10 students' math marks from the first two math tests in grade 9, obtain from Edsby online. These students took enriched math both years and grade 11 computer science in grade 10. Next, get the average of the first two math tests in grade 10 from those same grade 10 students, obtain from report card. Average tests in grade 9 and then calculate percent change for test average in grade 9 to average in grade 10 for each and the average percent change from all 10 students.

Once completed get 10 different grade 10 students' math marks from the first two math tests in grade 9, obtain from Edsby online. These students must have taken enriched math both years and did not take

grade 11 computer science in grade 10. Get the average of the first two math tests in grade 10 from the new set of grade 10 students, obtain from report card. Average grade 9 tests of the new set of grade 10 students, calculate percent change for test average in grade 9 to average in grade 10 for each student and then find the average of all 10 students' percent changes.

In this experiment, the independent variable is the grade 11 computer science course. Students tested took enriched math in grade 9 and 10 but the difference between one of the groups and the other is that one took the grade 11 computer science course in grade 10 while the other did not. This allows for a clear and distinct difference letting conclusions to be made based on this major difference.

The dependent variable is the percent change in the average of the first 2 math tests in grade 9 compared to the first 2 math tests in grade 10. The dependent variable is measuring this for the group of students who took grade 11 computer science in grade 10 and the group that did not. These are searched to actually see the affect computer science has on math; to help answer the guiding question. Another dependent variable measured is the number of students taking the computer science course that enjoyed it and the most popular answers for each question in the survey. The number of student's choice per answer in the survey was recorded to analyze various qualitative data and see how subjects' feelings and opinions towards computer science are.

In this experiment, one of the controlled variables is that for both groups of students consisted the same students for each group for grade 9 and 10. This needs to be controlled or else there wouldn't be an accurate correlation. If one set of students were recorded for grade 9 and another for grade 10, the data could suggest drastic improvement or decline when in actuality it could be the varying skills in math between students. Another controlled variable for both groups is the taking of enriched math in both grade 9 and 10. This needed to be kept the same because different levels of math courses might teach differently or at a different pace/environment. If enriched math is taken both years it is reasonable to say the subjects' have accustomed to the style and environment that course has. Something else that is kept the same was the school the students went to in grade 9 and 10. This variable is controlled for the reason that overall average school math proficiency can differ from school to school and consistent base level education can be achieved easily if all the teachers and students are interacting in one place.

Results

Grade 9 Math Mark Test 1	Grade 9 Math Mark Test 2	Avg. of Both Grade 9 Tests	Avg. of First 2 Math Tests in Grade 10	% Change	Overall Average Change
71	74	72.5	87	+14.5	+6.25%
75	63	69	91	+22	
83	83	83	95	+12	
83	79	81	85	+4	
84	84	84	90	+6	
87	92	89.5	95	+5.5	
88	98	93	85	-8	
89	81	85	90	+5	
90	89	89.5	88	-1.5	
92	100	96	99	+3	

Table 1 - Students Who Took Grade 11 Computer Science in Grade 10's math marks and change

Grade 9 Math Mark Test 1	Grade 9 Math Mark Test 2	Avg. of Both Grade 9 Tests	Avg. of First 2 Math Tests in Grade 10	% Change	Overall Average Change
68	70	69	76	+7	+1.40%
71	91	81	89	+8	
74	68	71	81	+10	
80	79	79.5	85	+5.5	
84	100	92	96	+4	
84	86	85	88	+3	
86	93	89.5	84	-5.5	
90	96	93	88	-5	
92	100	96	87	-9	
100	100	100	96	-4	

Table 2 - Students who didn't take grade 11 computer science in grade 10's math marks and change

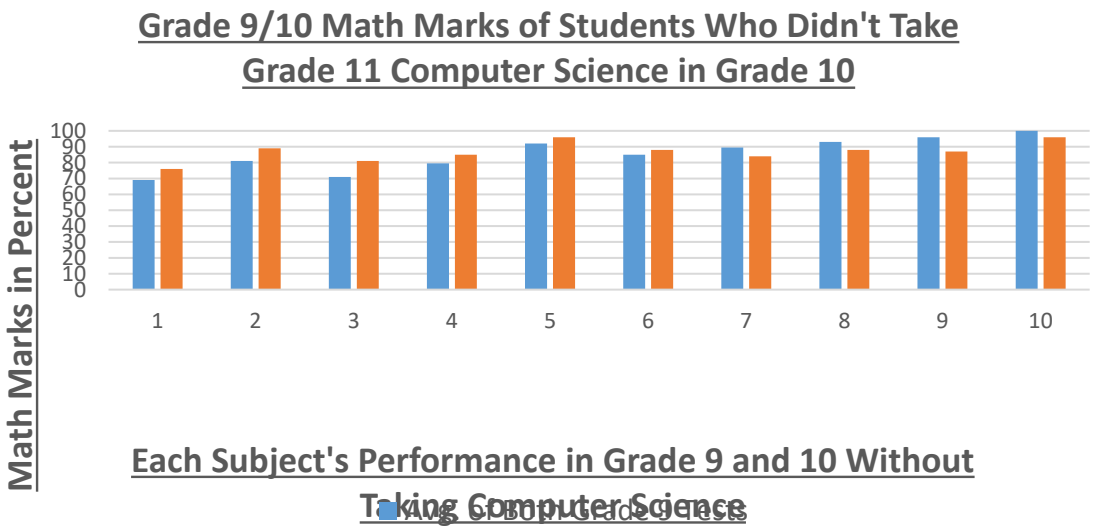

Figure 1 – Comparing the change in math marks from grade 9 to 10 of students who didn't take computer science

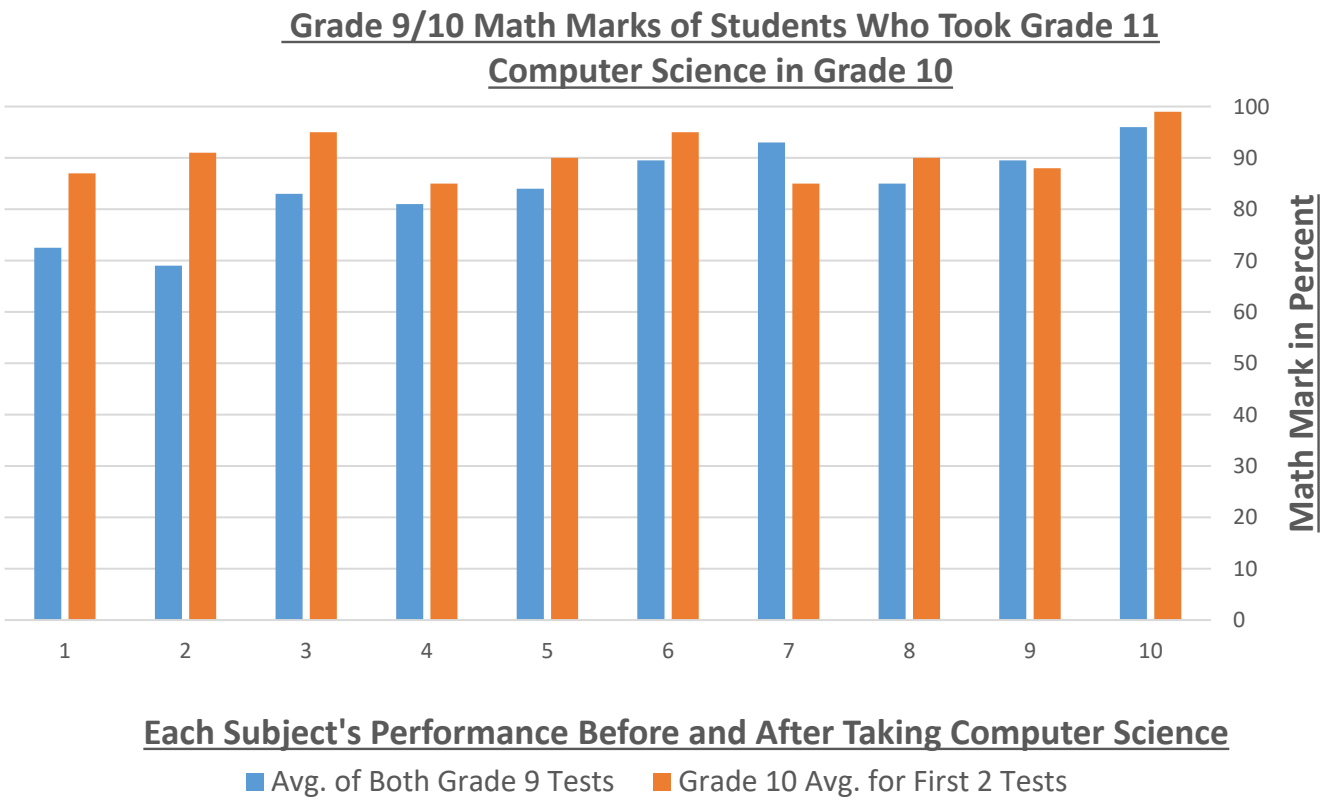

Figure 2 – Comparing the change in math marks from grade 9 to 10 of students who did take computer science

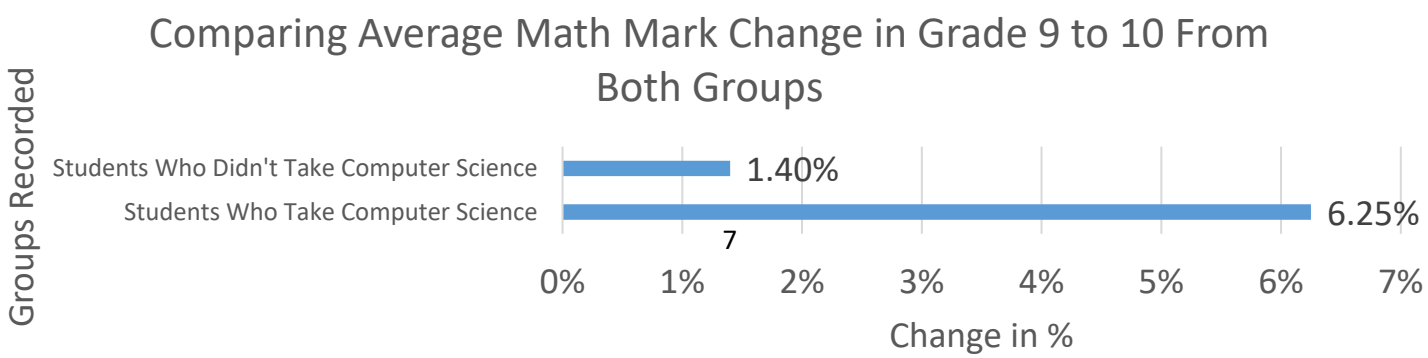

Figure 3 – Percent change in math marks of both groups who did and didn't take computer science

Survey Result

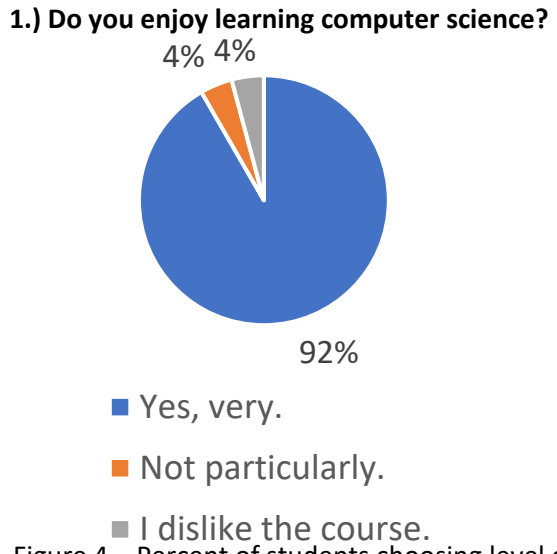

Figure 4 – Percent of students choosing level of enjoyment learning computer science

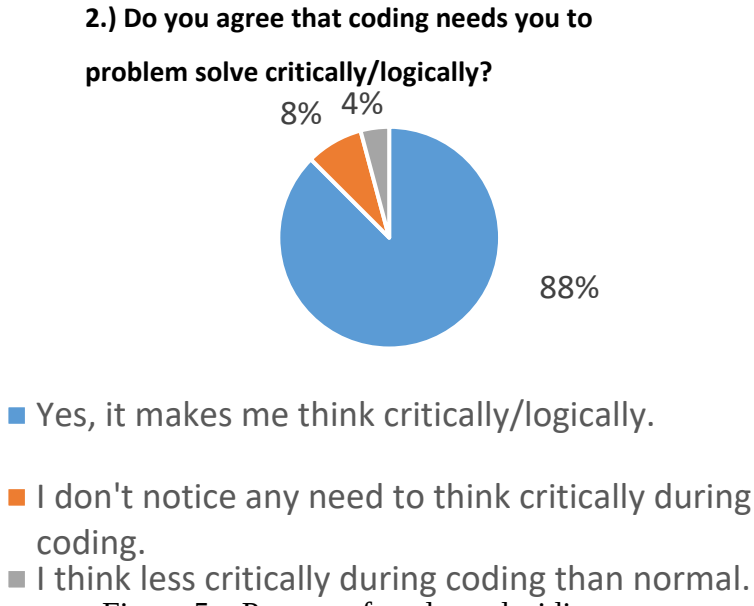

Figure 5 – Percent of students deciding if critical thinking is used when coding

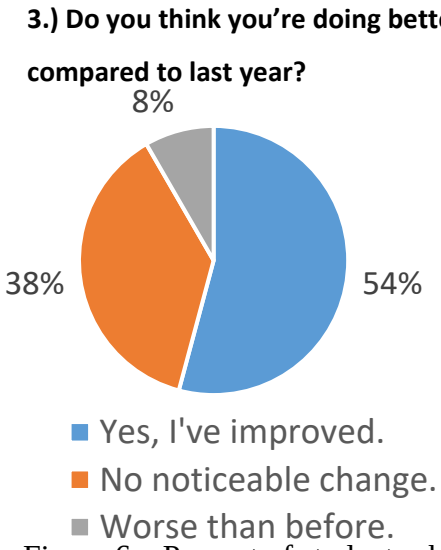

Figure 6 – Percent of students choosing level of improvement in math they believe to have

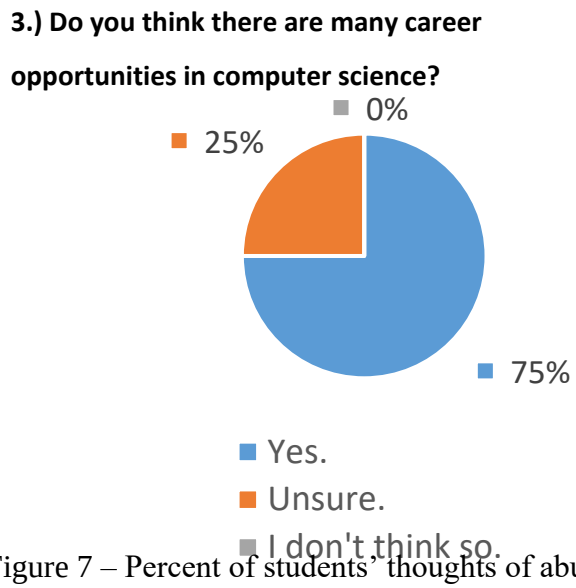

Figure 7 – Percent of students' thoughts of abundant career opportunities in computer science

Discussion/Conclusion

The main scientific question that is driving this experiment was *"How would taking computer science in grade school affect high school success in math?"* It was hypothesized that math marks would rise because coding uses the same parts of the brain used when doing math. From this experiment, it can be concluded that this hypothesis was correct. It is correct because

the students who take computer science had a greater net improvement than the group of students who didn't take it. This conclusion, however, has some important significance. As various research has shown, Canadian students' math marks have been going down for several years now, and the root of this problem seems to stem from the curriculum itself. If the data from the greater improvement of the students who took computer science over the students who didn't take it also applies to a grander scale, provincially or even nationally; it is likely Canadian students' math marks will begin to increase with better ability to connect math to a real-world context if computer programming was introduced to the curriculum. It would introduce future Canadian generations who are better problem solvers and ones who think logically and critically. Another significant outcome to this conclusion could have is more Canadians going and being proficient in the computer and math fields. As our world is rapidly becoming more technologically based, there is a greater demand for workers in those related industries. Obviously more people participating and employed in Canadian business, especially an important one like technology, would benefit the people working in those businesses but also consumers within and outside of Canada. So overall, the data obtained from my experiment proved the hypothesis of the main question, and the possible implications of this verdict look very promising with valuable upsides, especially if enacted on a large education system.

Looking at students that take grade 11 computer science in grade 10, the overall net change in math averages was +6.25%. Looking for the same data in the group of students who don't take grade 11 computer in grade 10, their net change in math averages was +1.40%. Comparing this data, it can be calculated that those who took grade 11 computer science in grade 10 improved in math more than the grade 10 students who didn't take that course by 4.85%, indicating those who take computer science will likely improve in math proficiency. Analyzing the survey, it can be seen that most people who take grade 11 computer science enjoy it and agree that higher level thinking is required during coding. Over half of the survey participants notice they improved at math compared to last year and 75% of them agree there are many job opportunities in computer science. This shows most people who take computer science see the value of it and agree it gives benefits.

Possible errors in conducting this experiment could include subject size. 10 students for each group and 24 participants in the survey is sufficient, but not ideal. For a more accurate percent change between groups, it would be preferable to record data from hundreds of thousands of students. This could indicate if the percent difference between both groups is in actuality larger or smaller, and could indicate the average difference between different areas of data collection (city to city). Also because of time constraints, only a small portion of their grade 9 and 10 marks was compared. Ideally, comparing data throughout an entire school year or longer would show a more precise average in case certain comparisons were outliers.

Application

The information from this experiment suggests there is a correlation between developing skill in computer programming and skill in math. This could be used during admissions process in post-secondary education. For example, if a student applies for a math course, admission officers could factor in any proficiency in computer programming into their decision or vice versa if a student applies in a computer science course they would look at their math marks. However, this already happens in some schools but something that could be done for a larger audience could be tutoring and city programs involving computer programming. Currently, a child would typically learn to code if they were already adequate at math; but as struggling math students get math tutoring, another approach to improvement of their skill could be tutoring using programming. Also, underprivileged kids could participate in programs combining programming and games together to let them have fun, and teach them what is possible with math and a computer. Possible locations could be at various YMCA centres or local libraries. But an even better approach considering a bigger picture would be to include or implement it in the core curriculum starting in elementary school. This will teach the students how to think logically and connect math to the real world better. Overall, if the information from this experiment is correct, or close to the truth, the applications using it could span across generations.

References

- Dishman, L. (2016, June 14). Why Coding Is Still The Most Important Job Skill Of The Future. Retrieved October 04, 2017, from https://www.fastcompany.com/3060883/why-coding-is-the-job-skill-of-the-future-for-everyone
- McMahon, T. (2014, February 26). Canadian students have more math class, lower test scores. Retrieved October 04, 2017, from http://www.macleans.ca/society/life/canadian-students-have-more-math-class-lower-test-scores/
- Missio, E. (2017, March 09). Why Kids Should Learn To Code (And How To Get Them Started) | *CBC Parents*. Retrieved October 04, 2017, from http://www.cbc.ca/parents/learning/view/why-kids-should-learn-to-code-and-how-to-get-them-started
- Parnin, C. (2014, February 21). Scientists Begin Looking at Programmers' Brains: The Neuroscience of Programming. Retrieved October 04, 2017, from http://www.huffingtonpost.com/chris-parnin/scientists-begin-looking-_b_4829981.html

The Effect That the Amount of Time Students Read on Their Academic Performance

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I. Abstract

The experiment was about the effect of reading on the academic performance of grade ten students. The students read for either 45v minutes a night pf 15 minutes a night for a week and took a test at the end of those weeks. This went on for 4 weeks. When the students read for 45 minutes a night, they received higher test scores at the end of each week. The information conducted in the experiment is valuable to students so that they can see the importance of reading in their daily academic lives

II. Introduction

SCICAN! Is a project that allows and encourages students to pursue their interests and look beyond them to understand the scientific aspect of that interest. This investigation explores reading, a task that has many proven beneficial outcomes or aspects. Specifically, how reading can affect the performance that students achieve in school.

Knowing how the amount that students read affects their academic performances is important so that educators and parents can place the correct amount of emphasis and reading that their students should take part in. Reading is usually pushed upon students by parents and teachers, so if there is a positive correlation between reading and academic performance, it may act as a motivator for more students to value reading. Reading is known by scientists to have many benefits, such as aiding in the ability to fall asleep quickly (Mayo Clinic) and even helping to prevent Alzheimer's (Daily Mail UK). The type of reading that students do has been proven to aid students in postsecondary education (Taylor Francis), but passion for it has to be established while young, so knowing exactly how reading affects academic success and the brain is important for students to know so that they can target different ways of reading that suit their interests best.

In order to investigate the effect of reading on academic performance, one must focus on a specific quality such as genre of books, length of books, difficulty—or in this case, the amount of time read. This leads to the question of, how does the amount of time that students spend reading affect their overall academic performance? The hypothesis drawn from this question is: If students read books for longer amounts of time each day, then they will experience an increase in overall academic performance, because reading has many positive impacts, even associated with the brain in terms of being proven to prevent Alzheimer's, so, it will also positively impact the parts of the brain required for

the cognitive thinking that is used in school in a positive way.

III. Methods

The experiment was conducted using a group of six grade ten students of the enriched academic course level, all students used are 15 years old. The students are divided into two groups of three students each named group one and group two. All students were given the same novel, The Mayor of Casterbridge. During the first week of the experiment, group one read for 45 minutes each night and group two read for 15 minutes a night. At the end of the week all of the students took the same general knowledge test, consisting of grade 10 course level math, science, and English. This was repeated during week two except the students took a test with different questions than the first test but with the same grade 10 course level difficulty. During the third week of the experiment, group one read for 15 minutes each night and group two read for 45 minutes a night. At the end of the week all of the students took a grade 10 level course test different from groups two and three. This was repeated during week two. Upon concluding the survey, chart was used to record the student test scores, amount of time read, and average test scores of each student individually, the two groups of students for each amount of time read, and the total average tests sored for both groups combine for each amount of time read. All the tests were taken in a quest room at the same time for all the students each week. [See Results]

A survey consisting of 9 questions was also conducted using Google Forms. This survey was distributed online to 35 students taking grade 10 enriched science. The questions of the survey consisted of:

- Do you like reading?
- Do you think that reading affects your overall academic performance?
- Are you a responsible student?
- How are your grades usually?
- Would you say that reading helps to manage stress?
- Why do you read?
- How many books do you read a month?
- How often are you told that you need to read more often?

These questions are to be used as a basis of understanding the results of the experiment in terms of the student's opinions on reading and how often they usually read versus their grades in order to test the accuracy of the results. The results of the survey are automatically made into graphs by Google Forms.

The dependent variable of this survey is the scores that the students receive on their tests. This is dependent on the independent variable of the amount of time that students spend reading each night. The ages of students, the tests that the students took, the conditions in which they took those tests, and the novels that the students read were all kept controlled or constant. They were kept

constant in order to keep the results of the experiment as accurate as possible. For this experiment, if there is more than on dependent variable, then the results of the experiment will no longer be the effects of the amount of times that students read on their academic performance, but the effect of test conditions, or age on academic performance. Which is not what the survey is indented to investigate.

IV. Results

Experimental Results: Whole Group

Week One: Student	Time Read	Test Score
1	45 Minutes	87%
2	45 Minutes	83%
3	45 Minutes	84%
4	15 Minutes	87%
5	15 Minutes	92%
6	15 Minutes	96%

Week Two:

Student	Time Read	Test Score
1	45 Minutes	88%
2	45 Minutes	84%
3	45 Minutes	76%
4	15 Minutes	80%
5	15 Minutes	91%
6	15 Minutes	93%

Week Three: Student	Amount of Time Read	Score
1	15 minutes	96%
2	15 minutes	93%
3	15 minutes	80%
4	45 minutes	72%
5	45 minutes	97%
6	45 minutes	98%

Week Four: Student	Amount of Time Read	Score
1	15 minutes	84%
2	15 minutes	85%
3	15 minutes	88%
4	45 minutes	96%
5	45 minutes	100%
6	45 minutes	100%

Group Results:

Group Number	Average % avg. for 45 minutes	Average % avg. for 15 minutes
1	83.7%	87.7%
2	93.8%	89.8%
Total % for 45 Minutes	**Total % avg. For 45 Minutes**	
88.75%	88.75%	

Individual Results:

Student	Score for 45 Minutes	Sore for 15 Minutes
1	87%	96%
1	88%	84%
Average :	**87.5%**	**90%**

Percent Change in Averages when time Increased for Student 1: -2.5%

Student	Score for 45 Minutes	Sore for 15 Minutes
2	83%	93%
2	84%	85%
Average:	**83.5%**	**89%**

Percent Change in Averages When Time Increased for Student 2: -5.5%

Student	Score for 45 Minutes	Sore for 15 Minutes
3	84%	80%
3	76%	88%
Average:	**80%**	**84%**

Percent Change in Averages When Time Increased for Student 3: -4.0%

Student	Score for 45 Minutes	Sore for 15 Minutes
4	72%	87%
4	96%	80%
Average:	**84%**	**83.5%**

Percent Change in Averages When Time Increased for Student 4: +0.5%

Student	Score for 45 Minutes	Sore for 15 Minutes
5	97%	96%
5	100%	91%
Average:	**98.5%**	**93.5%**

Percent Change in Averages When Time Increased for Student 5: +5.0%

Student	Score for 45 Minutes	Sore for 15 Minutes
6	98%	96%
6	100%	93%
Average:	**99%**	**94.5%**

Percent Change in Averages When Time Increased for Student 6: +4.5%

Results From Survey:

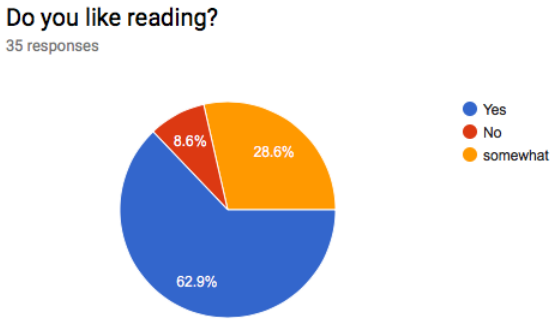

Figure 1: Shows the amount of students who do and do not believe that reading affects their academic performance.

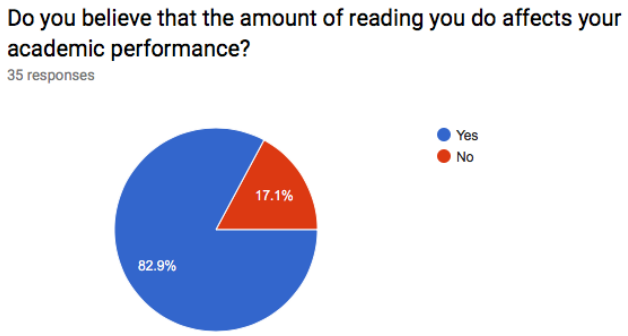

Figure 2: Shows whether or not students believe that the amount of reading that they do affects their academic performance.

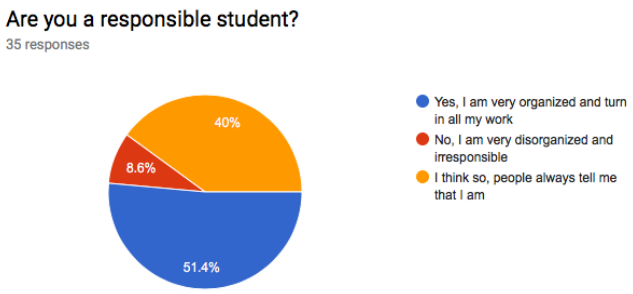

Figure 3: Shows how responsible that students believe themselves to be.

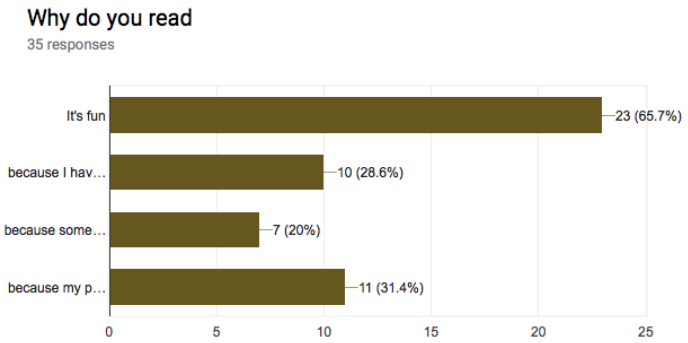

Figure 4: Shows why students choose to read. [It's fun, because I have to for school, because someone recommended a book to me, because my parents force me to read]

Figure 5: Shows how many books students claim that they read per month.

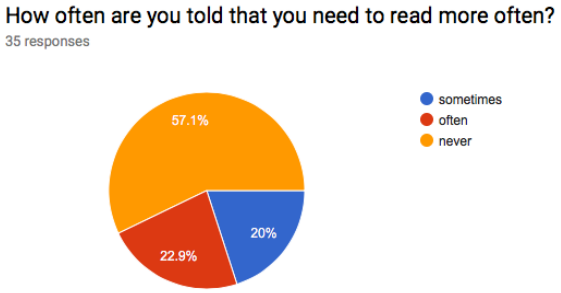

Figure 6: Shows how often that students are told that they need to read more.

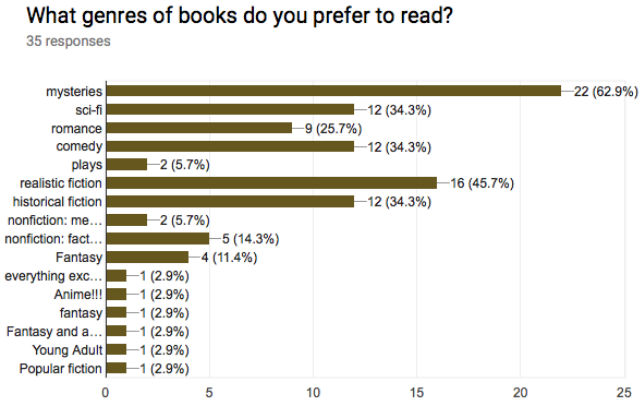

Figure 7: Shows what genres of books students prefer to read.

V. Discussions/Conclusions

The original purpose of this experiment was to examine the effect of the amount of reading done on academic performance. The

original hypothesis is “if students read books for longer amounts of time, then they will experience an increase in overall academic performance, because reading has many positive impacts, even associated with the brain in terms of being proven to prevent Alzheimer’s, so it will also positively impact the parts of the brain required for the cognitive thinking that is used in school in a positive way.” This hypothesis is only proven partially correct. The overall averages of both the children who read for 15 minutes and for 45 minutes a day were identical. But the averages of the individual students, and of the two groups themselves proved that after reading for 45 minutes a night the test results are higher.

The average test score for group one (students 1-3) when reading for 15 minutes a night is 91% when reading for 45 minutes a night the average test score is 84%. The scores received when reading for 15 minutes a night is greater. The average test score for group two (students 4-6) when reading for 15 minutes a night is 87 % when reading for 45 minutes a night the average test score is 94%. For the case of group two, the average test score received when reading for 45 minutes is greater. The overall average test score for reading for 45 minutes a night is 88.75%. The average test score when reading for 15 minutes of nights is also 88.75%, proving to be exactly the same for both reading amounts. However, personally, for each of the students, the test scores received are about 4% greater when reading for 45 minutes a night than 15 minutes a night.

VI. Application

Teachers could use the results of the experiment conducted to gauge the levels of homework that they give their students. And maybe realizing the effects of reading on academic performance will allow teachers to plan the amount of homework that they give to their students so that it allows for time to read. Teachers often want their students to be successful, and reading every night can improve a student's stress levels, and how they do on tests. Librarians can use the results of this experiment in order to increase the emphasis that they put on reading. And rather than just telling students to read because it is a good pastime, they can tell students how it can affect their academics, and stress levels in the long run. The knowledge of the benefits of reading is not only something that can be helpful to high school students now, but even further on in life, in university etc., where they will be faced with harder texts to read and even

busier lives. Reading now as high school students will prepare them for higher level reading that they will have to do as well as help them see reading as a positive stress reliever rather than an unwanted burden.

VI. References

Cox, S. R., M.A. Ph.D., Friesner, D. L., M.A. Ph.D., & Khayum, M., M.A. Ph.D. (2014, July 8). Do Reading

Skills Courses Help Underprepared Readers Achieve Academic Success in College? Retrieved

October 05, 2017, from

http://www.tandfonline.com/doi/abs/10.1080/10790195.2003.10850147

Dr. Mercola. (2016, August 18). How Reading Reduces Stress, Enhances Empathy and More. Retrieved

January 18, 2018, from

https://articles.mercola.com/sites/articles/archive/2016/08/18/reading-benefits.aspx

Hope, J. (2013, July 04). Reading can help save your memory: It slows decline in brain power say scientists.

Retrieved October 05, 2017, from

http://www.dailymail.co.uk/health/article-2355212/Reading-help-save-memory-It-slows-decline

brain-power-say-scientists.html

M. (2017, May 03). 6 steps to better sleep. Retrieved October 05, 2017, from

http://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/art-20048379

Michaud, A. (2016). Intelligence and Early Mastery of the Reading Skill. *Journal of Biometrics*

& Biostatistics, 07 (04). doi:10.4172/2155-6180.1000327

Storrs, C. (2016, February 03). This is your child's brain on reading. Retrieved October 19, 2017, from

http://www.cnn.com/2015/08/05/health/parents-reading-to-kids-study/index.html

The Energy of Different Types of Food Eaten at Breakfast

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Abstract

Breakfast is an important part of the average person's life by starting off the day because of this some may wonder: do different types of food give people more energy? This question is why this following experiment is conducted: every day for breakfast the test subject eats a breakfast with different types of food. After some time passes, note how many push ups the subject can do in a minute and record that data. After conducting that experiment it is found that the type of food with the most energy is carbs, and grain is a close second. While the data shows that there is a best type of food, it is was very close with second place and some might even consider is a tie. More research must be done to find a definite conclusion.

Introduction

Breakfast is the first meal of the day and can affect a person's mood throughout the day depending on what kind of food that person eats. It is crucial to a human's day. After a human goes without food for as long as 12 hours, their glycogen stores are low. (Department of Health & Human Services 2012,October 31) Glycogen is glucose that is stored and if a human has low glucose than that human won't have a lot of energy. This project can help the human race understand their bodies better and how their diets affect their day to day lives.

Having a well balanced diet is important to being productive since: employees with an unhealthy diets were 66 percent more likely to experience productivity loss than those who regularly eat whole grains, fruits and vegetables.(Dallafior,K 2012, October 16) Research shows that what humans eat impacts their performance at work. (What's in the Breakroom: Employee Diet and Productivity, 2009) Can different types of food impact a person's energy? It is hypothesised that if food high in carbohydrates are eaten at breakfast than that person will have more energy than if that person eats food with less carbohydrates. The carbohydrates give more energy to the body than other types of food because glucose is absorbed from carbohydrates.

Methods

Eat the breakfast specified for each day. After two hours see how many push ups the test subject can do in a minute.

Day 1	Fruit
Day 2	Vegetable
Day 3	Grain
Day 4	Dairy
Day 5	Meat
Day 6	Carbs
Day 7	Fat
Day 8	Protein
Day 9	No Food

Day 10	Subject's Normal Breakfast

The variables in this experiment are as following: the type of food is the independent, the energy of each person is the dependent variable, and the control variables are: the portion sizes, because in this experiment there needs to be the same size of each type of food to find which type has the most potential to give energy. The temperature of the room the subject is in at all times because the lower the temperature the more the subject's body uses energy to heat itself up and less is used to do push ups.

Results

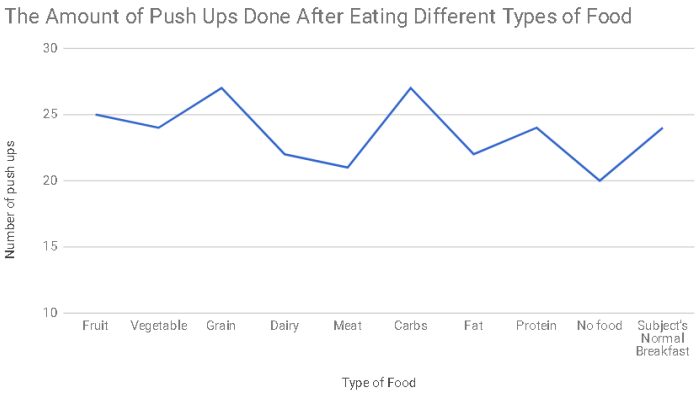

Figure 1:This is the results form one test subject that is 15 years of age

Discussion

The hypothesis is correct since it states the best types of foods are carbs which lines up with the data from Figure 1.

While the data shows that carbs are the best, the category of grain is also very close, because of this the results seems weak and there should be more test subjects and more data collected to find a more accurate top category. This data could be interpreted that there is no best category since all of them are pretty close and that any food can make a good breakfast.

Application

This information could help the general public if they are trying to find the best breakfast possible. It can also help the scientific community by showing them that that different types of breakfast can have different effects on people and if a member is to conduct an experiment on humans to keep that fact in mind.

References

Dallafior, K. (2012, October 16). The Morning Meal's Impact on Productivity. Retrieved October 05, 2017, from https://www.ahealthiermichigan.org/2012/10/16/the-morning-meals-impact-on-productivity/

Department of Health & Human Services. (2012, October 31). Breakfast. Retrieved October 05, 2017, from https://www.betterhealth.vic.gov.au/health/healthyliving/breakfast

What's in the Breakroom: Employee Diet and Productivity. (2009). Retrieved October 5, 2017, from What's in the Breakroom: Employee Diet and Productivity

The Physics Behind Figure Skating Spins

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ABSTRACT

How does figure skaters' arms and leg coordination affect the speed and number of rotations of their spins? This experiment is beneficial to skaters because it will give them a clear understanding on how physics' laws are implemented on their spinning skills. The subjects are performing a basic one-foot spin but in three different methods. As subjects pull their arms and leg in at the same time, they were able to increase the speed and the number of rotations of their one-foot spin. In *conclusion*, when skaters pull their arms and leg together, they are adding more force, the angular velocity must increase in order for angular momentum to stay constant.

INTRODUCTION

Based on the article "The physics Behind Figure Skating Spins" (Samuel Hokan, October 5th 2017), it stated that understanding the basic law of physics behind the spins are beneficial for skaters because it gives them a clear understanding of why and how their arms or leg positioned in a certain way and how the coordination between the two play a major impact on the figure skaters' spinning skills. When skaters do not understand what are responsible for the outcome of their spins, it may cause them to take a longer time to understand the concept of the spin, which may give them a more difficult time to master a certain spin. The main purpose of this project is to find the answer to the question, how does figure skaters' arms and leg coordination affect the number of rotations and the speed of the spins? The hypothesis of the experiment's result is that when skaters pull their arms and leg inward at the same time, they will be able to create more rotations because if the arms and the legs are cooperating with each other, then there will be more force being generated.

METHOD

The subjects are being asked to perform a basic one-foot/scratch spin. The subjects are repeating the same spin three times, but slightly different each time. This experiment does not require the subjects to be right footed or left footed. The subjects may choose to use which ever leg they want to represent their "free" leg- leg that is not touching the ice, but is responsible for generating force when the subjects pull the leg in. The first method is to pull their arms inward, then pull their free leg in when the time hits seven seconds. The second method, the subjects are being ask to repeat the same process as method one but pulling their leg in before the arms. Lastly, the subjects are pulling their arms and leg inward together at the same time. Each method, the observer is counting how many full rotations are completed in the span of fifteen seconds. The rotations of each method are to be only counted, if it was completed in the span of fifteen seconds, or rotations that are completed but the spin stopped before the timer is up; those rotations are also identified as completed rotations.

The independent variables are the subjects and the subjects' arms and leg coordination. These are chosen as the independent variables because it is

not depended on any of the other variables. If the independent variables changes, then the dependent variables will also be affected. The dependent variables are the subjects' balance, speed, and number of rotations of their spins. The reason for this is because if the subjects' arms and leg are not cooperating together correctly, then the results and the outcome of the balance, number of rotations and the speed of the spins would be different. These variables depend on the independent and the controlled variables. The controlled variables are variables that must stay constant or unchanged in order for the results from the experiment to be classify as true. In this experiment, the controlled variables are the time limit- which is fifteen seconds, and the skaters' clothing. The timer is one of two controlled variables because if different methods allowed subjects to spin for a longer span of time, then that method is most likely to have more rotations then the methods who are only allowing the subjects to spin until fifteen seconds. The results of each method cannot be compared because it was not true. Clothing is also a controlled variable because it impacts the subjects' speed, which decreases the number of rotations. The subjects are required to wear leggings and a tight shirt, or jacket. This strategy helps prevent any external objects/materials from affecting the speed of the spins.

RESULTS

After conducting this experiment, the results and data are collected and organized into a table chart. There was a pattern when the data and results were analyzed. The pattern was when subjects pulled their arms and leg inward together at the same time, the number of rotations and the speed were increased. In figure 1, the third method had an outstanding of rotations completed compared to the others. As an observer, when the subjects attempt to use the first and second methods to perform the one-foot/scratch spin, the subjects' speed and number of rotations declined. These two method gave the subjects a more difficult task to try to increase the speed and number of rotations.

SUBJECTS	**ARMS BEFORE LEG PULL IN (@7sec) Method 1**	**LEG BEFORE ARMS PULL IN (@7sec) Method 2**	**ARMS AND LEG PULL IN TOGETHER Method 3**
Person 1	11 rotations/15sec	11 rotations/15 sec	26 rotations/15 sec
Person 2	15 rotations/15sec	9 rotations/15 sec	28 rotations/15sec
Person 3	15 rotations/15 sec	6 rotations/15 sec	26.5 rotations/15 sec
Person 4	12 rotations/ 15 sec	7 rotations/ 15 sec	27 rotations/15 sec
Person 5	9 rotations/15 sec	5 rotations/15 sec	19 rotations/15 sec

Figure 1- All the data and results from the experiment are collected and organized into this table chart. Each method is separated into different columns and the number of rotations completed are recorded below. Each method was done once by five different subjects. The subjects had fifteen seconds to spin and only rotations that are completed under 15 seconds are counted.

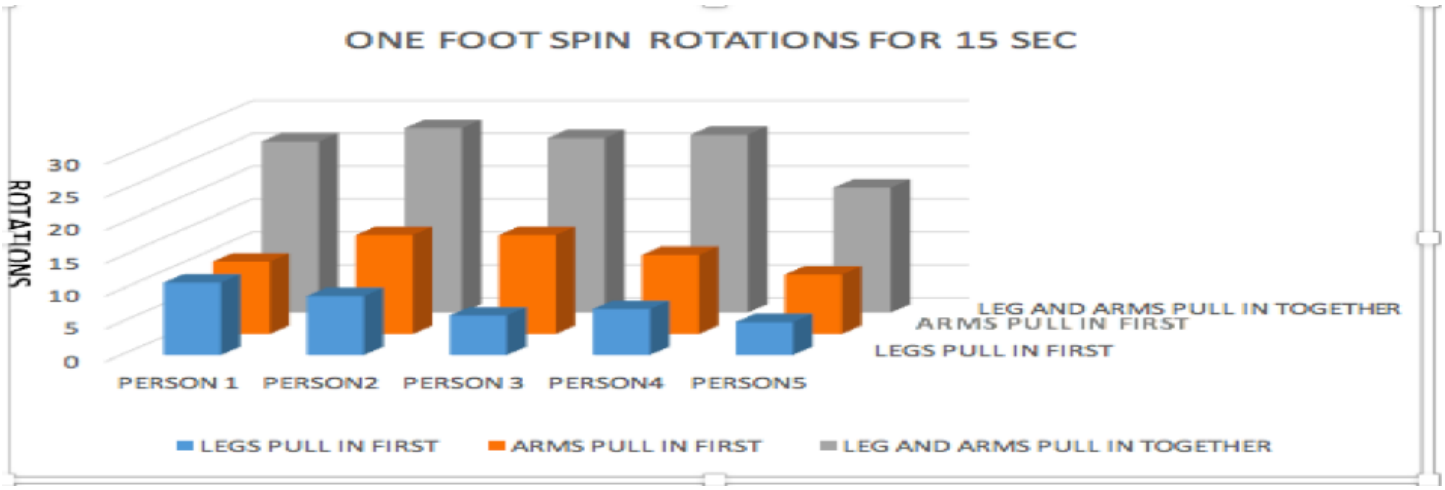

Figure 2- This graph contains the information from figure 2. This figure gives the author a clear understanding how big of a difference in terms of number of rotations in each method. All method was done once by the same five subjects and the same limited time of fifteen seconds.

DISCUSSION AND CONCLUSION

To restate the hypothesis of this project, the hypothesis of this experiment's result is that when skaters pull their arms and leg inward at the same time, they will be able to create more rotations because if the arms and the legs are cooperating with each other, then there will be more force being generated. Base on the data collected, the hypothesis is true. The third method that required the subjects to pull their arms and leg in together at the same time had more speed and number of rotations. The results of this experiment did not fully answer the question of this experiment. The results prove that the third method is the ideal strategy for figure skaters to use, but it did not clarify the science behind it. There is this one law from Isaac Newton that clarified why the results of this experiment was what it was. In his first law of motion he stated, objects that are in motion will stay in motion and will keep a constant rate, unless an external torque or force is applied onto the object. This made sense because when the subjects used the third method, the subjects' arms and leg were pulled inward together which means the mass is reduced, so the inertia is also reduced. When the inertia is reduced the angular of velocity must increase in order to satisfy the fundamental law of physics- maintain angular momentum at a constant rate.

Some errors during this experiment, are subjects' blades. Some subjects had freshly sharpened blades while others were dull. The subjects will have sharpened blades had the advantage to spin at a faster rate because the friction between the blades and the ice were reduced. While the dull blade had more friction, the speed was much slower.

APPLICATION

The information collected from this experiment are beneficial to figure skaters, because now the skaters are able to understand why their spins are increasing or decreasing in speed or number of rotations. They can use this information to learn and master more difficult skills that are related to laws of physics (motions and angles) in the future. There was also this research about humanoids robots ice skating (Chris Iverach Brerton, 2002), and they used data and information from figure skating researches and experiments to help them structure and build their robots' blades- how the blades would affect the robots' speed and how long it takes the robot to make a sharp turn. The information gathered from the project can not only help athletes from figure skating but dancers, and snowboarders. All the athletes in these sports rely on the speed and rotations base on the arms and leg coordination.

REFERENCES

Chris Iverach Brerton, Andrew Winton and Jacky. (2002, April0. Ice skating humanoid robots. Retrieved on November 15 2017 from http://www.ca.umanitoba.ca/~chrisib/publications/skating.pdf

Nancy Whealan. (2017, June 29). Extree athlecticism can take a toll on figure skaters' bones and joints. Retrieved from https://meducalxpress.com/news/2017-06extreme-athlectism-toll-figure-skaters-html

Samuel Hokin. (2016 October 5). The Physics of Everyday Stuff-figure skating spins. Retreived on October 5th 2017 retreived from http://www.bsharop.org/physics/spins

How Sugar Levels in Food Affect Fatigue in Daily Activities

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ABSTRACT

It's an undocumented universal fact that irrespective of the age everyone enjoys sweets in every shape or form. Consumption of sugar in any form creates a rapid illusion of happy and active mind for a very short time. The purpose of the experimental study is to determine the correlation of sugar intake and fatigue. Subjects consumed high and low sugar diet for three days. Each day subjects completed two objectives and one subjective test to measure fatigue levels. Study show that subjects were more active and effective with their day routine on the days when low sugar diet was consumed. Subject experience greater fatigue on the high sugar diet days. This study would help understand the implication of sugar consumption on health.

Keywords: Sugar, High sugar diet, Fatigue, Low sugar diet, sluggish

I. INTRODUCTION

This topic will aid in learning the phenomena and symptoms of sugar crash. This knowledge will help plan diet to regulate sugar intake. Controlled sugar levels would consequently assist to reduce the symptoms of fatigue, irritability and hunger. This topic will also help understand diseases caused by uncontrolled sugar levels.

How do sugar levels in food has effect on body causing fatigue during daily activities?

The hypothesis consists if foods with high level of sugar are consumed then, the pancreas will release insulin to regulate high sugar level in blood stream. Insulin helps to break down sugar and a burst of energy is experienced followed by crash or low sugar level leading to fatigue and irritability. Fatigue is experienced after eating sugar rich diet because the level of neurotransmitter responsible for arousal and appetite is decreased. The body feels tired after a high carb diet because blood is pushed to the stomach to digest the food, this leaves less blood for the rest of the body causing lethargy.

Many scientists around the world are realizing the importance of this issue. Shawn Talbott is an elite scientist with and EMP in entrepreneurship from MIT and a PhD in nutritional biochemistry from Rutgers. Talbott has also educated top level athletes at the United States Olympic Training Centers. He has written many articles and few books on nutrition and fitness. Mr. Talbott encourages eating diets with less sugar and is

looking deeper into ways to education people and communities about eating right and shopping healthy and smart in the grocery store.

II. METHODS

The purpose of this project is to determine how the amount of sugar in food affects fatigue. To measure the effect of sugar intake on fatigue, an experiment needs to be conducted. This project is based on an experiment to test how different amounts of sugar in food contribute to mental and physical exhaustion in the body. The experiment will include 3 subjects in the same age group (12-15 years). Subjects will consume foods with high sugar levels for 3 days and foods with low sugar levels for the following 3 days. Each day, 45 mins after eating, subjects will complete various tasks used as objective measures of fatigue. Their reaction time will be tested in these tasks, and will be used as a measure of fatigue.

Independent Variable: Diets

Dependent Variable: Fatigue [45 mins] hours after eating, measured by Samn-Perelli test and reaction time tests

Control Variable: Age group, food eaten and time intervals between eating and fatigue tests

III. RESULTS

Person 1: Data

Table should be read from up to down and be read across left to right for each day.

Type of Test	Day 1: Sugar	Day 2: Sugar	Day 3: Sugar	Day 4: Less Sugar	Day 5: Less Sugar	Day 6: Less Sugar
Samn-Perelli 7 pt. Scale test	3	4	7	2	3	5
Reaction Time Test	399 ms	587 ms	764 ms	388 ms	370 ms	359 ms
Run-Cup Test	24 secs	31 secs	43 secs	21 secs	21 secs	18 secs

Table 1

During day 2 of the experiment person 1 felt very low in energy and lazy to do their daily activities. By day 3 person 1 felt exhausted and tired as they felt unmotivated and sluggish to even complete their daily chores. During day 5 and day 6 person 1 said they felt energized and could complete their tasks faster and with more focus. Person 1 also noticed a difference in their mood; more tired and distracted during the high sugar days and calm and attentive during low sugar days.

Person 2: Data Table should be read from up to down and be read across left to right for each day.

Type of Test	Day 1: Sugar	Day 2: Sugar	Day 3: Sugar	Day 4: Less Sugar	Day 5: Less Sugar	Day 6: Less Sugar
Samn-Perelli 7 pt. Scale test	1	1	1	5	5	5
Reaction Time Test	389 ms	492 ms	654 ms	357 ms	334 ms	319 ms
Run-Cup Test	32 secs	43 secs	57 secs	31 secs	26 secs	1 secs

Table 2

During the experiment person 2 did not feel any different in energy level or alertness on high sugar days (subjective scale). Although the reaction time (objective measurement) suggests Person 2 performed better on low sugar day. During the high sugar days person 2 felt alert but was not very motivated. Person 2 reported that sugar consumption gave spike in energy level for a short period of time followed quickly by decline in energy and mood.

Person 3: Data: Table should be read from up to down and be read across left to right for each day.

Type of Test	Day 1: Sugar	Day 2: Sugar	Day 3: Sugar	Day 4: Less Sugar	Day 5: Less Sugar	Day 6: Less Sugar
Samn-Perelli 7 pt. Scale test	3	5	6	2	3	1
Reaction Time Test	373 ms	491 ms	784 ms	387 ms	329 ms	284 ms
Run-Cup Test	28 secs	32 secs	46 secs	25 secs	18 secs	16 secs

Table 3

During the experiment in day 2, person 3 said they felt very tired and distracted. Person 3 said they couldn't concentrate very well and were feeling very lazy and reluctant to do anything with an added caving to have more sugar. During day 5 and 6 of the experiment Person 3 said they felt very calm, relaxed and attentive while doing work and other activities. Person 3 said it improved their mood when eating healthier food as it made them feel they were doing something good for their body and health. Objective test outcomes (Reaction time) improved as expected on low sugar days.

I. DISSCUSIONS/ CONCLUSION

The hypothesis was correct. In the hypothesis, it was mentioned that eating food with high sugar content will cause more fatigue and leave the subject tired. My experiments prove this point as well as foods with high levels of sugar will cause change in appetite. The purpose of this project was to create awareness and increase the knowledge on effects of sugar on our metabolism. This information would help plan diets to regulate sugar intake. Having controlled levels of sugar intake can help reduce sugar crash, fatigue and irritability.

Many patterns were observed during the 6 days of high and low sugar intake. On high sugar intake days, a plunge in mood and attitude was observed. Subjects feel easily tired and were sluggish to complete tasks. The data collected from the experiment also suggests that subjects felt energized and were able to focus better during low sugar days. The information gathered from the experiment also indicates that intake of food with high sugar content also increased carving for such food throughout the day.

While conducting the experiment many things could have gone wrong. The subject's emotions, stress levels, and energy due to the change in their diet could have affected the test results in calculating fatigue. If subjects are feeling stressed they will usually feel the need to complete tasks faster and will be hyperactive unrelated eating sugary foods. They will have less fatigue as their body and mind is dealing with stress or a different emotion. Therefore, personal emotions and feelings of the subject including stress could play a major part in calculating fatigue.

II. APPLICATION

The purpose of this project was to find out how sugar levels in food affect fatigue in daily activities? This information can be shared with organizations like FDA to promote less artificial sugars in foods and drinks and also encourage use of natural or better alternative like honey. This can give people the knowledge and data to convince them to buy products with less to no sugar and read labels on food before purchasing. This project can help people in everyday lives to keep track of their

sugar intake and take care of their health by regulating sugar consumption in their everyday diet.

III. REFRENCES

Feeling Sluggish? Restore Your Equilibrium. (2016, March 31). Retrieved November 14, 2017, from https://alternativemedicine.com/feeling-sluggish/

Effect on Students' Academic Performances from Listening to Music While Studying

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ABSTRACT

Music has become more than a recreation; it is now a part of most people's academic lifestyle. More and more people are listening to it while completing their daily homework, believing that this influence of music actually has lead them to academic improvement. An experiment is conveyed to find out how the effect of listening to music differs in academic performance for some students. Students who normally listen to music while doing homework, as well as students who do not, are selected to read an article and later answer questions based off of the information read, to test their memory and level of concentration. There is really no specific comparison as to which group of students does better in terms of answering questions. Some do well on being specific with answering in full detail according to the given information, while others answer correctly, but do not provide enough detail regarding the questions. Because of its benefits to increasing memory, it is found that although music is not recommended to be heard while completing homework, for some students however, music does really help them concentrate better and be more efficient while working.

INTRODUCTION

Music is heard a lot more these days than when it existed many years ago for just festivals and parties; people listen to it whenever they work, when they want to be motivated for something or when they just want to complement their simple mood swings. It is important to know how it effects people differently because no one really knows whether or not listening to these songs help them in – for example – things like studying. Finding the answer to this will help people know for sure how music impacts their life in a positive or negative way, and give people the opportunity to explore the different variations in music that could potentially improve their brain development.

The brain is divided into different compartments with different functions. In the region of the temporal lobe – which is responsible for speech comprehension – there is a small part called the auditory cortex - which processes sounds in the brain. Music is almost like its own language, so it can activate this part more than normal sound would and it especially activates regions near it which are associated with memory (*How Our Brains Process Melodies That Pull on Our Heartstrings)*. Brains are simple because they like repetition; they are always predicting on what will happen next based on a

given pattern. This is why reading cue cards over and over again can help someone memorize more when they've learned the order of the information. Music involves a lot of pattern - this is how it can be very distracting when being engaged in anything that requires a greater thought process.

Brains depend on neurons, when people are studying or doing something that requires attention, their brains take in those neurons which sendoff electrical pulses, also known as brain waves. If people are listening to music, their brain will take in the lyrics and focus on that information instead of the study notes. So then, how does listening to music while studying affect a student's overall academic performance? The importance of finding this answer is especially for those students who do listen to music while working on a daily basis. It is believed that if students listen to music while they are engaged in cognitive tasks (meaning anything that requires a greater thought process), then they will do poorly on tests and evaluations because they will be distracted and lose their concentration.

METHODS

To find the answer to this question an experiment is conducted through a given test. Students are selected to read an article consisting of information they have never heard of, that way this would give all students a fair chance to be successful in answering the following questions that will be given after reading the article. The students who normally listen to music while doing homework, would listen to music while reading the article. Other students who do not listen to music while doing homework, would read the article quietly as they normally would have. After an appropriate amount of time given (depending on the article length and depth of information), the article would be taken away and the students would be given a set of questions based solely off of the information in the article.

In this experiment a few variables are defined: the dependent variable consisting of the ability to successfully answer the given questions will vary depending on the student's ability to stay focused while reading, the independent variable – some students will listen to music while some will not, and finally, the controlled variable – students who listen to music normally, listen to music the entire time while reading the article and students who normally do not

listen to music while studying, do not listen to music while reading the article. All students will be expected to read the article for the full time given. The controlled variable is chosen so that this way, the experiment will be more exact and "real" when students use their own studying method. If a student is forced to follow a studying method – such as listening to music when they normally do not – then of course that student will have a better chance of doing poorly because they are not used to that method.

The article that is given for this experiment (*Sea Spiders Use Their Hearts, Not Guts, To Pump Oxygen)*:

Sea Spiders Use Their Guts, Not Hearts, To Pump Oxygen by *Ashley Johnson* on October 23, 2017

Sea spiders, which have inhabited Earth for over 500 million years, are **fascinating** creatures. The marine **arthropods**, which range in size from a millimeter long to as big as a dinner plate, have eight jointed legs that **convene** around a tiny body. Since their torsos are so small, sea spiders use their legs to conduct normal body functions such as digestion and reproduction. Now, it seems the creatures also have a **unique** breathing mechanism.

The latest discovery was made by a team led by University of Montana Associate Professor Arthur Woods. The researchers were curious to see how the spiders' weak, tiny hearts managed to pump blood and oxygen from the central part of their bodies to the tips of their long, thin legs especially, in the larger Antarctic species.

To **unravel** the mystery, they injected **fluorescent** chemicals into the blood of 12 sea spider species from Antarctica and the US to see how far their small hearts were able to transport it. Not surprisingly, it was a very short distance. To make up for the **shortcoming**, the spiders have **adapted** by using their guts to pump blood. Woods says, "Unlike us, with our centrally located guts that are all **confined** to a single body **cavity**, the guts of sea spiders branch multiple times and sections of gut tube go down to the end of every leg."

Just like in humans, the guts **contract** to move food along. However, since the spiders' legs are not as **flexible** as the **abdomen**, they are unable to stretch or expand. Hence, when the spider pushes digestive **fluids** down its legs, the blood gets pushed up. **Conversely**, when the digestive fluids are pushed up, the blood flows back down. The scientists **theorized** that this action helps the oxygen, which is passively **diffused** into the animal's legs, to be **circulated** throughout the body.

To test the **thesis**, the team lowered the oxygen levels in the surrounding seawater and observed that the sea spiders' gut **contractions** instantly increased. Amy Moran, a marine **ecologist** at the University of Hawaii at Manoa, who helped with the study, says, "It's like when you take a person up to altitude, and they breathe faster, and their heart rate goes up. The sea spiders are using their legs as **gills** and their guts as hearts." The researchers, who published their findings in the journal *Current Biology* on July 10, 2017, believe that though this is the first time this kind of gut-based **circulatory** system has been observed, it may be more common than we realize.

Though **classified** as **Chelicerates**, a group that includes **terrestrial** spiders, horseshoe crabs, mites and ticks, sea spiders, or pycnogonids, are not considered "true" spiders. While some **geneticists** believe there is a distant relationship, Moran says, "They're about as closely related to a terrestrial spider as a seahorse is to a horse."

Questions that are given to be answered after reading this article (the right answer or what the answer should have looked like is written in **bold** / red…)

1. How long have sea spiders been on Earth? – **500 million years**

2. Why do they conduct functions like digestion and reproduction through their legs?
-**Because their torsos are very small**

3. What did researchers do to test their curiosity? What did they want to see?
-injected fluorescent chemicals into spider's blood
-wanted to see how far their small hearts were able to transport it

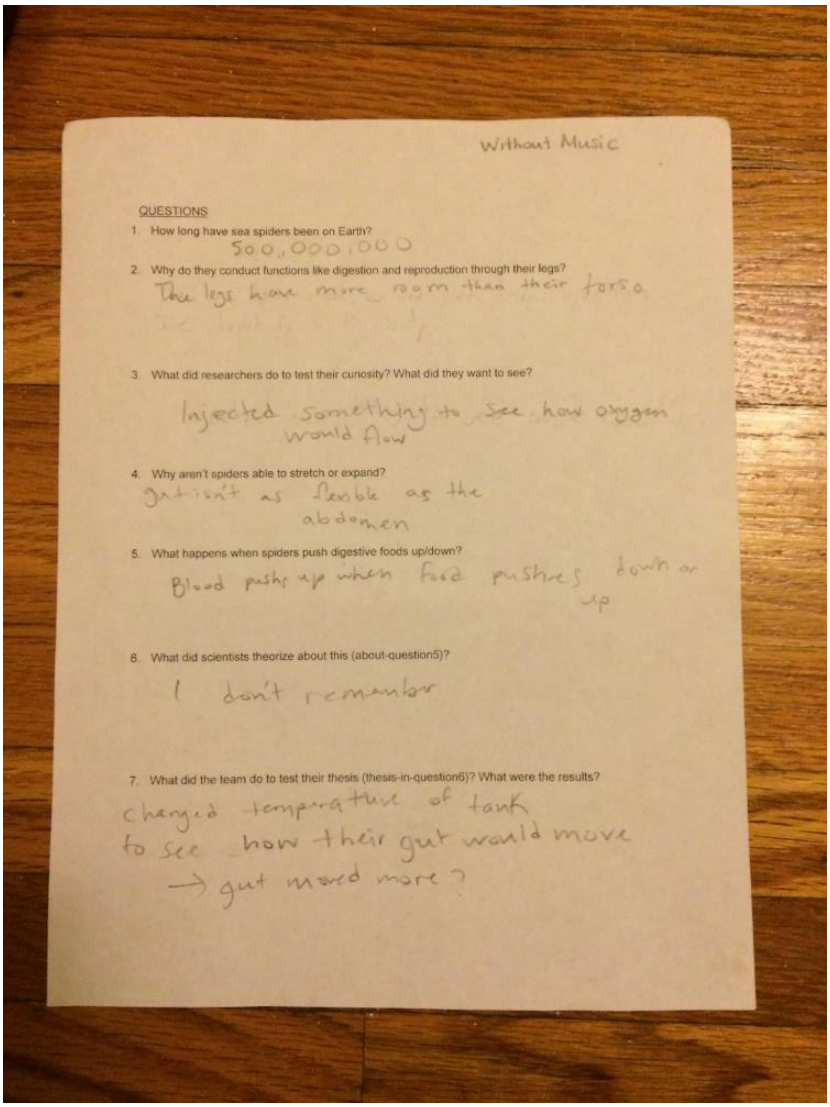
4. Why aren't spiders able to stretch or expand?
-their legs aren't as flexible as the abdomen

5. What happens when spiders push digestive foods up/down?
-blood flows up its leg when digestive foods push down
-blood flows down its leg when digestive foods push up

6. What did scientists theorize about this (about-question5)?
-theorized that this action helps the oxygen which is diffused in the spider's leg to get circulated to rest of the body

7. What did the team do to test their thesis (thesis-in-question6)? What were the results?
-lowered oxygen levels in seawater to see movement in gut contraction
-gut contractions increased

RESULTS



Without Music

QUESTIONS

1. How long have sea spiders been on Earth?

500,000,000

2. Why do they conduct functions like digestion and reproduction through their legs?

The legs have more room than their torso

3. What did researchers do to test their curiosity? What did they want to see?

Injected something to see how oxygen would flow

4. Why aren't spiders able to stretch or expand?

Gut isn't as flexible as the abdomen

5. What happens when spiders push digestive foods up/down?

Blood pushes up when food pushes down or up

6. What did scientists theorize about this (about-question5)?

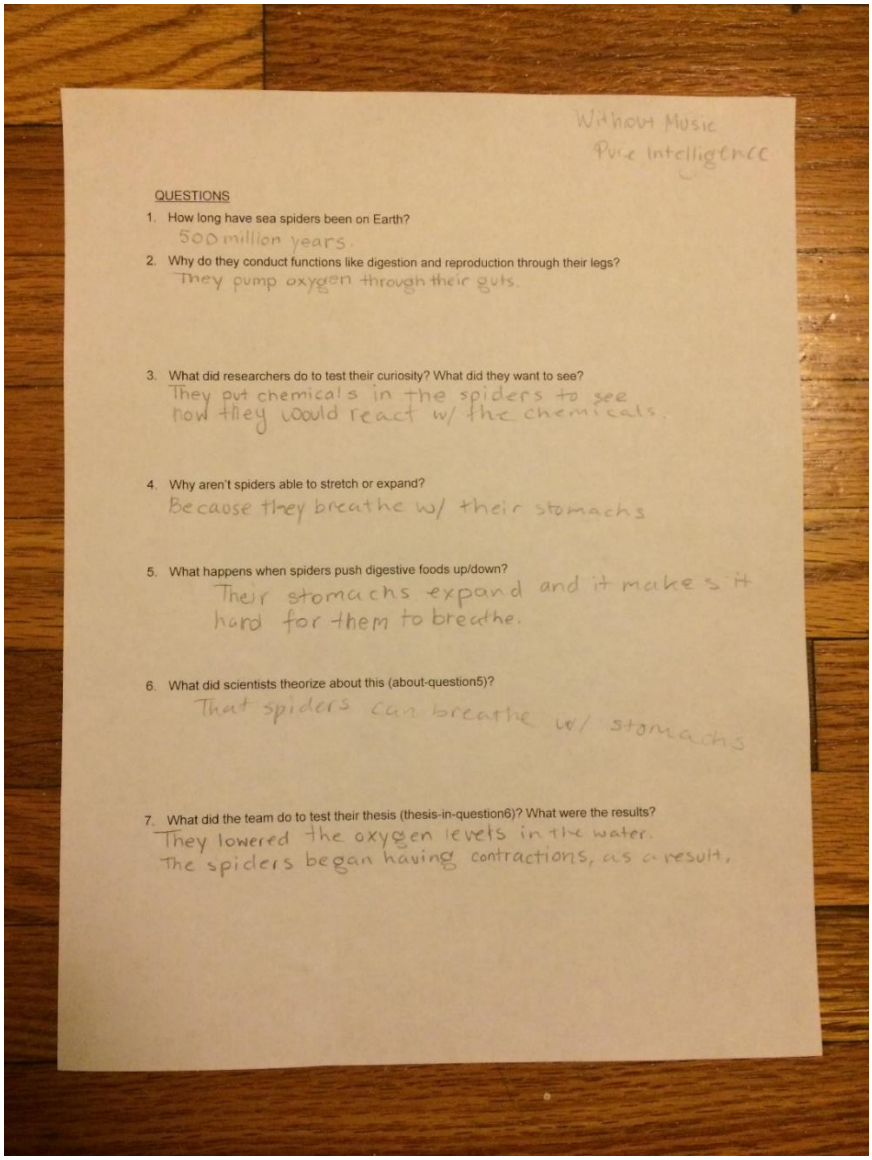
I don't remember

7. What did the team do to test their thesis (thesis-in-question6)? What were the results?

changed temperature of tank to see how their gut would move

→ gut moved more?

Figure 1. Student #1 does not listen to music while reading article and answers questions correctly for the most part however, some questions are in vague detail and one question is un answered due to lack of memory from reading this topic.

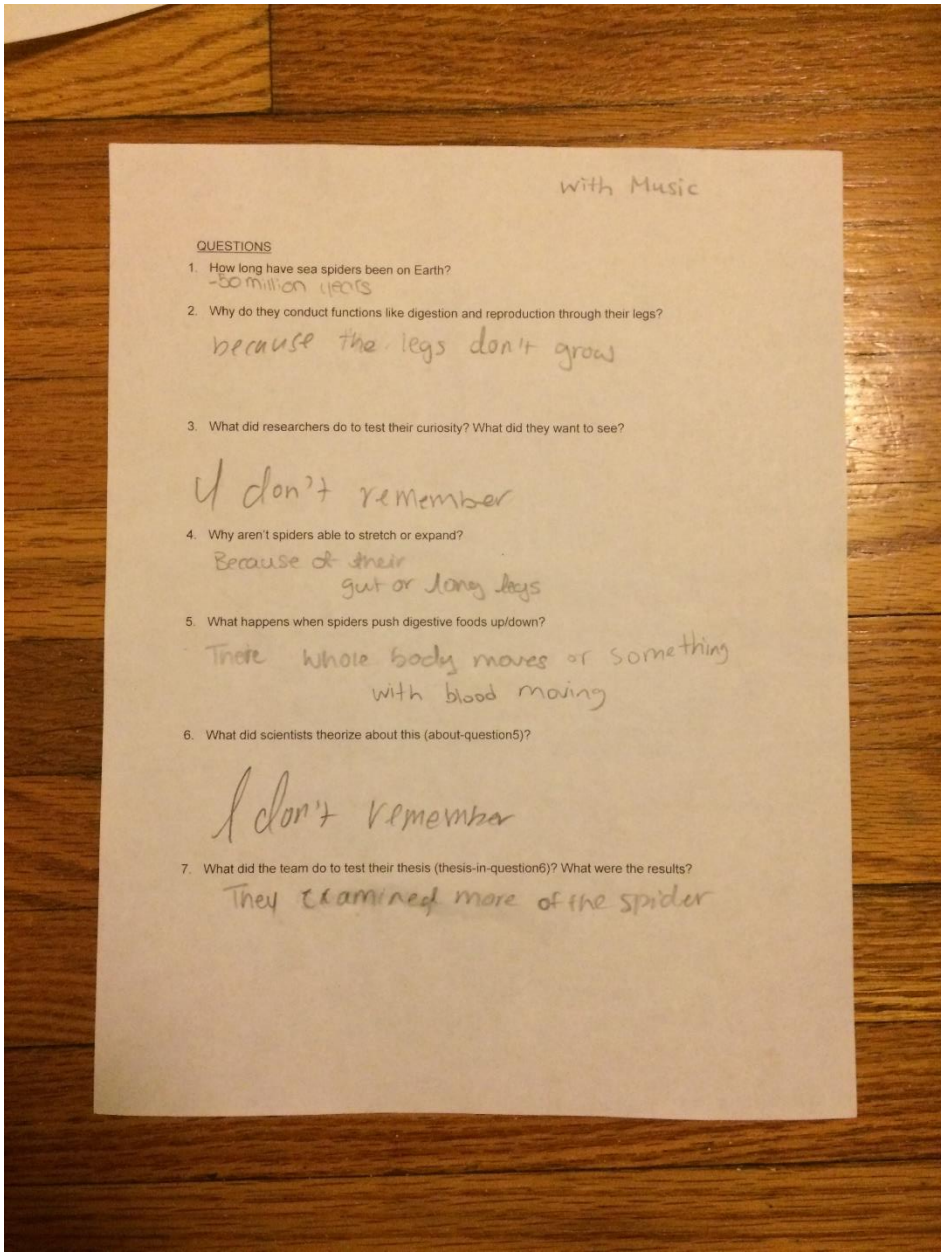


Without Music
Pure Intelligence

QUESTIONS

1. How long have sea spiders been on Earth?
   500 million years.
2. Why do they conduct functions like digestion and reproduction through their legs?
   They pump oxygen through their guts.
3. What did researchers do to test their curiosity? What did they want to see?
   They put chemicals in the spiders to see how they would react w/ the chemicals.
4. Why aren't spiders able to stretch or expand?
   Because they breathe w/ their stomachs
5. What happens when spiders push digestive foods up/down?
   Their stomachs expand and it makes it hard for them to breathe.
6. What did scientists theorize about this (about-question5)?
   That spiders can breathe w/ stomachs
7. What did the team do to test their thesis (thesis-in-question6)? What were the results?
   They lowered the oxygen levels in the water. The spiders began having contractions, as a result,

Figure 2. Student #2 reads article without listening to music and answers questions with more detail than student #1 in figure 1. However, this student repeats their answers when they can not remember specific information related to this topic.

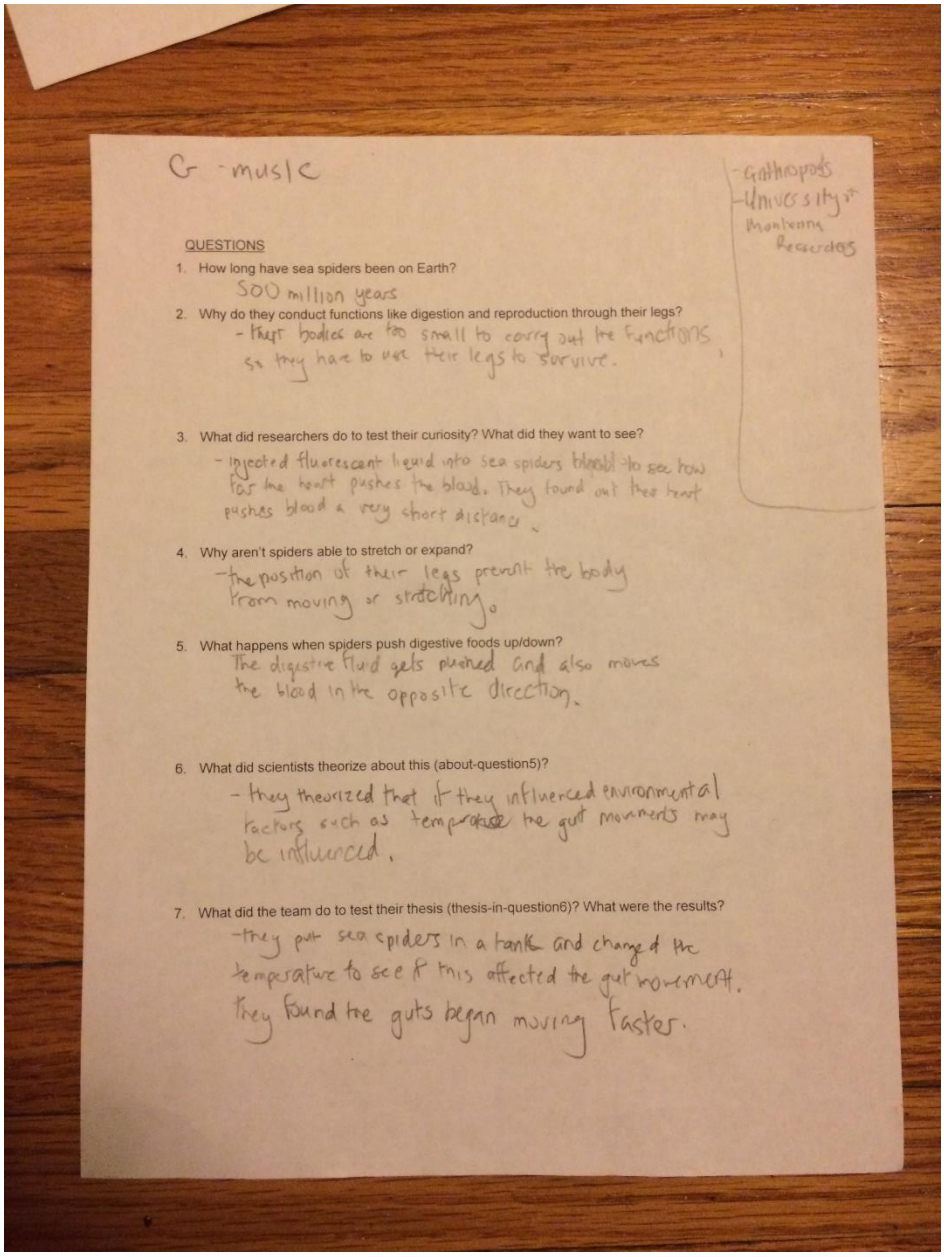


with Music

QUESTIONS

1. How long have sea spiders been on Earth?
   -50 million years
2. Why do they conduct functions like digestion and reproduction through their legs?
   because the legs don't grow
3. What did researchers do to test their curiosity? What did they want to see?
   I don't remember
4. Why aren't spiders able to stretch or expand?
   Because of their gut or long legs
5. What happens when spiders push digestive foods up/down?
   There whole body moves or something with blood moving
6. What did scientists theorize about this (about-question5)?
   I don't remember
7. What did the team do to test their thesis (thesis-in-question6)? What were the results?
   They examined more of the spider

Figure 3. Student #3 reads article while listening to music and answers all questions very poorly in the sense that they leave a few blank and the ones that are completed, are answered in no specific detail as well answers are repeated a lot throughout questions.



G - music

- Arthropods
- University of Montanna Researchers

QUESTIONS

1. How long have sea spiders been on Earth?
   500 million years
2. Why do they conduct functions like digestion and reproduction through their legs?
   - their bodies are too small to carry out the functions, so they have to use their legs to survive.
3. What did researchers do to test their curiosity? What did they want to see?
   - injected fluorescent liquid into sea spiders blood to see how far the heart pushes the blood. They found out that heart pushes blood a very short distance.
4. Why aren't spiders able to stretch or expand?
   - the position of their legs prevent the body from moving or stretching.
5. What happens when spiders push digestive foods up/down?
   The digestive fluid gets pushed and also moves the blood in the opposite direction.
6. What did scientists theorize about this (about-question5)?
   - they theorized that if they influenced environmental factors such as temperature the gut movements may be influenced.
7. What did the team do to test their thesis (thesis-in-question6)? What were the results?
   - they put sea spiders in a tank and change of the temperature to see if this affected the gut movement. They found the guts began moving faster.

Figure 4. Student #4 reads the article while listening to music and answers all questions in great detail compared to the other students in figures 1,2 and 3.

DISCUSSION/CONCLUSION

This hypothesis is closely accurate according to the two students in figure 1 & 2 who do not listen to music while answering the questions from the article; they remember most of the information and answer correctly. However, in figure 4, one of the students who does listen to music, answers in the most detail of those two students in figure 1 and 2 combined, therefore this hypothesis is not entirely correct. According to this hypothesis, the students who listen to music while reading this article, are thought to do poorly on answering questions, but this is proven to be wrong when the student listening to music in figure 4 does the best overall.

The data received from this test does not entirely support the hypothesis in the sense that there is no exact comparison as to which group of students – whether they listen to music or not – does better on answering questions. When scientists report on the side effects of students listening to music, they usually claim that music is not recommended to be heard while engaged in cognitive tasks. Although it is true that student number three in figure 3 does listen to music and answers the most poorly overall with vague information, they claim to have another incorporated studying method which is not considered during this test. They claim to study by not only listening to music, but also writing down information, as that is what helps them remember most. The results of this test could have been different if these conditions are incorporated. Because different people have different studying methods, it really depends on each person's way of how they remember information. The student in figure 4 who answers in most detail overall, only studies by listening to music unlike student number three in figure 3 who not only listens to music, but also uses other methods. This could have also affected those students who do not listen to music; they could perhaps answer questions with more detail if they incorporate their own studying method or they study in a similar situation/place relative to where they usually study. This test proves that music might be huge factor that could potentially affect a student's academic performance, but it is definitely not everything when it comes to extra personal preferences.

APPLICATION

Now that the effect of listening to music while working is been shared through this investigation, more people will hopefully take in the advantages and disadvantages of music in their daily lives as they choose to incorporate it into their daily routines. Knowing that music has abilities to boost memory, it can be used in many fields of study such as working with people who have Alzheimer's. Listening to music can get patients who have this disease to be more focused on the person they are interacting with, when they listen to a certain song and trigger certain memories of that person. Music has this overall reputation of being beneficial to the brain as it also

has a reputation of being distracting while engaged in cognitive tasks. This investigation proves that there is no right answer as to whether or not music helps to increase academic performance; it truly does depend on the student's chosen studying methods and how they feel they learn the best.

REFERENCES

Ashley Johnson (October 23rd, 2017), *Sea Spiders Use Their Hearts, Not Guts, To Pump Oxygen.* Retrieved on November 27th, 2017. Retrieved from https://www.dogonews.com/2017/10/23/sea-spiders-use-their-guts-not-hearts-to-pump-oxygen

Cory Turner (2014, September 10). *The Is Your Brain. This Is Your Brain on Music.* Retrieved From http://www.npr.org/sections/ed/2014/09/10/343681493/this-is-your-brain-this-is-your-brain-on-music

Lecia Bushak (2014, March 11). *This Is Your Brain on Music: How Our Brains Process Melodies That Pull on Our Heartstrings.* Retrieved on January 10, 2018. Retrieved from

http://www.medicaldaily.com/your-brain-music-how-our-brains-process-melodies-pull-our-heartstrings-271007

Prashant Magar (2016, September 15). *How does Music affect the brain? The Answer Will Make Your Jaw Drop*. Retrieved From https://www.buzzle.com/articles/how-does-music-affect-the-brain.html

Sheela Doraiswamy (2012, October 8). *Does Music Help You Study?.* Retrieved From http://www.mindthesciencegap.org/2012/10/08/does-music-help-you-study/

Changes to People's Mood in Response to the Different Lyrics and Beats

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Abstract

Various studies have confirmed that music can have effects on the mood of the listener. This project explores the different factors in a song that could affect people's emotions. Knowing the answer to how this happens could potentially give people some control over their emotions. An experiment was then conducted to really confirm if the previous predictions are right. For the investigation, subjects listen to three different songs and give feedback on how they feel. The results mostly depend on what the lyrics talk about and the continuous tempo of the song. The songs that highlight a lot of bad events have negative effects on the subjects while the complete opposite happens for songs with faster tempos and higher chords. The results justify the initial theory and it shows that music does affect people.

I. INTRODUCTION

Sounds are everywhere. Whether it's created by birds chirping outside or the sound made by someone's ringtone. Music is just an organized combination of independent vocals and chords. It occurs in many different forms such as rhythms, keys and even genres like pop and rap. All of these key elements have a massive impact on people. Over the years human beings have been listening to music, and are moved by what they listen to. The sole objective of this project is to dive deeper into the whole idea of how music influences people.

Various studies that have been conducted and confirmed several benefits to listening to music.

- A study conducted by Georgia Tech college students who take a least of one music-related course, have a greater likelihood of staying in school than the rest of the students who enrolled. (Blog.oup,2014)
- A team of researchers examined the relation between students who don't study music and those that study it, music students show significantly less stress and anxiety when taking a test. (Blog.oup,2014)
- In another review, researchers studied patients who were about to go through surgery. The patients were asked to either listen to music or take drugs before a surgery. The results showed that the patients who listened to music had less anxiety than the people who took drugs. (Daniel Levitin, 2013)

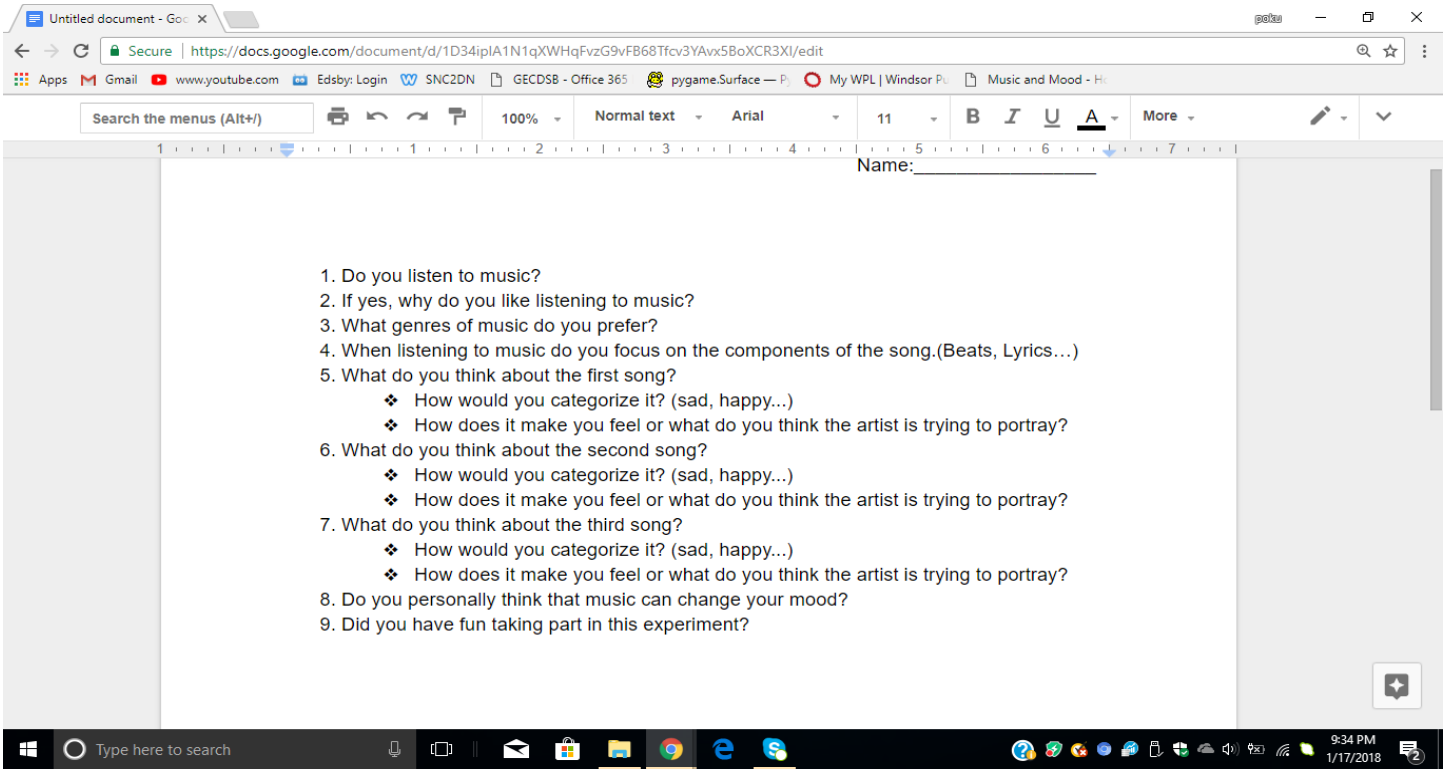
Learning more about this can help identify why this happens because it could potentially lead to the ability to have some control over someone's emotions. People who are diagnosed with emotional branches of chronic diseases can use music to cure their illnesses along with other treatments. Students in high school and post-secondary can really use this to relieve stress. (NCBI)

Figure 1-Demonstrates that turning up a song can help people to become less stressed when working.

The research proves that music does have amazing effects on people. However, why are the moods of humans affected by numerous beats and lyrics? Some predict that if subjects listen to songs with different beats and lyrics then according to the specific words; the story that is told in the song or the continuous rhythm or pitch of the song it alters one's emotions because the brain analyzes songs with higher pitches and faster speed as excitement but the brain examines songs with dull tones and minor keys as sad. Occurrences of both high and low chords in songs cause feelings like love.

II. Methods

To further prove previous theories, it is imperative that an experiment along these lines is conducted to support any ideas. For this particular experiment, students between ages 14 and 15 can specifically to listen to three different songs and give back feedback about how they feel. The more the merrier. Prior to the experiment day chosen, supply the subjects with this list of questions in Figure 2.



Name:_____

1. Do you listen to music?
2. If yes, why do you like listening to music?
3. What genres of music do you prefer?
4. When listening to music do you focus on the components of the song.(Beats, Lyrics…)
5. What do you think about the first song?
   - How would you categorize it? (sad, happy...)
   - How does it make you feel or what do you think the artist is trying to portray?
6. What do you think about the second song?
   - How would you categorize it? (sad, happy...)
   - How does it make you feel or what do you think the artist is trying to portray?
7. What do you think about the third song?
   - How would you categorize it? (sad, happy...)
   - How does it make you feel or what do you think the artist is trying to portray?
8. Do you personally think that music can change your mood?
9. Did you have fun taking part in this experiment?

Figure 2-This is a list of questions that should be used for this experiment.

The conductor has to provide the first subject with any writing utensils that they need along with the questions. Subject A can insert headphones into a computer or phone with the chosen music playlist. They have to listen to each song for a period of 3 minutes; these have to be from three different categories (songs that are classified as sad or happy or motivational). They can stop in-between each song for about 30s to enable them some time to write something down. This process has to be repeated for every song that is chosen. For the results to be fair for this whole experiment the conductor has to repeat all the previous steps for every subject. The conductor of the exercise can then collect the paper with the newfound data.

Some independent variables in this experiment can be that there are three particular songs for every subject, and the people selected also count as independent variables.

The dependent variables in this study are how the subject's mood is affected; the number of negative and positive emotions they have after listening to the songs. This is because these variables depend on the listener and most importantly the category of songs.

The different variables that are controlled throughout the whole evaluation are the length of

the songs, same songs, same number of songs, environment, questions, age group and identical versions of the song for all the subjects. This is critical because if one subject listens to a song for thirty seconds but the other participant listens to the same song for a period of five minutes, the second subject has more exposure to the song and they will probably be able to give accurate descriptions about how they feel whereas the first subject barely listened to the song. This investigation also has to be conducted in the same environment and with the same age group because different age groups have beliefs and attitudes. People around the age of fifty might find classical music appealing whilst teenagers might have a liking for rap or pop music. Basic counter cultures can have effects on the results. Evidently the same selected songs and questions should be used for every subject. These key elements should be the same for every experiment to avoid any flaws in the results.

III. Results

For this experiment specifically, the songs are How could you leave us by NF (a sad song), Havana (trap nation remix) by Camila Cabello (happy song) and Angel by the Wings by Sia. (motivational music)

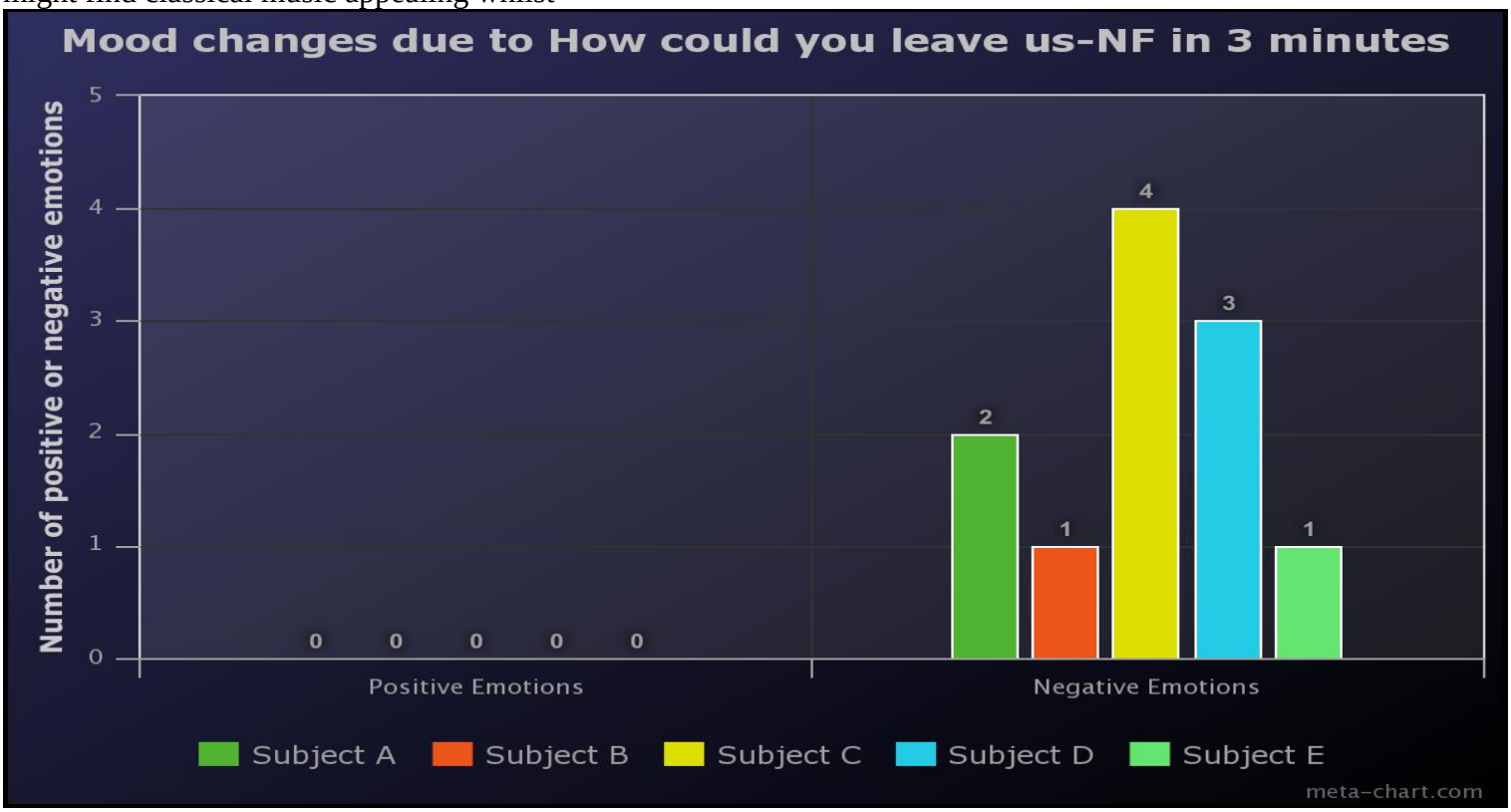


Figure 3-This graph shows the number of positive and negative emotions that the listener feels after listening to How could leave us for a period of 3 minutes.

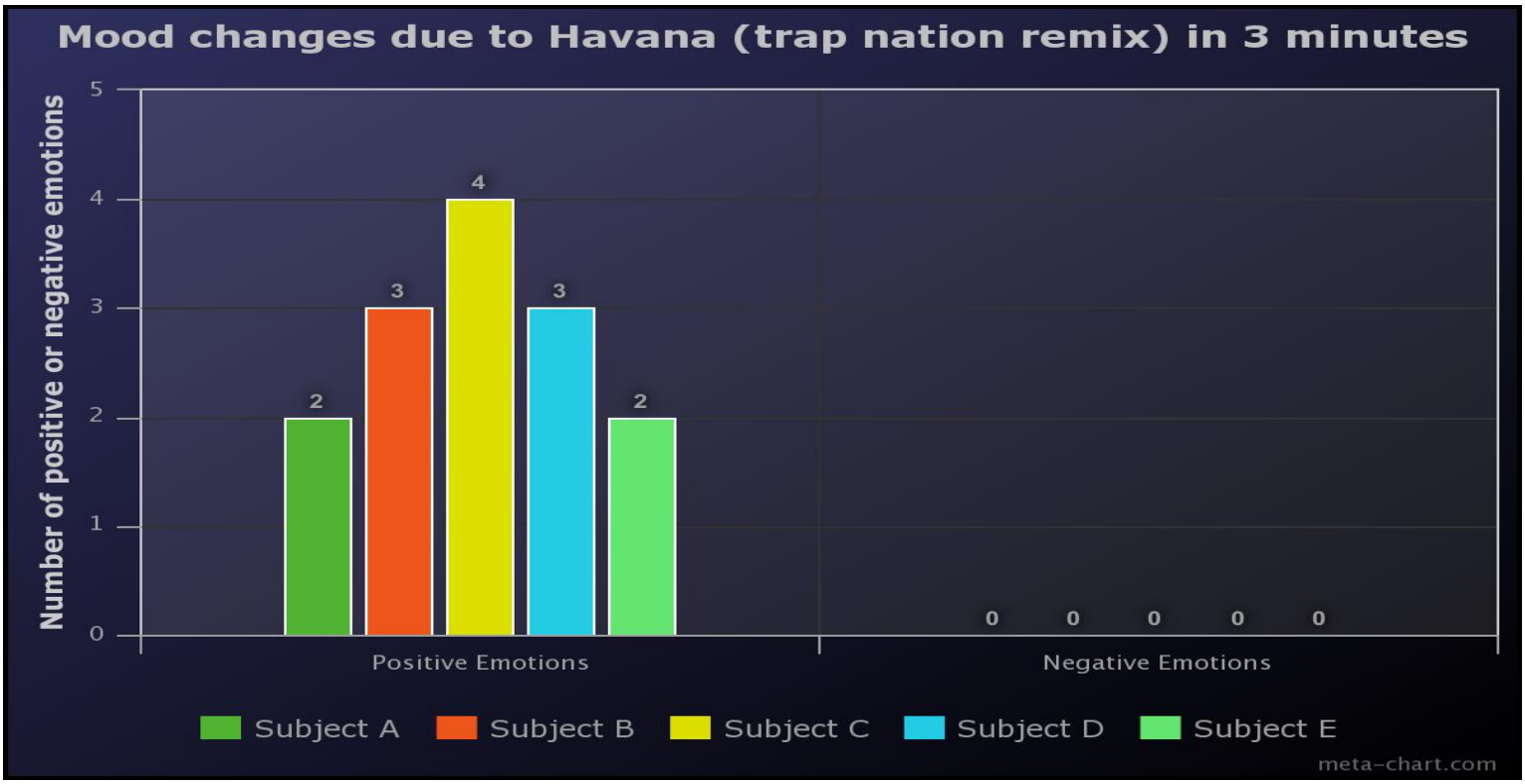


Figure 4-This shows the number of positive and negative emotions that the listeners have after listening to Havana for 3 minutes.

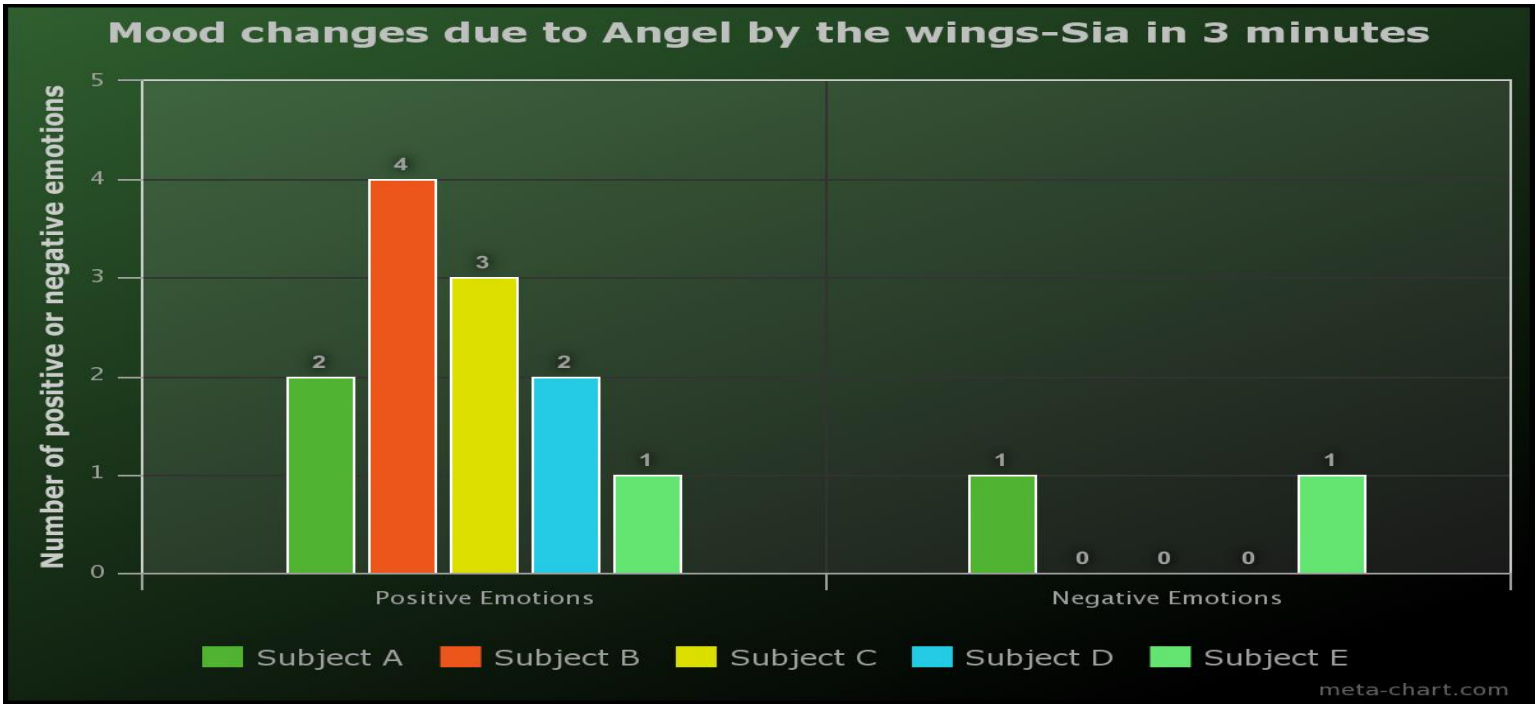


Figure 5-This shows the number of positive and negative emotions that the listeners have after listening to Angel by the wings for 3 minutes.

IV. Discussion/Conclusion

The hypothesis is really similar to the actual results. When the subjects listen to the songs according to the whole story of the song the subject's mood is affected. For example, for the song; How could you leave us, the song discloses the struggles that the musician goes through because he lost his mother. The rhythm of the song has occasional high chords but mostly consists of minor keys. This clearly affects the subjects in a negative way because they disclose that they feel sad and emphatic.5 out of 5 people reveal that they feel sad. 2 out of 5 people disclose that they are angry and frustrated about what happened to the artist. 1 out of 5 people feel emphatic for the artist. For the second song; Havana, which has very high chords and an upbeat rhythm especially since it is a remix affects the subjects in positive ways. One of the subjects even disclose that they feel like dancing. This is various beats like that of Havana's are much faster and exciting beats and it talks about living an exciting life in Utopia (something like paradise). 4 out of 5 people agree that the lyrics are cheerful and 5 out of 5 people reveal that they feel happy. The lyrics in Angel by the Wings are somber and it talks about how people can do anything. 4 out of 5 people reveal that they feel hopeful and encouraged. 1 out of 5 people feel that the song is sad because of the slow beats and the lyrics of the song.

These results confirm that the previous predictions are right. The song; How could you leave us influenced people negatively. They reveal that they feel sad because of what the artist went through. Havana on the other hand affects the subjects in positive ways. This is because of the stimulating beats. Similar experiments have been conducted that have identical results. A study in 2013 in the subject of the Journal of Positive Psychology found that people who listened to upbeat music improves their moods and boosts their happiness. In the experiment, participants were asked to try to improve their mood, but they only succeeded when they listened to the upbeat music of Copland as opposed to the sadder tunes of Stravinsky. (Healthline,2017) Some experiments have actually recorded different results. For this evaluation it was proved that playing exciting music (fast tempo, dramatic content) for long periods of time is not very healthy because it leads to cortisol and noradrenaline production. An overdose of these hormones can create many health problems like depression but these results are mostly related to genres like heavy metal.(Weebly) There are some holes in this experiment because the aspect of different genres is not taken into account. The results can drastically change these results but until that is proved these results are quite precise.

V. Application

The information can be of help to fields like the medical field, specifically areas that deal with the cognitive neuroscience of music. These results can be used to further their studies and knowledge on how music affects the mood and why? Other branches of medicine that can also use this data are hospitals that specialize in mental health. These results can be used for disorders and illnesses like depression and bipolar disorder in an attempt to try to control their mood changes using music. This newfound data can be used by anyone whether they are teenagers or people of age. Music can be used to de-stress and everyone needs that every once in a while.

Figure 6-This picture displays that music can be a therapy session for some people because they might relate to the song.

VII. References

Barry Goldstein. (2018). Music and the Brain. The fascinating ways music affects your mood and mind. Retrieved from January 18,2018 from https://www.consciouslifestylemag.com/music-and-the-brain-affects-mood/

Deane Alban. How Music Affects Your Brain. Retrieved on January 16,2018 from https://bebrainfit.com/music-brain

Elizabeth Landau. (2013). This is music on your brain. Health Benefits of Music. Retrieved on January 16,2018 from http://www.cnn.com/2013/04/15/health/brain-music-research/index.html

Erin Canty. (2016). The effect different genres of music can have on your mind, body, and community. When we only listen to one type of music or swear off a genre entirely, we miss out. Retrieved on January 16,2018 from http://www.upworthy.com/the-effect-different-genres-of-music-can-have-on-your-mind-body-and-community

Jane Turner and Brian Kelly. (2000). Emotional dimensions of chronic disease. Retrieved on January 16,2018 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1070773/

https://www.healthline.com/health-news/mental-listening-to-music-lifts-or-reinforces-mood-051713

How does music affect you. Retrieved on January 16,2018 from https://effectsofmusicinquiry.weebly.com/conclusion.html

Ashford University Staff. (2017). How does music affect your brain. Retrieved on January 19, 2018 from https://www.ashford.edu/online-degrees/student-lifestyle/how-does-music-affect-your-brain

Martyn Shuttleworth (Jun 2, 2008). Controlled Variables. Retrieved on Jan 18, 2018 from Explorable.com: https://explorable.com/controlled-var

Nameesa Mall. The Role of Music in Today's World. Retrieved on January 16,2018 from http://www.irfi.org/articles/articles_1101_1150/role_of_music_in_today_world.html

Scott Huntington. (2014). Why we should dive deep into studying music history. Retrieved on January 16,2018 from https://blog.oup.com/2014/01/studying-music-history/

Shannon Jewell. Can Music Reduce Stress. What's in the story? Retrieved on January 18,2018 from https://askabiologist.asu.edu/plosable/does-playing-music-reduce-stress

Suzanne Boothby. (2017). Does Music Affect Your Mood? Retrieved on January 18,2018 from

How Long Use and Large Amounts of Foundation Can Affect the Skin.

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I. Abstract

The goal for this experiment was to see how large amounts of foundation, worn for a long period of time would affect the skin. To come up with an answer for the original statement, willing participants placed large quantities of different brands of foundation on the skin for a week and recorded the results. A survey was also conducted, where ten people were asked a series of nine questions that properly demonstrated and showed how the general public applies foundation, and how it affects the skin. 50% of people surveyed wear foundation all day. 40% of people surveyed experienced an increase in blemishes and irritation after wearing foundation for too long. All participants who conducted the experiment, experienced a blemish and irritation. The scientist noticed a trend in the data collected that showed the longer the foundation is applied to the skin, the more chance of skin irritation.

II. Introduction

It is important for everyone to understand how the chemicals and other ingredients in makeup affect the skin. Makeup is something that 40% of people wear daily. It is imperative that the public understand what goes into makeup seeing as "the average women owns 40 makeup products" (Escobar, 2015) at any given time. With the wide variety of makeup products used everyday the purpose of this project was to figure out the affects large amounts of makeup can have on the skin. If foundation is used on a daily basis in large quantities, then the skin will become damaged or irritated because "oil in cosmetics can clog and create blocked pores and reddened bumps on the skin" (Siddons, 2009).

III. Method

The procedure was conducted in two parts. First a survey was conducted and filled out by 10 different people. Following that the experiment was started. To start the experiment, participants were to establish a clear patch of skin that would be safe from external forces that could potentially remove the makeup through out the experiment. Participants were then asked to cleanse said patch of skin with a moisturizing wipe. After that was completed

participants were asked to apply a quarter teaspoon of one of the multiple foundation provided on the area of skin using a Q-tip in a 1 inch thick layer. Next to the applied foundation apply another brand of foundation following the same steps. Participants were then asked to repeat all of the steps again excluding the first two until all brands were applied to the skin. Following this, participants were asked to keep the foundation on for 9 hours, cautiously going about the day to ensure the foundation was not rubbed off. After this, participants were instructed to remove the foundation with a cleansing wipe and record observations. The independent variable for this experiment was the foundation. The dependent variable was the effect of the foundation on the skin. The controlled variables were the amount of foundation used, the length of time it stayed on for, method of application, method of removal, and area of skin the foundation was applied on.

IV. Results

Table 1

	Day 1	**Day 2**	**Day 3**	**Da**
Participant 1	No irritation No discomfort No change	no irritation no discomfort no change	Slightly red And blotchy on the areas where the Mary Kay foundation was applied	Sar A li
Participant 2	No irritation no discomfort	No irritation no discomfort	No irritation No discomfort	Ble app are wa litt

Results from the experiment. As shown above, by day 4 of the controlled use of foundation a blemish had appeared on participant 2. Both Participants experienced a form of discomfort and irritation.

Table 2

How often do you wear foundation	
Option	**# of people**
Everyday	4
4-5 days a week	2
2-3 days a week	2
Only on occasion	2

Table 3

On the days you do were foundation how long do you keep it on for?	
Option	**# of people**
A couple Hours	1
All day	5
Just when I'm out of the house	4

The table above shows the results from the Table three shows the results from the second first question asked in the survey. Majority of question asked in the survey. Majority of people the people surveyed wear foundation everyday. Wear foundation all day long.

Table 4

How do you remove your foundation?	
Option	**# of people**
Carefully remove makeup with a sanitizing wipe and then moisturize	6
Rinse with water and soap until all visible signs of the foundation are gone.	3
Forget take it off	1

Table 4 shows the results from the third question asked in the survey. The results show that majority of people surveyed follow proper removal techniques.

Table 6

Do you currently use ant form of prescription moisturizers or medication to reduce acne or blemishes?	
Option	**# of people**
Yes	5
No	5

Table 6 shows the results from question 5 in the survey.

Table 8

What brand(s) of foundation do you use?
BB Brand
Urban decay
L'Oreal
Two Faced born this way
Mac Brand
Maybelline
Tarte
Lancome
Avon
Joe Fresh
Covergirl
Fit-me
Benefit

Table 8 shows the results from question 7. Most people who conducted the survey have more than 1 type of foundation that they currently use

Table 5

Circle all that apply	
Option	**# of people**
Experience redness where applied	1
Notice an increase in blemishes	4
Experience discomfort	1

Not everyone who participated in the survey answered question 4 which table 5 shows the results of, however we can still tell that 40% of people surveyed notice an increase in blemishes.

Table 7

Do you regularly cleanse and moisturize your face before applying foundation?	
Option	**# of people**
Yes	8
No	2

Table 7 shows the results from question 6 in the survey. Majority of people follow proper application techniques however some still do not apply foundation correctly.

Table 9

What Brand(s) of cleansing products do you use?	
First-aid beauty	Mario Bodescu
Neutrogena	Biore
Nivea	Garnier
Mary kay	
Clean and clear	
Tarte	
Aveeno	
La Roche Posey	
Noxzema	
Cetaphil	
Vichy	

Table 9 shows the results from question 8 on the survey. Just like the results from table 8 show, majority of people who participated in the survey use more than one cleansing product daily.

V. Conclusion

The original hypothesis was correct. It stated that if large amounts of foundation were used on a daily bases the skin will become damaged or irritated. This was proven with the experiment, when after 5 days of placing a ¼ teaspoon of foundation in a semi thick one inch layer with two different foundations with two different people, it was noticed that both foundations had negative effects on the skin on both participants. It was also stated in the survey that 40 % of people noticed an increase in blemishes after wearing foundation for extended periods of time. Large quantities of foundation effect the skin negatively because as it was stated above, the experiment revealed that both brands of foundation caused different effects on the skin, the mary kay foundation caused the skin to become red and blotchy in places where it was applied and covergirl caused a blemish to appear. Based on the experiment, Mary Kay had more harmful effects on the skin at a faster rate than covergirl. Covergirl was less severe and only caused slight discomfort for the second participant. Based on the survey, 40% of people wear foundation everyday of the week. 50% of people surveyed wear their foundation all day. 60% of people surveyed regularly remove their foundation carefully with a sanitizing wipe. 40% of people noticed an increase in blemishes after wearing foundation. 50% of people surveyed have or currently use prescription moisturizers or medication to reduce acne and blemishes. 80% of

people regularly cleanse and moisturize their face before applying foundation. The results of the experiment relate to the original question because the data collected shows how the way different people apply and wear foundation affects the way the skin the foundation was applied to reacts. The data from the experiment and the survey support the hypothesis because as stated and shown before majority of people do not take proper care of the skin that the foundation is applied to, which causes and increase in blemishes and irritation which is what the hypothesis predicted. The data collected is consistent with what other investigators have reported. Both LIVESTRONG and Renee Rouleau have preformed experiments and collected data from other sources that agree with the original hypothesis.

VI. Application

The data and conclusions drawn from this experiment could not be used in other fields besides cosmetics. The information shown in this journal would not corelate with any other field of study, however the information could be used where all forms of cosmetics are concerned especially during the processes of testing and creating. The general public could use this information to be more careful and cautious of what goes into the products to ensue what is being bought and applied to the skin isn't going to have lasting or scarring effects on the skin. The scientific community could use this information as a gate way to learn more on the subject and create better products that will not have as harmful effects on the skin. The results from this experiment could potentially open the general publics eyes to the harmful effects of anything being purchased and used not just in cosmetics. The information could further the advancement of better products by grabbing the general public attention to what is going into the products used in todays society, and demanding that the scientific community provides better products that will not harm the human body.

VII. References

How Does Makeup Affect The Skin? – Siddons, S (2009, August 20th) Retrieved January 18, 2018 from www.health.howstuffworks.com/skin-care/beauty/skin-and-makeup/makeup-affects-your-skin.htm

Is Wearing Foundation Makeup Every Day Bad For Your Skin? - Renée Rouleau. (2017, November 10). Retrieved January 18, 2018, from http://blog.reneerouleau.com/is-wearing-foundation-makeup-daily-bad-for-your-skin/

The Amount of Makeup Products the Average Women Owns is Plain Shocking- Escobar, S (2015, October 14th) www.goodhousekeeping.com/makeup/a34976/average-makeup-products-owned

What Are the Effects of Makeup on the Skin? - Uzoma, K. (2015, February 18). Retrieved January 18, 2018, from

https://www.livestrong.com/article/160667-what-are-the-effects-of-makeup-on-the-skin/

Negatives on one's Mental Capabilities due to the Abuse of Technology

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Abstract

This research investigated, what the negatives were on one's mental capabilities (specifically attention span, memory and cognitive abilities), which came along with overusing technology? This is relevant to today's society because, as one knows, technology is taking this world by storm, and is an addiction which appeals to people of all ages, as that's the only thing people are caught up in these days. Something this good can't be all positives, which is why, further investigation was done to see the negatives. This investigation was done with an experiment, as 2 people were given the same test which dealt difficult problem-solving questions, with one given access to their phones, and one wasn't. A following test was given 3-5 hours later, which tested if subjects remembered that same test, and then the marks were compared for both tests, to see if there was any negative correlation between the mark on the second test and the amount of questions searched up. From this procedure which was done 3 times, it was found that there was a correlation, as the more questions that were searched up, the worse subjects ended up doing, as the more dependency one has on their phone, the worse memory they can have about the material. This ties in with the big idea, as this can prove that as one uses technology more so during their day, this can imply they have a shorter attention span since they are constantly on their phone, and this can also lead to a shorter memory. As well the results can imply that one should refrain from overusing their technology, as then it won't end up affect their memory, attention span, and cognitive abilities.

Introduction

This project is about how people's memories, attention span and cognitive abilities can be affected when they end up overusing their devices and technology, and how much of an impact it can have, as opposed to those who barely use their phones. The point of this research being done is to prove that technology can be harmful on one's mental capabilities at times when overused, and that it can be better to refrain from giving into the urge of constantly going to our devices, as it can help us focus on the actual reality around us.

This topic is important but also controversial, as studies have shown that a human's attention span has been reported to be less than a goldfish's, which begs to ask the question, what plays a role in this? Social Media and technology is known to play a role in decrease in attention span and withdrawal from society. But as well, it is known to help with multitasking and prioritizing capabilities to work more efficiently. Also with

gamers, video games are known to help with better development of motor skills, when people are exposed to different visual environments for example. ADHD and ADD are both attention based disorders which affect one's attention span, and recent surveys and studies show that kids in elementary school who are attached to their devices and spend more than 1-2 hours on them, were 1.6-2.1 times more likely to develop ADHD. This controversial topic of technology either being beneficial or harmful to society is an important one as it has its impacts on the growth of society but also the detachment of people from society.

The question being asked here is how the time spent on technology can affect one's attention span/cognitive abilities, and detach one from society?

If one is to use technology for an excessive amount of time opposed to someone who doesn't as frequently, then some of the aftermaths they are likely to have is a shorter attention span and detachment from society, because studies show that kids and adults who are known to spend over 1-2 hours on social media and on their devices, have a greater risk of developing ADHD, and being drawn away from society. As well this may be able to lead to weaker bonds with family members and others close ones, as studies show that kids who are surrounded by parents who are attached to their screens, feel less supported by them, and often mimic those same things.

Methods

The first step that needs to be done when conducting this experiment, is to set the first two subjects side by side at a table (providing them with test #1 face down and a pencil and eraser), with a divider in between. Allow one of the two subjects to have access to their phone, while the other doesn't, and start 2 individual timers for each when they are ready to start. When each subject is done with their test and hands it back, stop their timer and write their time down in the chart along with their name, and whether they had access to their phone. When both subjects are done, compare their answers on the test to the answer key, and give them marks according to whether they answered each question right. Tally up their marks and give them a mark out of the total tally it should be out of (given on the answer key). Find the percentage of the mark they received and put the grade in the box for their result on the table corresponding to the person. For the second follow up test, follow the same steps as used for the first test (on the same subjects), but wait 3-5 hours after the first test has been done at the minimum before calling subjects back.

The independent variable here was the ability to use phones, as that was the factor that was changed throughout the procedure. The dependent variables were the time it takes to finish each test, the score received on each test by each subject, the average scores and times for each test corresponding to the group of people, and the number of questions searched up on first test in relation to result on second test.

The controlled variables here were, the tests which remain the same and the minimum number of hours to wait before giving out the second test to the subjects. The tests were remained controlled, as it was necessary for them to be the same difficulty throughout for all subjects, so it was constant to ensure for more accurate results. As well the minimum number of hours needed to wait in between tests was kept the same, as no subjects could get a head start on the next test, as the point of the procedure was done to see how well subjects could remember after a set time

Results

This table shows the initial time, and result for each subject's attempt at both Test #1 and #2, as well as if they had access to their phones (if so, how many questions searched using their phones).

Subject	Phone Availability	Time – Test #1	Result	Time - Test #2	Result (2nd
1	Yes Questions Searched:3	8:00 minutes	35.5/50 (71%)	5:47 minutes	4/9 (44.4%
2	No	9:02 minutes	29.5/50 (59%)	7:39 minutes	7.5/9 (83.3%
3	Yes Questions Searched:2	21:00 minutes	47.5/50 (95%)	8:00 minutes	5/9 (56%)
4	No	41:00 minutes	47.5/50 (95%)	10:00 minutes	8/9 (89%)
5	Yes Questions Searched:2	26:17 minutes	37/50 (74%)	9:46 minutes	5.5/9 (61%
6	No	13:15 minutes	34/50 (68%)	7:20 minutes	8.5/9 (94%

Table 1

Test 1	
Time	*Result*
*Group with **Phone** Availability*	*Group with **Phone** Availability*
Test 2	
Time	*Result*
*Group with **Phone** Availability*	*Group with **No Phone** Availability*

This table shows which group ended up doing better in each category – corresponding to test #

Which group did better in each category? (quicker time and better percentage) - Average Based

Table 2

Averages	
Averages for - No Phone Availability	
Time – Test #1	*21.1 minutes*
Results – Test #1	*74%*
Time - Test #2	*8.38 minutes*
Results – Test #2	*88.8%*
Averages for - Phone Availability	
Time – Test #1	*18.4 minutes*
Results – Test #1	*80%*
Time - Test #2	*7.8 minutes*
Results – Test #2	*54%*

Table 3

This table shows the averages for the times and results for each group of people – corresponding to test #

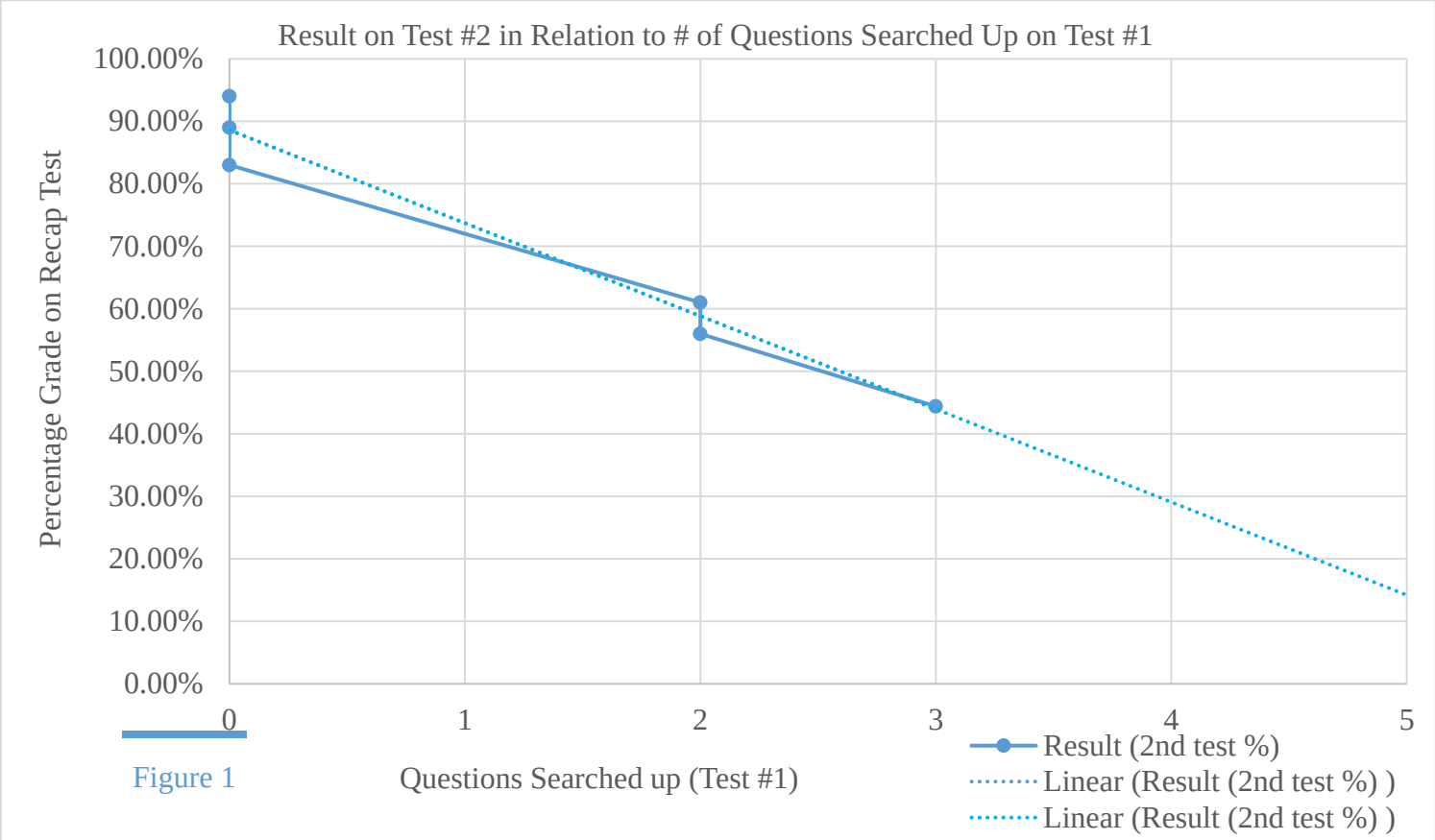

Figure 1

Discussion/Conclusion

The original hypothesis has been proven correct by the results, as those results showed that those who didn't use a phone on the first of two tests, ended up receiving higher grades on the second test which dealt with attention span and memory, meaning that one who uses online sources more frequently, is bound to have a lower attention span in some cases. To answer the initial question which was being asked, the number of hours being put in to technology daily *can* affect one's attention span, as the results showed, the more one depended on devices, there was a worse result on the second test (dealing with memory and attention span), showing that essentially those people payed little attention to the actual material, and more so on devices. This relates to the question asked as this emulates how the more one spends on devices, the less focus there is on the other surroundings, and how it starts to affect memory, attention and cognitive abilities. When dealing with questions testing how well one can remember past events, those who had access to phones did not perform as well, since the results can demonstrate how one can easily forget something previously read hours before, when dealing with technology, which can be distracting in these cases as shown. When one has no connections to the digital world, it is easy focus on one task, and can improve one's memory of the task at hand, as the subject is allowing for it to be processed it on its own, with no devices limiting potential for memory of the material. The amount of questions searched up correlates with the result on the second test, as ones who searched up less questions ended up doing slightly better, since there was less dependency on phones, showing there was still some attempt to accomplish it, and problem solve solely, allowing for better memory of the material covered.

This related back to my original question, as it was being asked how the hours spent on devices could possibly negatively affect ones mental capabilities, and the results given aided with answering that question, as the results gathered were to show the comparison in the results for two tests, one which tested cognitive abilities, and the second to test memory/attention span, for two groups of people, those who would have the option to depend on phones, and those who were deviceless, and see what the difference was in terms of grades.

These results further prove the hypothesis, as the results prove that the more one is found to be depending on their devices, even for a short-term period to get the answer for a question (as done so in the procedure), it can have a negative impact on one's attention span, cognitive abilities and memory. Using the results, the more questions one searched up, the worst result they had on the second test, as this had implications that since one is found to be depending on their phone more so, they are spending less time trying to process the questions, and are more concerned about the answer rather than the solution. The reason those who had no access to their phone did better on the memory test would be since they problem solved for the

questions on the first test and using their brain instead of outside sources, so they would have a better memory of it since they didn't have devices to distract them, nor did they skim past it. These results were consistent with other investigators reports as those reports had similar tests done, for example one report made people go to an art museum and take pictures of art, while the same thing was done with others, except they just observed, taking no pictures. Results showed that those who just observed normally had better memory of the material. This example along with other research papers done, further helps prove and goes along with the point that technology can have a massive negative impact on one's memory of certain things, as well can draw away from one's attention span, as they will be more caught up in the device than the actual surroundings.

Something that ended up going not as planned would have to be the initial test being too difficult for some subjects to complete without a device, which is why they ended up getting a far lower grade oftentimes than those who had access to their devices. This was expected, but not to the extent which it was at when the experiment was conducted, as it was expected for them to struggle with 1 or maybe 2 questions at worst. If they hadn't had issues with the first test, then the results wouldn't have varied this greatly, but the overall conclusion would've been the same.

Application

This new information gained can be applied in fields like neurology, anthropology, psychology, and other fields which concern human behavior. More research can be done which builds off this as when dealing with those fields, one can further examine how technology can exactly affect one's attention span/memory or cognitive abilities. There can be a more in depth look in to which parts of the brain are affected from this, and how it can change the way people behave. The public can also benefit from this as this information is targeting that audience and how negative it can act on the public. Using this research, they can adjust their lifestyle and usage on technology accordingly. This way they can limit their use of technology daily and interact more with their surroundings. This also fits in with the big picture as it targets most people in society these days, and further manifests on the point that technology can be harmful as well on one's mental capabilities in the long run, as it can be an abuse of power.

References

a) Andrew, E. (2016, August 15). Is Technology Making or Attention Span Shorter Than A Goldfish's? Retrieved October 04, 2017, from http://www.iflscience.com/technology/technology-making-your-attention-span-shorter-goldfish-s/

b) Baral, S. (2016, August 16). How The Internet Affects The Brain: The Connection Between Technology And Human Memory. Retrieved October 18, 2017, from http://www.ibtimes.com/how-internet-

affects-your-brain-connection-between-technology-human-memory-2402754

c) Development of Cognitive Control. (n.d.). Retrieved November 15, 2017, from https://www.uwo.ca/bmi/research/featured/morton.html

d) Green, C. S., & Bavelier, D. (2003, May 29). Action video game modifies visual selective attention. Retrieved October 04, 2017, from https://www.ncbi.nlm.nih.gov/pubmed/12774121/

e) Impact of Social Media Addiction in Families. (2017, August 09). Retrieved October 04, 2017, from https://www.addictionhope.com/blog/social-media-addiction-families/

f) People Collection. (n.d.). Retrieved November 15, 2017, from https://www.ualberta.ca/arts/about/people-collection/sandra-wiebe

g) Rieger, S. (2015, December 03). Screen Time Is Bad For Kids Development: University Of Alberta Researchers. Retrieved November 15, 2017, from http://www.huffingtonpost.ca/2015/12/03/screen-time-kids-alberta-study_n_8711094.html

h) Wilmer, H. H., Sherman, L. E., & Chein, J. M. (2017, April 25). Smartphones and Cognition: A Review of Research Exploring the Links between Mobile Technology Habits and Cognitive Functioning. Retrieved October 18, 2017, from https://www.semanticscholar.org/paper/Smartphones-and-Cognition-A-Review-of-Research-Exp-Wilmer-Sherman/267375e2b17e53afe1fc8b9b15b25820c7b0133a

WiRed

(video game addiction)

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Abstract

Video game addiction is a recent controversy surrounding anyone playing video games. Video game addiction is now being listed as a mental disorder by the World Health Organisation (WHO). To see what makes video games so addicting, students at Al-Hijra academy played different versions of the game Red, and gave an opinion on what version of the game was most addicting. Most of the students form grades 1 to 8 preferred the final version of the game which offered great challenge within a simple formula. The 2nd version of the game failed among the students as it never offered quite the challenge. The first version of the game was liked by a lot of the younger students as it included a variety of colors that were absent in the 2nd and 3rd versions of the game. The results showed that a simple and frantic game formula was the most addictive among the students and was the most fun.

Introduction

The intention of this project was to gain knowledge on computer science, to understand the basics of the Unity software and learn how to create addictive videogames. During research an article on the controversial topic of video game addiction had shown that the WHO had listed videogame addiction as a mental disorder. typically, more than 6 hours a week was considered an addiction. Finally, the question occurred: What makes mobile videogames so addicting? After hours of playing countless videogames, a possible answer, if a video game is fast paced, simple, and competitive then it would be very addictive because of its challenging and repetitive gameplay.

Method

After creating all 3 versions of Red (Videogame) in the Unity game maker, the collecting of data had started. Gathering 20 students from grades 1-8 each student was requested to try each version of the game 5 times than asked to continue, there yes or no answer was recorded. To get a more accurate result

their opinion on each version of the game was recorded, most of the older students from grades 4 to 8 usually gave their opinion on why they liked the game and how to improve it in the future they also explained why the other versions of the game were disliked and ultimately not fun. This gave a more definitive answer to why they liked or disliked a version of the game aside from the basic yes or no answer. Looking at the recorded results the most addictive game is chosen after roughly 2400 trials. The results are then condensed to which game they ultimately liked by only using there (yes) answer leaving the conductor of the experiment with only 160 final results. (further or lesser experimentation may vary from these projected results), than the most addictive game is chosen according to the results. The variables included the different school grades, the first version of the game having a different color scheme from the second and third versions. The third game having a different timer from not at all in the first and second version of the game. The controls included the same 3 games being played by each person 5 times, the first and second version of the game having no timer, and the second and third versions of the game having the same colour scheme.

Results

Each version of the game included a new element. Version 1 had the player tap through 6 colours and swipe up when red appeared. Version 2 was similar but removed all colours aside from black, white, and red. Version 3 added a score system and a timer that counts down from the 5 second mark, and every swipe on red added 2 bonus seconds.

The results showed that regardless of the game version and gender, grades 1-3 were not more inclined to play the game after each attempt. Grades 4-8 however were more inclined to play the game after each trial. The greatest difference was with the grades 7 and 8 as they highly preferred the final version of the game as opposed to earlier versions. The males in both these classes also preferred the final version more than the females in their classes.

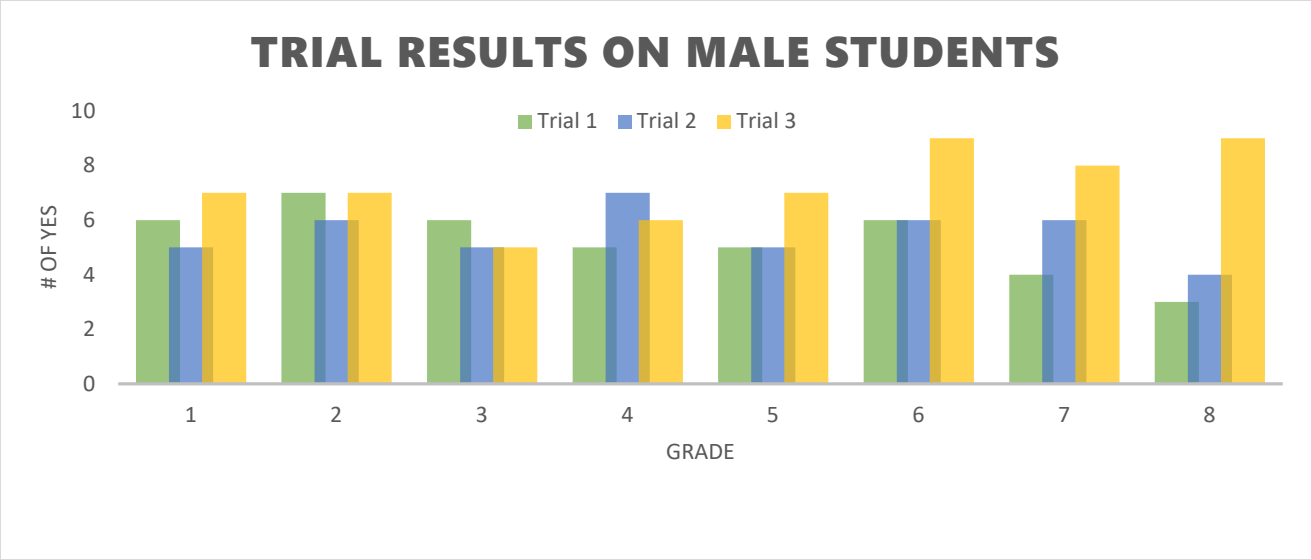

Figure 1- Number of YES answers given to each version of the game from male students from each grade

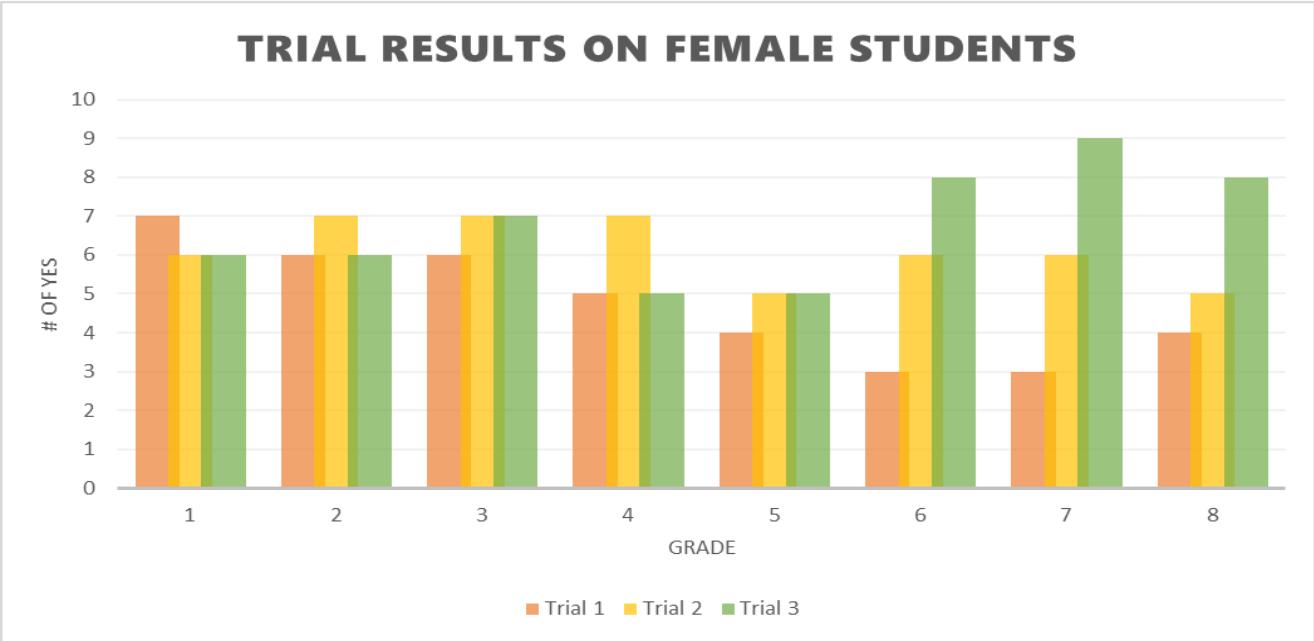

Figure2-Number of yes answers given to each version of the game from female students from each grade

Discussion/Conclusion

The hypothesis was proven correct to an extent. The game became more popular and addicting when it was made simpler, fast-paced, and competitive. Although this only applied to the oldest 4 grades, and especially the males of the two eldest grades. If an opportunity was resented to repeat this experiment, a reflex measuring tool would be included into the background of the game to asses how reflex may have an impact on the reception of the game. The results conclude that grades 1-3, both male and female, find any type of mobile experience addicting if there is a type of visual, haptic, or audible stimuli. As the game became simpler, more fast-paced, and competitive, the grades 1-3 still did not seem more interested, their interest levels remained the same regardless of the game version.

Grades 4-8 became more interested in the game as the versions progressed. The simpler the game became (by reducing the number of colours), the more likely they were to play again. Although the final version, which added a timer was by far the most popular, especially among the males of the oldest two grades. The score system allowed for the kids to keep track of their scores and compete for the high score.

Application

This project helps to get a deeper understanding of videogame addiction and improves knowledge about it from a business, medical and practical standpoint. It teaches you how to make a video game but most importantly an addictive one that attracts a large audience. From a medical standpoint it shows you the dangerous effects of prolonged hours of playing videogames, it also shows how similar it is to substance and drug abuse. (Mainly through the research aspect of the project). Lastly it provides a basic background to the world of computer science

References

Makuch, E. (2016, October 17). DLC and Microtransactions: New Study Shows How Gamers Feel About Them. Retrieved January 18, 2018, from https://www.gamespot.com/articles/dlc-and-microtransactions-new-study-shows-how-game/1100-6444522/

Griffiths, M. (2008). Internet And Video-Game Addiction. *Adolescent Addiction*, 231-267. doi:10.1016/b978-012373625-3.50010-3

Issue Information. (2015). *Addiction Biology*, *20*(4), I-Ii. doi:10.1111/adb.12213

Hamilton, K. (2017, November 30). Opinion: In-game purchases poison the well. Retrieved January 18, 2018, from https://www.techspot.com/news/72103-opinion-game-purchases-poison-well.html

(n.d.). Retrieved January 18, 2018, from http://www.camh.ca/en/hospital/health_information/a_z_mental_health_and_addiction_information/drug-use-addiction/Pages/addiction.aspx

Smith, D. (2015, April 22). I miss the days when I only had to pay once for a video game. Retrieved January 18, 2018, from http://www.businessinsider.com/microtransactions-are-ruining-video-games-2015-4

Video Game Addiction Symptoms and Treatment. (n.d.). Retrieved January 18, 2018, from https://americanaddictioncenters.org/video-gaming-addiction/

Wells, J. (2012). Metabolic response to playing video games. *Http://isrctn.org/*>. doi:10.1186/isrctn22537903

The Innovation of Enteric Coatings Using Naturally Made Polymers

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ABSTRACT

The purpose of this experiment is to develop, test, and produce as many enteric coatings made of natural ingredients as possible that can be classified as "fast acting" by quickly dissolving in the stomach. To test this, an innovation was designed which involved creating polymers using the chosen ingredients, coating a Mentos candy with the coating, and testing its dissolving times in club soda. After conducting this experiment, it was proved that five successful coating could be made from Flour, Gelatin, Seaweed, Sugarcane Extract, and Shellac. The conclusion reached was that Plant Based or Organic ingredients proved the best results when tested as an enteric coating.

INTRODUCTION

The purpose of this Innovation is to test what types of natural ingredients can be used to develop enteric coatings that dissolve quicker than brand name medications, and can be classified as "fast acting."

Answering the given Statement of Purpose is important because it will help a majority of the population get a safer and more effective form of medication. Most prescription drugs are coated in gelatin, which is shown to cause minor effects such as bloating and heartburn. (WebMD) However, some medications contain resins which are heavily processed and have been shown to sometimes contain phthalates, a type of plastic that can cause several side effects. (Leah Zurbe, Prevention). In doing this experiment, several coatings will be developed that use natural and more effective designs.

What ingredients can be used to produce an enteric coating that is natural, effective and can dissolve quicker than regular coatings?

If the enteric coating of prescription medications is made with more natural and less dense materials, then the medication it coats will be able to dissolve quicker, allowing it to be more effective. Enteric Coatings are used to encase tablets to protect them from stomach acid. (Sheffield Biosciences/Kerry) Hypothetically, by creating a thinner coating, this should allow the medication to

dissolve quicker, increasing the effect is will have. Also, by using natural ingredients, this coating will be able to be used by a broad variety of patients, potentially suiting their specific health needs.

METHODS

In order to test the different coatings developed, they shall be applied to a Mentos candy, and left to set. Once completed, the Mentos' will be placed in a container of Club Soda, and timed until the coating has dissolved. Once the coating dissolves, a vigorous bubbling reaction should be spotted, indicating the reaction.

- Mix Gelatin with Tap Water to form paste.
- Gently coat Mentos in paste and leave to set.
- Place formed Mentos into a glass of Club Soda (room temp.)
- Start a timer, and wait for the Mentos to vigorously bubble.
- Once Mentos bubbles, record time taken.
- Repeat Steps the first five steps with Flour.
- Repeat Steps repeat the first five steps with Shellac Coating (spray onto Mentos)

The independent variable is the enteric coating on the pill. The dependent variable is the time taken for the coating to dissolve. The control variable is the Mentos being used as pill and Club Soda as stomach enzymes, and the type of Club Soda being used to test the coating.

RESULTS

In addition to the innovation below, a background survey will be conducted to produce additional information that will be used as a preface to the overall presentation. The following questions will be asked in the survey:

1. What is your preferred medication type?
2. What are any complaints about medications you have taken?
3. Would you be open to using a medication coated with a natural and more effective coating?

In order to test the different coatings developed, they shall be applied to a Mentos candy, and left to set. Once completed, the Mentos' will be placed in a container of Club Soda, and timed until the coating has dissolved. Once the coating dissolves, a vigorous bubbling reaction should be spotted, indicating the reaction.

Survey Results

1. What is your preferred medication type?

Responses to Question 1 (survey)

Medication Type	Number of Votes
Capsule	6
Chewable	3
Tablet	2
Soft Gel Tablet	5
Liquid/Syrup	7

Table 1- Table of the Survey Results from Question

Responses to Question 1(survey)

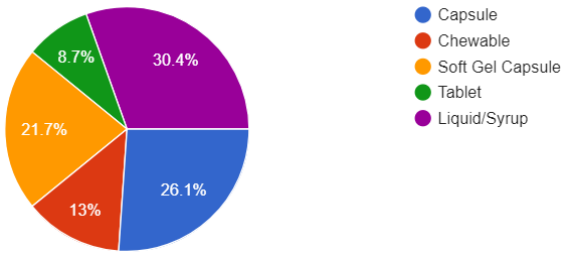

Figure 1- Graph of the Survey Results to Question 1

2. What are some complaints you have about current forms of medication?

Responses to Question 2

	Number of Entries
Taste-Related	11
Size	6
Side Effects	3
Release Time	1
Other	2

Table 2-Table of the Response to Question 2 (Survey)

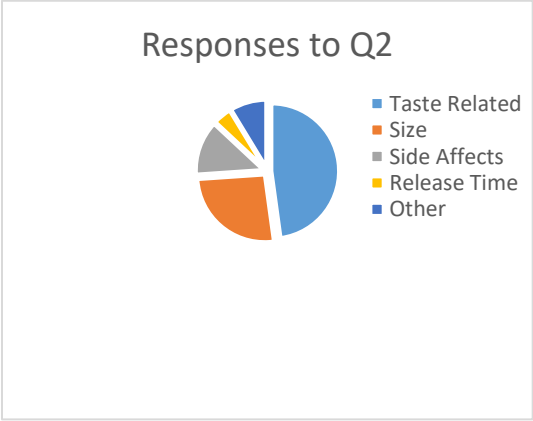

Figure 2- Graph of the responses to Question 2 (survey)

3. Would you be open to using a medication coated with a natural and more effective coating?

Responses to Question 3

Answer	Number of Votes
Yes	20
No	3

Table 3- Table of the results to Question 3 (Survey)

Responses to Question 3

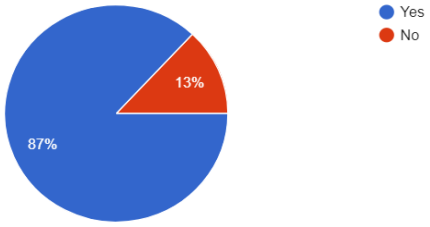

Figure 3- Graph of the results to Question 3 (Survey)

Generic Medicines Dissolving Time in Club Soda

Name	Time to First Release (min)	Time to Coating Dissolving (min)
Tylenol EZ to Swallow	1:28	7:42
Exact Ibuprofen	8:10	33:12

Table 4 – Table of the time taken for brand name medications to dissolve in club soda

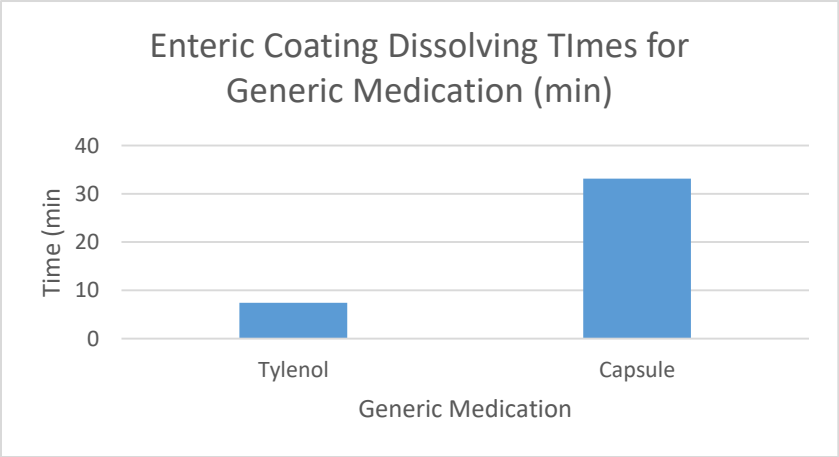

Figure 4-Graph of the time taken for brand name medications to dissolve in club soda.

Release times for Homemade Enteric Coatings

Coating Type	**Time to First Release (min)**	**Time to Coating Dissolving (min)**
1. Gelatin	0:42	1:47
2. Flour	0:00	0:00 *instant dissolving*
3. Shellac	0:30	1:28
Seaweecd	~1:44	6:58
5. Sugarcane	0:32	5:38
6. Natural Honey	0:29	1:52

Table 5- Graph of the Release times for homemade Enteric Coatings.

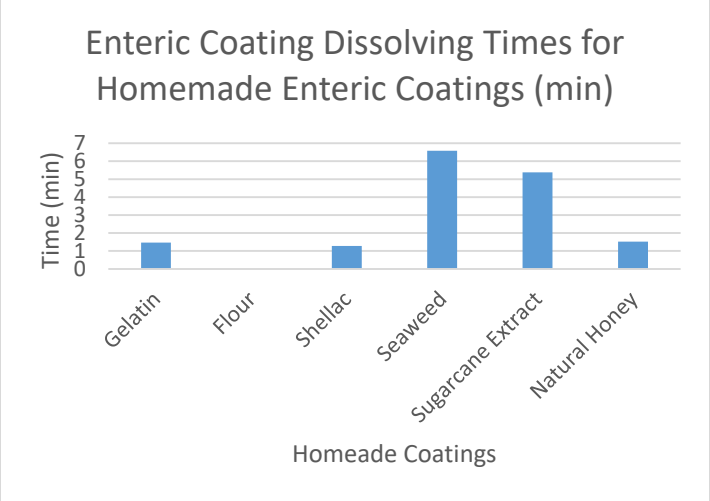

Figure 5 -Graph of the time taken for homemade enteric coatings to dissolve in club soda.

DISCUSSION

After conducting the experiment, it can be concluded that in general, plant/

organic based ingredients are the best category of ingredients to use when developing an enteric coating that is more effective, normal, and easier to dissolve. The criteria for Plant and Organic Based Ingredients is that the ingredient must be derived from organic matter with little to no processing or intervention. For this experiment, a successful coating can be deduced as a coating that avoids using processed or artificial ingredients, while still being able to easily break down in the stomach, effectively delivering a potential medication. In the experiment, 4 of the 6 coatings were plant based and all four were broken down by the Club Soda in under 15 minutes' maximum. This could be due to the natural sugars, which in most cases like Palm Sugar or Honey were heated up to form a polymer like substance that would cool down and harden.

The results of the experiment show several trends that can be observed. The first trend was that Plant or Organic based coatings that contained sugar, both natural or processed, formed air tight seals that generally encapsulated the Mentos better than other coatings. The only exception to this was with the Seaweed coating, which absorbed water while still allowing the Mentos to slowly release, possibly due to the plant's porus features from its underwater life. Another trend was that coatings that formed polymer like substances were more durable when compared to other coatings. This trend was found in coatings made from Honey, Gelatin, Palm Sugar, and Shellac. While the Flour coating did form a polymer, it was very weak, and resulted in repeated failures, where the coating instantly broke apart. Overall, the most effective coating was the between the Shellac and Seaweed, as the Shellac formed a thin, almost invisible coating, while the Seaweed was able to break down through the coating.

Some of the possible errors that could have occurred were with the timings. All timings stated above were recorded by observation as to when the coating was broken by the soda. In recording the time by hand, the numeric results may not have been as precise as desired. In addition to this, due to a lack of certain resources, each coating was tested once, rather than being the average of several trials. These errors could dramatically effect the validity of these results.

APPLICATION

The results of this experiment can be used to help not only the pharmaceutical industry, but several other industries. Developing these new fast dissolving coatings provides a new alternative for doctors and nurses, who traditionally rely on IV's for delivering medicines quickly. This provides medical staff with an alternative to IV's that still keeps the quick delivery standard that medical staff require in emergency situations. Not only can this innovation benefit humans, but also animals, like cats and dogs, who also currently rely on the use of IV's.

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REFERENCES

Bahadur, S., Chanda, R., & Ro, A. (2014). [Abstract]. FORMULATION AND EVALUATION OF ENTERIC COATED MICROCAPSULES OF DICLOFENAC SODIUM FOR MODIFIED RELEASE BY COMBINATION OF WET GRANULATION AND THERMAL CHANGE METHOD, 2(4). Retrieved October 19, 2017, from https://www.japtronline.com/index.php/JOAPR/article/view/32/30.

Challener, C. A. (2017, October 16). Oral Delivery of Biologic APIs: The Challenge Continues. Retrieved October 19, 2017, from http://www.pharmtech.com/oral-delivery-biologic-apis-challenge-continues

Knowledge base. (n.d.). Retrieved October 19, 2017, from http://www.dfepharma.com/en/knowledge-base/oral-solid-dose/wet-granulation.aspx

Enteric Coatings. (n.d.). Retrieved October 05, 2017, from http://www.sheffieldbioscience.com/enteric/

GELATIN: Uses, Side Effects, Interactions and Warnings. (n.d.). Retrieved October 05, 2017, from https://www.webmd.com/vitamins-supplements/ingredientmono-1051-gelatin.aspx?activeingredientid=1051\

Stone, K. (n.d.). What Is an Active Pharmaceutical Ingredient? Retrieved October 19, 2017, from

https://www.thebalance.com/api-active-pharmaceutical-ingredient-2663020

Zerbe, L. (2012, January 19). Plastic in Medications Could Make You Sick. Retrieved October 05, 2017, from https://www.prevention.com/health/healthy-living/dangers-pthalates-pill-coating

Production of biological active ingredients. (n.d.). Retrieved October 19, 2017, from http://www.industry.siemens.com/verticals/global/en/pharma-industries/technological-offerings/pages/bio-apis.aspx

How the Amount of Sleep Effects School Marks

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Abstract

Student are always competing to get the highest mark possible. When doing this they sometimes sacrifice sleep and other activities to do so. People now days are sleeping way later than before because of the amount of work they get. An experiment was conducted to see if there was a correlation between the amount of sleep you get and school performance. To conduct this experiment, 5 people took 3 tests a day for 3 days with 6,8 and 10 hours of sleep. The subjects then recorded and compared the results with each test performance. With all the results collected, it was shown that those who slept for 10 hours had the highest average with around 85% followed by the 8-hour sleep and finally those with 6 hours of sleep. So, with that in mind those who are fighting for every percent possible, it is recommended to have 10 hours of sleep.

Introduction

P As a student, marks are very important. Students are always trying to find the easiest and best way to get the highest marks possible. Whenever students think or study, the brain works hard to send signals to other parts of the body. After a long day of work the brain eventually gets tired and needs to rest. So that brings the question. Does sleep have a correlation with student's educational capabilities?

This topic is important. People will now know if sleeping for only 5-6 hours will affect how well you do in school compared to those who slept for a greater time. It is said by (*Derk-Jan Dijk, professor of sleep and physiology at the Surrey Sleep Research Centre)* that the quality of sleep one gets can have a greater affect on people rather than the quantity. So, if someone sleeps for only 3 hours but has a good sleep it is the same if not better then sleeping for 10 hours but a not so good slumber. There has been a rise in the number of students dropping activities they love to do because the amount of homework they get leaves little to no time for students to relax before they sleep (August 31, 2015 by Craig Canapari MD). Students are not going out as much anymore because they feel sleep can help them further in education instead of going out and playing sports. Teens have irregular sleeping patterns. Some days they stay up all night

and still have the energy to go through the next day without any problems, on other days they may struggle to function even after 10 hours of sleep (sleepfoundation.org).

Does the amount of sleep one gets at night affect school grades?

If a student only has 6 hours of sleep **then** it shouldn't make a difference if the quality of his/her sleep was good. This is **because** student use sleep to get refreshed. If someone has an amazing sleep that only lasted 5 hours then the goal of their sleep has been accomplished, they should feel refreshed in the morning. Now, if a student has a terrible sleep which lasted 10 hours they sacrificed some time trying to sleep. So, in the end it's the same outcome.

Method

Sleep for 10 hours. At 9:00 AM complete the math test provided, it will be labeled test one day one. When complete mark the test and record the results. At approximately 12:00 PM complete the math test provided labeled test 2 day 1. Finally, at 5:00 PM complete the math test provided labeled test 3 day 1. When complete mark the test and record the results. Repeat all steps the next day with 8 hours. When finished steps with 8 hours sleep the next day once again repeat all steps. When complete compare results.

Independent Variable: The independent variable for this experiment is the amount of sleep the subject gets at night. It does not rely on any other factors.

Dependent Variable. The grades/marks are what is being measured. That is why it is a dependent variable. The results will be different based on the amount of sleep, which is the independent variable. The marks rely on the amount of sleep.

Controlled Variable: The controlled variable for this experiment is the tests that the subjects are required to do. Each subject will partake in the exact same test. This, is to ensure that there are no differences that will invalidate the experiment.

Results

(Table 1) Test Taker Averages 10 Hours of Sleep

Table 1 Displays the Averages for the test taken with 10 hours of sleep

Name	Test Score Average
Subject 1	88%
Subject 2	87%
Subject 3	83%
Subject 4	80%
Subject 5	90%

(Table 2) Test Taker Averages 8 Hours of Sleep

Table 2 Displays the Averages for the test taken with 8 hours of sleep

Name	Name
Subject 1	78%
Subject 2	83%
Subject 3	83%
Subject 4	76%
Subject 5	86%

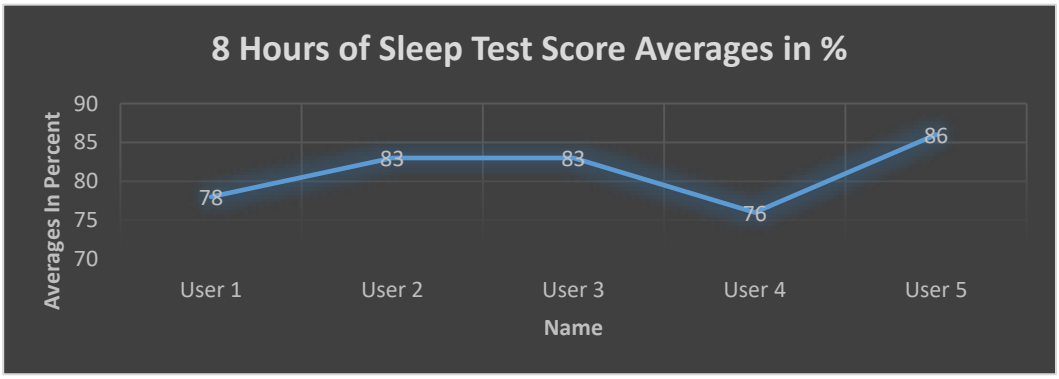
(Table 3) Test Taker Averages 6 Hours of Sleep

Table 3 Displays the Averages for the test taken with 6 hours of sleep

Name	Name
Subject 1	73%
Subject 2	72%
Subject 3	80%
Subject 4	82%
Subject 5	88%

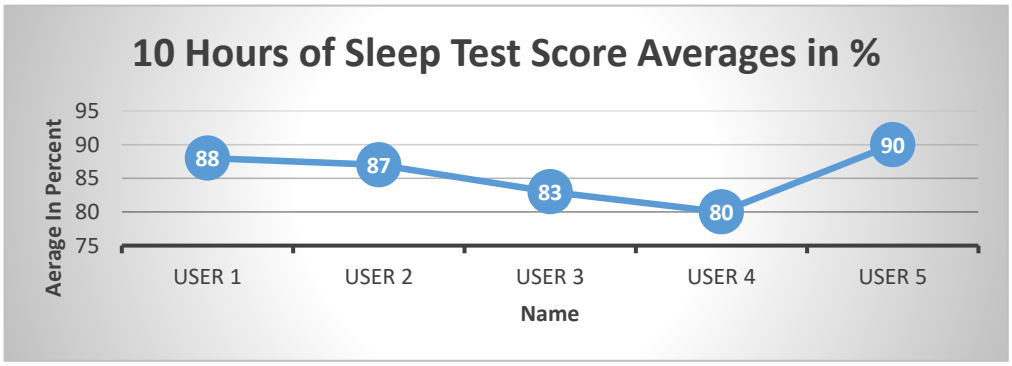
(Figure 1) Test Taker Averages 8 Hours of Sleep

Figure 1 Displays the Averages for the test taken with 8 hours of sleep



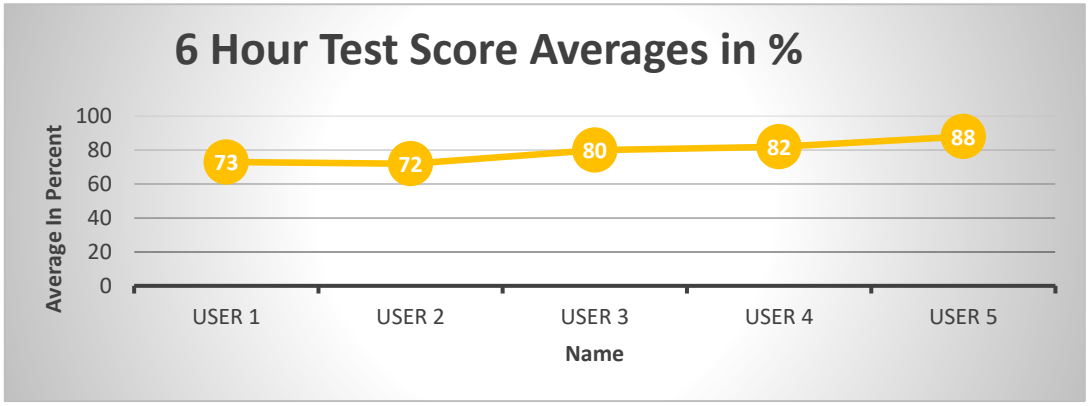
(Figure 2) Test Taker Averages 10 Hours of Sleep

Figure 2 Displays the Averages for the test taken with 10 hours of sleep



(Figure 3) Test Taker Averages 6 Hours of Sleep

Table 3 Displays the Averages for the test taken with 6 hours of sleep



Discussion/Conclusion

The initial hypothesis stated that it didn't matter whether how long someone slept if the quality of sleep was good. The experiment that was conducted did not address and answer this question as it did not test the quality of sleep. However, based on the data collected from the experiment, the subjects had the highest test score averages with 10 hours of sleep with an overall average test score being 86%. This was followed by the 8-hour sleep test score averages with 81% and then finally the test scores of the 6-hour sleep with an average score of 79%. The range between the highest and lowest being a whopping 7% difference. This ultimately concludes that those with a longer sleep time tend to have higher marks. There is a steady increase of test scores as you move between the averages of the 6,8 and 10 hours of sleep.

The results differ than what was stated earlier in the hypothesis. The experiment results differed than the hypothesis largely because the experiment did not measure what was being tested during the hypothesis. Scientists have agreed upon a consensus that the longer someone sleeps should have a correlation with the higher marks (Fred Danner, PhD, of the University of Kentucky,).

To have the best results possible the experiment should have monitored sleep patterns using accessories such as the Fitbit, this would allow the conductor of the experiment to ensure that each subject indeed had the exact amount of sleep required with no interferences in between. Also, the test that was used to conduct the experiment was math.

Every subject has different mathematical capabilities, subject one may be better at solving questions than subject 5. This is something that is not within the conductors control. So, t is impossible to have exact results without any outside

factors interfering. Had all the subjects possessed the same mathematical skills, the results may not have been as diverse as they were.

Application

As mentioned before this topic is very important to people. Since this project centered around school marks, it is especially useful to students. Students are always trying to find the best and most efficient way to secure high marks. People who are fighting for every mark are recommended to have approximately 10 hours of sleep to ensure maximum brain rest which would ultimately lead to best marks possible. In theory, the philosophy of longer sleep equals maximum an best effort could apply to anything, not just marks. After training for a sports event or competition, people should always look to rest and refresh themselves with some shut eye to ensure best results.

References

http://www.dailymail.co.uk/health/article-2542940/Worried-little-sleep-It-not-matter-all.html

https://drcraigcanapari.com/homework-vs-sleep-a-cause-of-stress-in-teens/

https://sleepfoundation.org/sleep-topics/teens-and-sleep

https://aasm.org/poor-sleep

How Much Can Badminton Affect Reflexes/Responsiveness, and How Much of an Impact Do Reflexes Have in Life?

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Abstract

Reflex-based sports, usually any sport that is played with a racquet, demand its athletes to have fast reactions and reflexes all the time, meaning that these professionals are at the top of the ladder in decision making and reactions. However, it is still uncertain whether people can actually improve reflexes through badminton, and how reactions and reflexes corelate with life. As an experiment to see how much badminton can improve reflexes, reaction times were recorded for three subjects, five times each, before and after playing 30 minutes of badminton. Next, to demonstrate how reflexes will be used in life, tennis balls were thrown at each subject (at different speeds and arcs) to see if the subjects will catch or dodge the tennis balls. From the average reaction times of each test, it shows that, generally, playing badminton improves the average reaction times. Each subject was also able to successfully dodge or catch the tennis balls with ease. The results show that badminton is, indeed, able to improve reflexes, even if it is only slight, and that reflexes are important when one's life is in harm's way, from a hurtling projectile, bad drivers, burning, and more.

Introduction

Reflex-based sports require a lot from athletes, like instant movements and decisions. To keep up with this, athletes work on reactions and reflexes to perfection. Working on these over a long period of time results in professional performance in the game, and reacting or making decisions in no time. So logically, playing badminton should have the ability to improve reaction times and help keep people safe from danger. This project tests how much badminton can really improve reflexes, and how reflexes are useful outside of physical activity.

Sports like badminton and table tennis can help people who have slow reflexes, or are less responsive, in an enormous way. Responsiveness is one of seven characteristics of life, and without it, there are difficulties in everyday activities. The nervous system, muscular system and human reflexes go hand in hand, and are an important protection mechanism in life. For example, blinking

when something flies towards someone, or raising an arm if a ball is thrown (Dowshen, 2013) are both protective reflexes that help people stay safe in life. If reflexes develop any further, then performing everyday tasks, doing a job, or playing games needing fast reactions will evidently, be easier. Although, how much of a development badminton makes is uncertain.

The question asks, "how much can badminton affect reflexes/responsiveness, and how much of an impact do reflexes have in life?" While the hypothesis to this question is: if reflex-based sports improve someone's reaction times, life would be more safe and easy, because reflexes help people evade danger in every situation. The muscular and nervous systems train subconsciously to know when danger approaches, and how to avoid getting hurt. Players in racquet sports work on reflexes to make sure that only 0.3 seconds to react to the ball (Crilley, date unknown) is sufficient, and practicing these sports can hone the speed of reactions. Practicing and muscle memory play a big role; by repeating the same movements, reactions become almost automatic (Jasmin, date unknown), and with the amount of time required in some sports to react to players or the ball, it can greatly improve performances in the game. This isn't just the case in sports, it applies to every situation in life, no matter if it's a practical or spontaneous event. Electrical impulses will travel quicker through the nervous system, and movements become automatic if there are any quick and dangerous situations in the surrounding area. This means that a faster reaction time will not only help in sports, but also in an unexpected event in life that is potentially life-threatening.

Methods

First, base reflexes were tested for each subject, five times with an online test, (url: https://www.humanbenchmark.com/tests/reactiontime), and recorded in milliseconds. The best, worst and average times were also noted. Next, each subject played badminton matches up to 11 points, for 30 minutes straight, where each person played against each other in that time span. Then, reaction times, like before, were recorded through the same method, and compared to the old ones, as well as the best, worst and average times. Lastly, three tennis balls were thrown at each person from 10 meters, with intention for the subjects to catch, or dodge the ball. Each throw was either a light lob, a high arced overhand throw (both of which should be caught) or a hard whip (for the subjects to dodge), and each type of throw was in a random order. Each person's movements and results were then recorded and analyzed.

The independent variables in this experiment are the testing subjects, the starting reflexes and skill level in badminton. Whereas the dependent variables are the reflex test results and performance during the throwing test. As for the controlled variables, the environment of reflex testing and badminton matches, since different places can be more distracting to others, making the

subjects lose focus on the task at hand. The type of exercise being done and length of time doing the exercises are controlled as well, because if it wasn't, there may have been more improvement for some subjects, but not others, which in turn, will alter the results. The directions on what to do when the tennis ball is thrown is controlled so each person is clear on what is happening, and minimal unexpected results would occur. The tennis balls, distance that the tennis balls were thrown at, and the speed of each type of throw are controlled because it kept the experiment equal for each subject, and therefore give honest results. If the balls, distance and speed of the throws keep changing, it will change how each subject will respond, meaning that nothing will be able to be compared to in the throwing tests.

Table 1 First Test		
Subject 1 Reaction Time (in milliseconds):	Subject 2 Reaction Time (in milliseconds):	Subject 3 Reaction Time (in milliseconds):
454 ms	287 ms	232 ms
258 ms	313 ms	267 ms
300 ms	278 ms	283 ms
276 ms	272 ms	265 ms
286 ms	279 ms	320 ms
Average: 286 ms	Average: 286 ms	Average: 273 ms
Best: 258 ms	Best: 272 ms	Best: 232 ms
Worst: 454 ms	Worst: 313 ms	Worst: 320 ms
Second Test		
227 ms	256 ms	253 ms
308 ms	248 ms	261 ms
268 ms	251 ms	276 ms

256 ms	277 ms	285 ms
292 ms	271 ms	295 ms
Average: 270 ms	Average: 261 ms	Average: 274 ms
Best: 227 ms	Best: 248 ms	Best: 253 ms
Worst: 308 ms	Worst: 277 ms	Worst: 295 ms

Results

Table 1: This table shows the ten reaction time tests that each subject did measured in milliseconds. The first five times were tested before playing badminton, and the next five after. Subject 1 and 2's average reaction time went down, whilst Subject 3's increased by 1.

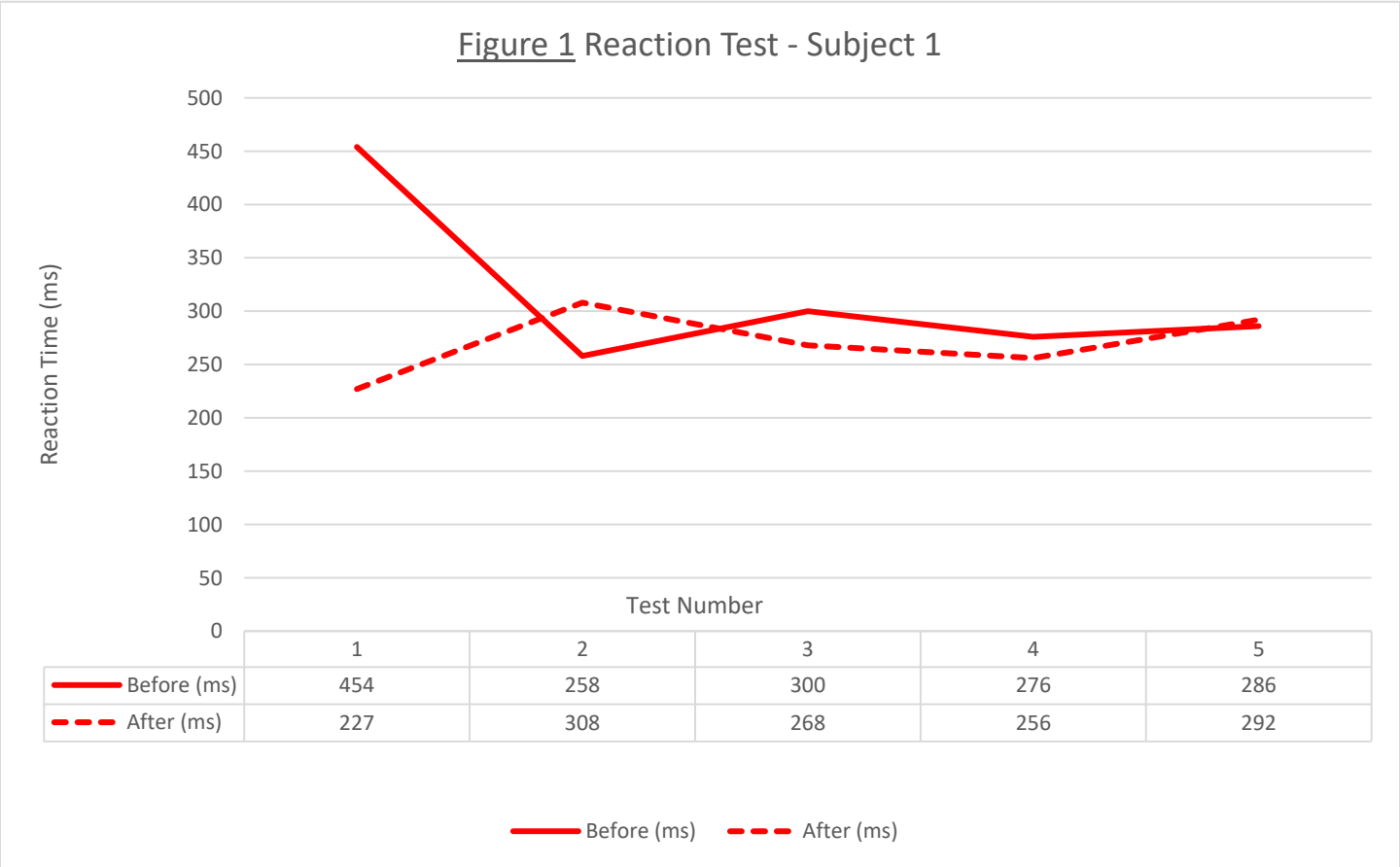
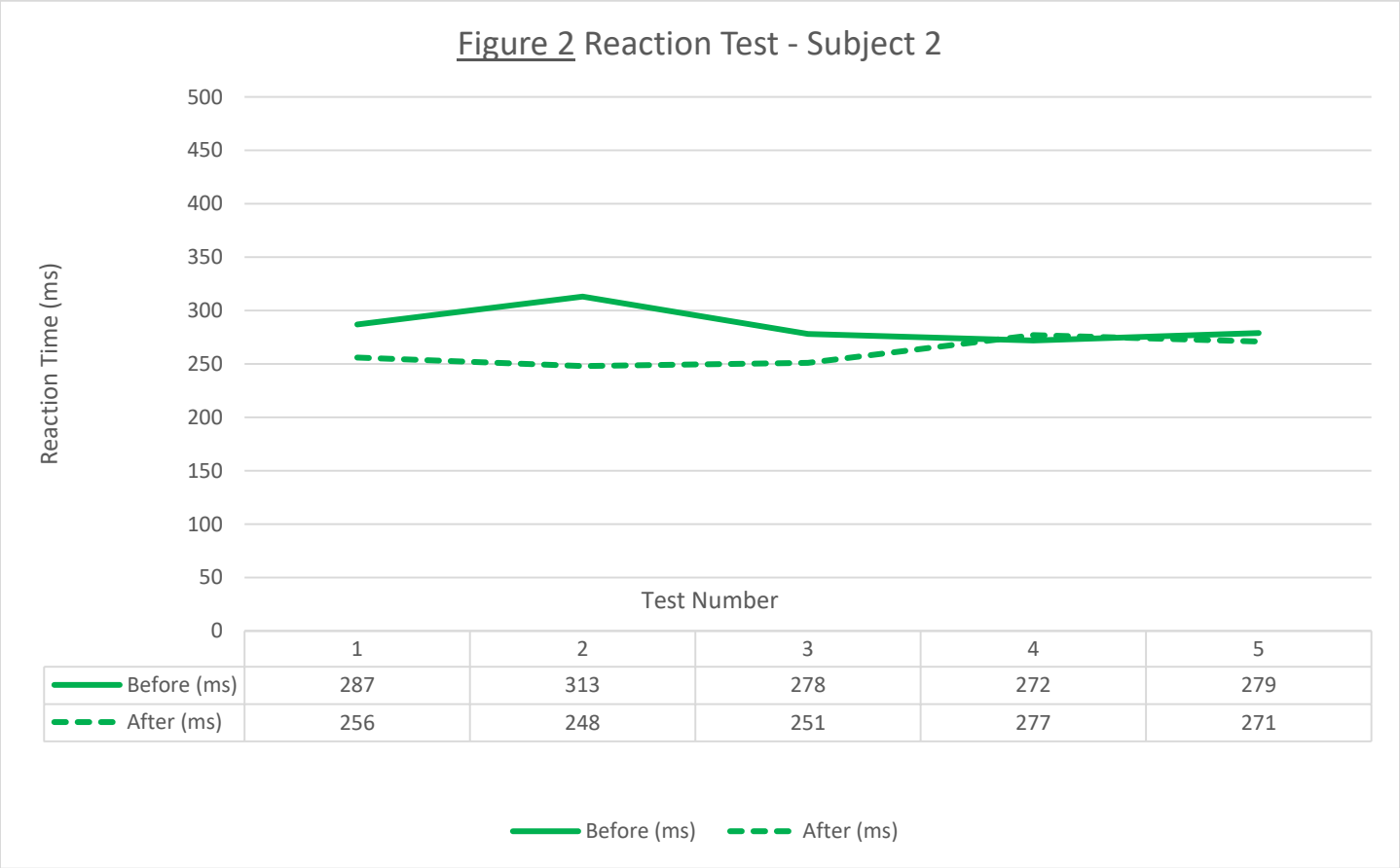


Figure 1: This graph shows the plotted times of Subject 1's reaction time tests. The dotted line shows the trend in reaction times before playing badminton, and the broken line shows the reaction times after playing badminton. With these reaction times, it allowed Subject 1 to catch and dodge the correct tennis ball throws.



	1	2	3	4	5
Before (ms)	287	313	278	272	279
After (ms)	256	248	251	277	271

Figure 2: This graph shows the plotted times of Subject 2's reaction time tests. The legend is the same as Figure 1, with the solid line representing the trend of the first five tests' results and the dotted line representing the next five tests. The average reaction time improved, and allow Subject 2 to successfully dodge and catch the tennis ball throws.

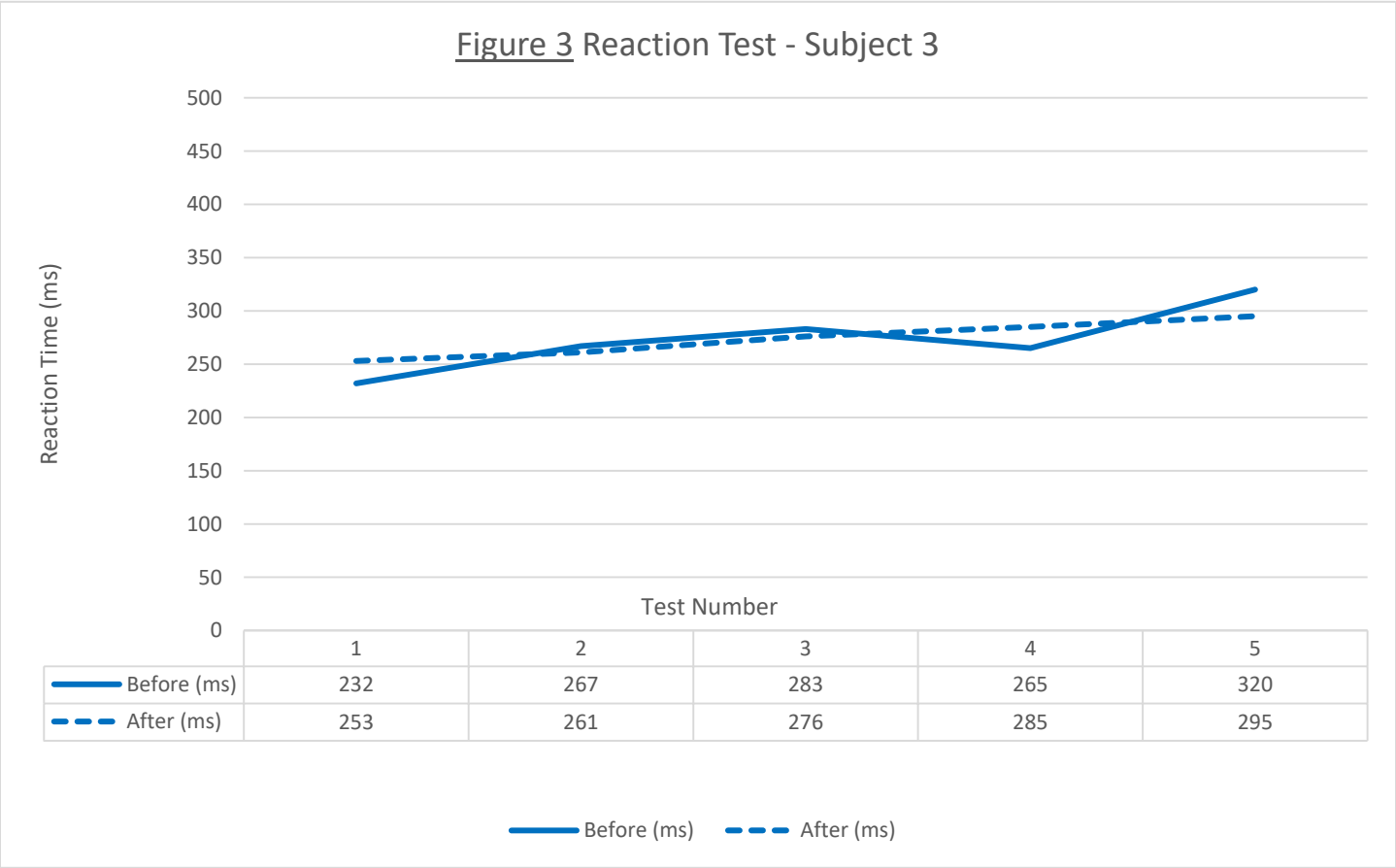


Figure 3: This graph shows Subject 3's reaction times test results, with the legend being the same as in the previous two Figures. Like the rest, these reaction times allow Subject 3 to successfully catch and dodge the correct throws.

Discussion/Conclusion

The hypothesis is partially correct. It states that the lives of people will be safer if reaction times are faster, and through the tennis ball throw test, everyone was able to dodge imminent danger. Even if muscle memory didn't play a role (since the tennis ball throwing test is only done once, meaning that there is no previous recording of the movement), the subjects were still able to catch and dodge the throws with quick reactions and decision making.

The data shows the difference between reaction times after playing badminton, and the question had asked if badminton can improve reflexes. This implies that the resulting reaction times after playing badminton are expected to be lower and reactions, faster. As for relating reflexes to life, the tennis ball throwing test demonstrates human reflexes put to the test; how the human body will naturally move when confronted with danger. Subject 1 and 2's data shows that badminton does improve reaction times, since the times and averages after playing badminton are lower than previously recorded, supporting the hypothesis that badminton will improve reflexes. Reactions and rapid decision making do have an impact in everyday lives as well. There are numerous situations where a person might have to spontaneously move a body part to avoid getting hurt, i.e. avoiding very hot objects, like cooking tools, gym class dodgeball, or other sports/games, and trying to maneuver through the halls without crashing into anyone. Faster reactions and decision making will help throughout the unexpected events of life, and supports the hypothesis that faster reaction times will be able to protect lives.

Some sources of error could have been the amount of time playing badminton and the amount of times the reaction times were tested in each subject. With more playing time and racquet sport exercise, reaction times will definitely be affected, at most, improving them significantly. With the individual reaction times of professionals and the amount of time put in practicing, it would make sense that if the subjects had played as much as pros do, then a decrease in reaction times will occur. Subject 3's average reaction time increased by 1, an unexpected result, as it increased instead of decreased. However, if more badminton had been played, then the average reaction times will be expected to decrease, just as the other subjects' average reaction times did.

Application

Reflexes and reactions aren't only used in sports, but in areas concerning kinesiology or biology as well. Knowing that reactions can be improved through practicing reflex-based sports, there may be other factors that can improve reactions individually, like muscle memory or adrenaline. These areas can also be studied to determine the most efficient way for humans to improve reflexes. These results can help people who desire and/or need to improve responsiveness. The studies that can be done may be looked towards for others to understand what should be done to

maximize the efficiency of reflex improving exercises.

References

Crilley, M. (n.d.). Which Sport Requires the Fastest Reflexes? Retrieved October 05, 2017, from http://livehealthy.chron.com/sport-requires-fastest-reflexes-9672.html

Dowshen, S. (Ed.). (2013, October). What Are Reflexes? Retrieved October 05, 2017, from http://kidshealth.org/en/kids/reflexes.html

Fadel, P. J. (2015, November 19). Reflex control of the circulation during exercise (S. Harridge, Ed.). Retrieved October 18, 2017, from http://onlinelibrary.wiley.com/doi/10.1111/sms.12600/full

Jasmin, L., MD (Ed.). (n.d.). A Quick Look at Reflexes. Retrieved October 05, 2017, from https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=1&ContentID=562

Robinson, R., & Caffrey, C. (2016). Reflexes and Reflex Tests. Retrieved October 18, 2017, from http://go.galegroup.com/ps/retrieve.do?tabID=Reference&resultListType=RESULT_LIST&searchResultsType=MultiTab&searchType=BasicSearchForm&currentPosition=3&docId=GALE%7CCX3630900664&docType=Topic+overview&sort=Relevance&contentSegment=&prodId=HWRC&contentSet=GALE%7CCX3630900664&searchId=R3&userGroupName=ko_k12hs_d27&inPS=true&authCount=1&u=ko_k12hs_d27#content

Choosing the healthiest diet out of vegan, vegetarian, or low carbohydrate based off of the feeling of healthiness, happiness, and hunger

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Abstract

What type of diet or food choices make people feel healthy, happy, and not hungry? Over the past few decades, humanity has been struggling with making the right food choices that greatly affect their performance, appearance, and well-being in life. An experiment conducted in 2017 includes gathering 3 people to test out 3 different diets (vegan, vegetarian, an low carbohydrate) for 3 days each (total of 9 days of dieting per person) in order to discover which of these 3 diets allow people to feel healthier, happier, and not hungry. This experiment found that people feel the healthiest, happiest, and fullest when they go vegetarian. And that going low on carbohydrates makes people feel the hungriest and going vegan makes people the saddest. Vegetarian diets or eating more vegetables while having a larger variety of foods to choose from can help those millions of people who suffer from poor diet related issues in developed countries such as obesity, being severely underweight, scurvy, and etc. or even just regular people who want to feel healthier, and happier, without feeling hungry.

Introduction

"Unhealthy eating linked to 400,000 US deaths per year" (France-Press A). This is a major issue since the beginning of the 21st century. United States of America is Canada's neighbouring country. It is also known as the most powerful country in the world. However, despite being so rich and powerful, many of their citizens are still dying due to unhealthy nutrition and diets. This experiment is extremely important because it can find the best possible solution to avoid 400 000 deaths in a single country each year. If USA has found the best diet that is sustainable, and healthy, it can save "$210 billion per year" (Robert Wood Johnson) as well as that many deaths. That is why, it is very important to find the solution to this problem.

Due to this issue, there is a question that occurs. What diet out of vegan, vegetarian, and low carbohydrate makes people feel and be the healthiest? The conclusion to this question can help those loads of people struggling from issues related to poor food choices in first world countries.

Before this experiment was conducted, the hypothesis was that the low carbohydrate diet must be the healthiest and most sustainable diet. If the low carbohydrate diet is the healthiest, then the experimenter would have little restlessness/fatigue, high energy, high amount of enjoyment, and better concentration during school. They would also be

eating "meat, fish, chicken, vegetables, nuts and seeds, eggs, fruits, and fats" (Ditch the Carbs). This is because decreasing the intake in carbohydrates also decreases the blood pressure in the blood which avoids hypertension (high blood pressure). Research claims that the effects of low carb diets are "weight loss [if already heavy], reduced hunger, better control over insulin and blood sugar" (Babcock 2017). A vegan and vegetarian diet just eliminates or limits the amount of animal substances in the body. This does not necessarily mean it is healthier. Reduced hunger and a well-balanced blood sugar level are important for feeling healthier. This is why a low carbohydrate diet must be healthier than a vegetarian and vegan diet.

Methods

To perform an experiment that would solve the question to find the healthiest diet, there are procedures that are made. For the first three days of experiment it will be focused on the vegan diet; meaning the experimenter will have no consumption of any animal or insect products (meaning they will have no consumption of meat, milk, eggs, and honey). On the next three days of experiment after the vegan diet, the experimenter will focus on the vegetarian diet; meaning no consumption of any meat products, however, milk, eggs, and honey are allowed. For the last three days of the experiment, the experimenter will focus on avoiding sugars, sweet fruits, and foods high in carbohydrates. On every day of the experiment being taken place, the experimenter will do an 8 minute exercise on 8-fit app after 7pm to have similar exercise as the other people doing the experiment. Before they go to sleep, on a scale from 1 to 10 (1 being bad, 10 being good) the experimenter will record their level of happiness, their level of feeling of healthiness and the experimenter will also record their level of hunger (1 being hungry, and 10 being full). They will all aim to go to sleep at 10:00pm to avoid affecting their results due to fatigue. They will also aim for 2000 calories per day to avoid over or under eating that would also affect the results.

There are specific variables to be noticed when doing the experiment. One variable to take notice is the independent variable. The independent variable in this experiment is the food being eaten, since the experimenter is able to change the different foods that he or she eats. Due to the change in foods, the experimenter's levels of healthiness, happiness, and hunger would change. Therefore, the dependent variables are the levels of healthiness, happiness, and hunger. The controlled variables are the amount of exercise, the amount of sleep, and the amount of calories eaten since these variables should not change.

Results

After each three of the experimenters have undergone this experiment for nine days, they brought in some results.

On the first day of the experiment, Person A, who is aged 15, began the vegan diet. The level of feeling of healthiness (1 in being very unhealthy, 10 in being very healthy) is rated as an 8. The level of feeling of happiness (1 in being very sad, 10 in being very happy) is also rated as an 8. The hunger level (1 in being very hungry, 10 in being very full) is rated as a 5.

Image 1: The image above shows the food Person A ate on the first day of the vegan diet. This shows a bowl of strawberries and a bowl of nuts.

On the second day continuing the vegan diet, Person A's level of feeling of healthiness is rated an 8 again. And the level of feeling of happiness is rated a 3. And the hunger level is rated a 4. Person A slept at 12:00am on day 2.

Image 2: The image above shows the food Person A ate on the second day of the vegan diet. This image shows an apple and some green sprouts with tofu.

On the third day continuing the vegan diet, Person A's level of feeling of healthiness is rated a 7. And the level of feeling of happiness is rated a 4. Finally, the hunger level is rated a 3.

On the fourth day, beginning the vegetarian diet, Person A's level of feeling of healthiness is rated a 9. And the level of feeling of happiness is rated a 9 as well. Finally, the hunger level is rated an 8.

Image 3: The image above shows the food Person A ate on the first day of the vegetarian diet. This image shows a poached egg, an omelette, some cooked spinach, and some rice.

On the fifth day continuing the vegetarian diet, Person A's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 9. Finally, the hunger level is rated an 8.

Image 4: The image above shows the food Person A ate on the second day of the vegetarian diet. This image shows some spinach, some tofu, some mushroom, some green sprouts, and some rice.

On the sixth day continuing the vegetarian diet, Person A's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated an 8 again. And finally, the hunger level is rated a 7.

On the seventh day, beginning the low carbohydrate diet, Person A's level of feeling of healthiness is rated a 9. And the level of feeling of happiness is rated a 7 as well. Finally, the hunger level is rated a 5.

Image 5: The image above shows the food that Person A ate on the first day of the low carbohydrate diet. This image shows a bowl of rice with cooked spinach, some lettuce, some chicken, and some eggs.

On the eighth day continuing the low carbohydrate diet, Person A's level of feeling of healthiness is rated a 7. And the level of feeling of happiness is rated a 6. And finally, the hunger level is rated a 4. Person A skipped exercise on day 8. Person A also slept at 12:00am on day 8, instead of the usual 10:00pm.

On the ninth day finishing off the low carbohydrate diet, Person A's level of feeling of healthiness is rated a 6. And the level of feeling of happiness is rated a 5. Finally, the hunger level is rated a 4. This finishes off Person A's part of the experiment.

Next, Person B also submitted the results for the experiment. On the first day of the experiment, Person B, who is aged 15, began the vegan diet. The level of feeling of healthiness is rated as a 7. The level of feeling of happiness is rated a 10. The hunger level is rated as an 8.

On the second day continuing the vegan diet, Person B's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated an 8 too. And the hunger level is rated a 7.

On the third day continuing the vegan diet, Person B's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated an 8 too. And the hunger level is rated a 7. This is just like day 2.

On the fourth day, beginning the vegetarian diet, Person B's level of feeling of healthiness is rated a 10. And the level of feeling of happiness is

rated a 10 as well. Finally, the hunger level is rated a 9.

On the fifth day continuing the vegetarian diet, Person B's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 10. And the hunger level is rated a 10 as well.

On the sixth day finishing off the vegetarian diet, Person B's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 9. And the hunger level is rated a 7.

On the seventh day, beginning the low carbohydrate diet, Person B's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 9. Finally, the hunger level is rated a 7.

On the eighth day continuing the low carbohydrate diet, Person B's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 9. And the hunger level is rated a 6.

On the ninth day finishing off the low carbohydrate diet, and Person's B part of the experiment, Person B's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 7. And the hunger level is rated a 5. This concludes Person B's part of the experiment.

Finally, Person C, aged in between 40 to 50 years old, began the experiment.

On the first day of the experiment, Person C began the vegan diet. The level of feeling of healthiness is rated as a 7. The level of feeling of happiness is rated a 7 too. And the hunger level is rated as a 7 again.

On the second day continuing the vegan diet, Person C's level of feeling of healthiness is rated a 7. And the level of feeling of happiness is rated an 8. And the hunger level is rated a 7.

On the third day finishing off the vegan diet, Person C's level of feeling of healthiness is rated a 7. And the level of feeling of happiness is rated an 8. And the hunger level is rated a 7. Just like day 2 for Person C.

On the fourth day, beginning the vegetarian diet, Person C's level of feeling of healthiness is rated a 9. And the level of feeling of happiness is rated a 9 as well. Finally, the hunger level is rated a 9 again.

On the fifth day, continuing the vegetarian diet, Person C's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 9. Finally, the hunger level is rated an 8.

To finish off the vegetarian diet for Person C, on the sixth day, Person C's level of feeling of healthiness is rated a 9. And the level of feeling of happiness is rated a 9. Finally, the hunger level is rated an 8.

On the seventh day, beginning the low carbohydrate diet, Person C's level of feeling of healthiness is rated an 8. And the level of feeling of

happiness is rated a 9. Finally, the hunger level is rated a 6.

On the eighth day, continuing the low carbohydrate diet, Person C's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 9. Finally, the hunger level is rated a 6.

On the ninth day, finishing the low carbohydrate diet, Person C's level of feeling of healthiness is rated an 8. And the level of feeling of happiness is rated a 9. Finally, the hunger level is rated a 6. Just like the eighth day. This concludes all the results for the three experimenters.

After taking all the data from the three experimenters and averaging it up, the results for the averages are calculated.

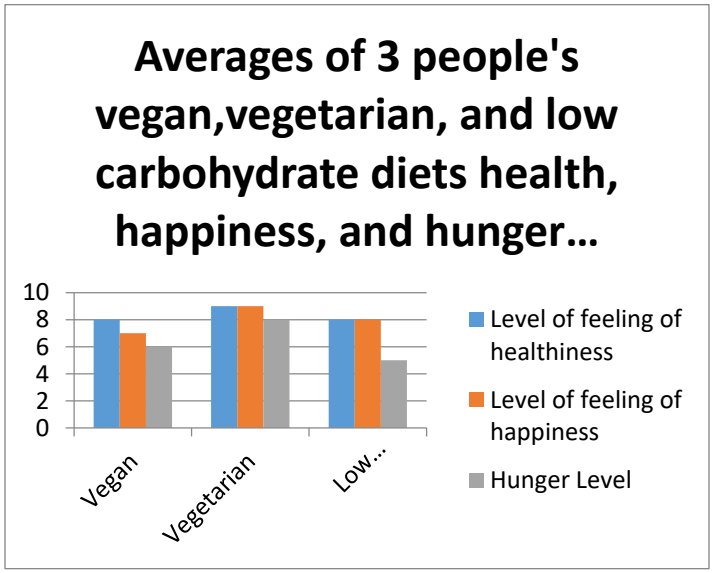

Figure 1: This graph above shows the averages of the three experimenters' results on the vegan, vegetarian, and low carbohydrate diet.

The vegan diet has averages. The average level of feeling of healthiness (1 in being very unhealthy, 10 in being very healthy) is 8. The average level of feeling of happiness (1 in being very sad, 10 in being very happy) is 7. The average level of hunger (1 in being very hungry, 10 in being very full) is 6.

The vegetarian diet also has averages. The average level of feeling of healthiness is 9. The average level of feeling of happiness is also a 9. The average level of hunger is 8.

And finally, the low carbohydrate diet has averages. The average level of feeling of healthiness is 8. The average level of feeling of happiness is 8 too. And, the average level of hunger is 5.

Based off of Figure 1, the vegan diet has the lowest happiness level, and people are hungry on this diet as well. The vegetarian diet has the highest level of healthiness, happiness, and hunger level. The low carbohydrate diet has the lowest hunger level. But, people seem to be pretty content with the diet.

Discussion/Conclusion

.In conclusion, the hypothesis is wrong and the low carbohydrate diet does not have the highest feeling of healthiness. The low carbohydrate diet restricts the amount of sugar intake leading to the decrease in hunger levels. The older aged person had higher hunger levels (as in fuller) in the low carbohydrate diet. Instead, the vegetarian diet has the highest feeling of healthiness, happiness, and hunger levels. The vegetarian diet has the least amount of restrictions comparing to the other diets. As well, the vegetarian diet had about the same ratings as the low carbohydrate diet for Person C (the older person). While Person A and B felt more full in the vegetarian diet comparing to the other diets. People also often felt happier in the vegetarian diet as well as healthier.

Some patterns found in the results are the drop in hunger levels, happiness, and healthiness levels in diets with more restrictions, such as vegan, and low carbohydrate. The trend noticed in the results for the vegan diet is the low happiness level, and low hunger level (hungry). The vegetarian diet, the diet with the least restrictions has the highest hunger levels (as in full), happiness, and healthiness levels. The low carbohydrate diet, with restrictions on carbohydrates (sugars) had the lowest hunger levels (as in hungry). Person A and B, aged 15 seemed to have inconsistent levels, while Person C, aged over 40 had levels around the same for each diet. Person B came from a different household and possibly ate very different foods than Person A and C.

Possible errors are that it was difficult for Person A, B, and C to write down everything they ate down. Another possible error is that the person's judgement was just before they slept and they could possibly feel tired at night. Another error that could arise was that they could have eaten very different foods which could affect the results. Person A, and B spend most of their days sitting down, while Person C was older and spend most their day standing up.

Application

Due to knowing that the vegetarian diet has the least amount of restrictions and many vegetables and fruits, this is the healthiest diet based off of the feeling of healthiness, happiness, and hunger. This information could be used for the general public in first world countries such as Canada, and the United States of America. It could be used to help them discover which diet they would most likely want to try first to adapt to a healthier lifestyle, which many people lack today. After they adapt to this change in choice of foods, they will then be able to become healthier, and therefore live longer, think better, and become happier. The world will also be able to save loads of money on healthcare to help people due to

their poor diets, and use the money instead for something else such as welfare.

References

Babcock, J. (2017, September 26). Low-Carb Diet: How It Works, Benefits and Risks. Retrieved October 04, 2017, from https://draxe.com/low-carb-diet/

F. (n.d.). How To Start A Low Carb Diet? Retrieved October 04, 2017, from https://www.ditchthecarbs.com/howtostart/

France-Presse, A. (2017, March 09). Unhealthy Eating Linked To 400,000 US Deaths Per Year: Study. Retrieved October 04, 2017, from https://www.ndtv.com/health/unhealthy-eating-linked-to-400-000-us-deaths-per-year-study-1668102

The Healthcare Costs of Obesity. (n.d.). Retrieved October 04, 2017, from https://stateofobesity.org/healthcare-costs-obesity/

10 ways to control high blood pressure without medication. (2015, May 30). Retrieved October 04, 2017, from http://www.mayoclinic.org/diseases-conditions/high-blood-pressure/in-depth/high-blood-pressure/art-20046974

The Effects of Different Rewards on Dog Training

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Abstract

An experiment was undertaken to see which reward dogs responded to the best: food, toys, or praise. It is important to find out what dogs respond to because then those results can be used to interpret what dogs will respond to in the future. It was hypothesized that the food reward would cause the most response in the subject. The subject was asked to perform three tricks, and for each trick was rewarded a different reward. The tricks were then evaluated, and the trick that was performed correctly the most times was the trick that had the best reaction to the associated reward. It was found that the food reward elicited a response in the subject 36% of the time, while the toy reward received a response 10% of the time, and the praise reward received a response 20% of the time. The food reward had the best response, proving the hypothesis however, due to external factors, the study did not have adequate time to complete, and results may not be accurate.

Introduction

It is important to train dogs for numerous reasons. One of those reasons, as stated by the SPCA, is that training "provides enrichment and stimulates your pup's brain" (www.greatplainsspca.org/top-10-to-train-your-dog/). By knowing the most effective way to train a dog, dog owners can provide the most enriching experience for their dogs, as well as promote a healthy dog/owner relationship.

From there arises a question: what method proves most effective while training a dog to obey a command? It was hypothesized that if different commands are taught using the methods of rewarding with treats, rewarding with toys, and rewarding with solely praise, then the treat method will be most effective because dogs are more motivated by food. "…food is vitally important and also one of life's luxuries" (www.companionanimalpsychology.com/2013/07/the-importance-of-food-in-dog-training.html). Animals need food to survive, so it naturally drives them to perform tasks. Animals will not die if they do not receive praise from their loved ones, or their favourite toy, but they will perish if they do not receive nutrients through food. "If your dog wasn't motivated by food in some capacity, she would be dead" (springforthdog.com/dogblog/myth-busting-dogs-that-arent-food-movitated). Humans can utilize a dog's natural need of food to teach dogs desired behaviours.

Methods

The experiment is as follows: Instruct subject to perform a command. Reward with a treat among completion. Instruct subject to repeat the command, once again being rewarded with a treat. Repeat the treat-based training twice weekly, at similar times of the day.

Next, the subject was instructed to perform a different command. Performance of this command was rewarded with the subject's preferred toy. The command is repeated. The subject is rewarded with a toy once again. Repeat the toy-based training twice weekly, at similar times of the day.

The subject is then asked to perform a third command. Completion of this command is then rewarded with praise, including both verbal praise (positive affirmations), and physical praise (petting and scratching). The command is repeated. The subjects is praised upon completion of the command once again. The praise-based training is repeated twice-weekly.

This process is repeated for four weeks. Training for each reward is repeated each week on the days the training for that reward was originally completed on. After four weeks, the training is stopped. Over the course of the fifth week, the subject is asked to perform each command a number of times. The number of successful completions, as well as how many times the subject was enticed by each reward, are recorded. The totals are then combined, and the highest total percentage of response elicited from the subject is the reward that was the most effective.

The independent variable in the experiment is the type of reward given. The dependant variable is execution of the command given. The controlled variables are the subject, the time of training sessions, the frequency of each training session, the time allotted to master each command, and the environment of the training sessions. The subject is kept the same because every dog is different. Dogs have different levels of intelligence, and one dog may learn commands more quickly or at a slower rate than another. When the subject is kept the same, it eliminates any differences between subjects, allowing for more accurate results. The time of each training session is controlled because the subject may respond differently at different times of the day. The time and frequency of the training sessions are kept controlled because allotting more time to mastering one command than the others would result inaccurate data. The environment is also controlled, as the subject may react differently due to environmental factors, allowing inaccurate results.

Results

Table 1: Showing the amount of times the subject responded to each reward

Reward Given	Amount of Times Subject Was Enticed to Perform Trick by Reward	Amount of Times Subject Successfully Performed Trick with Reward	Percentage of Total Subject Response to the Reward
Food	2/5	2/6	36%
Toy	1/5	0/5	10%
Praise	1/5	1/5	20%

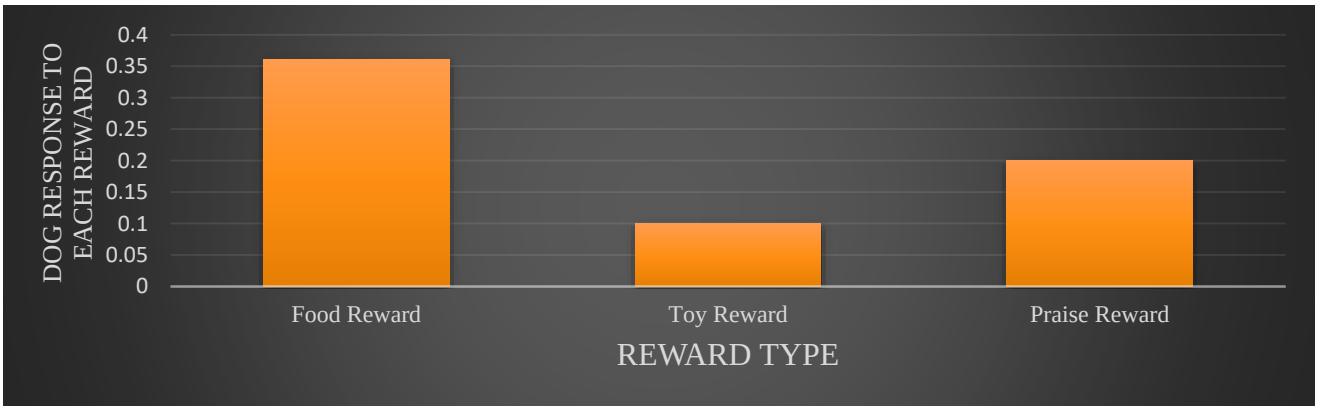

Figure 1: Shows the total subject response to each reward

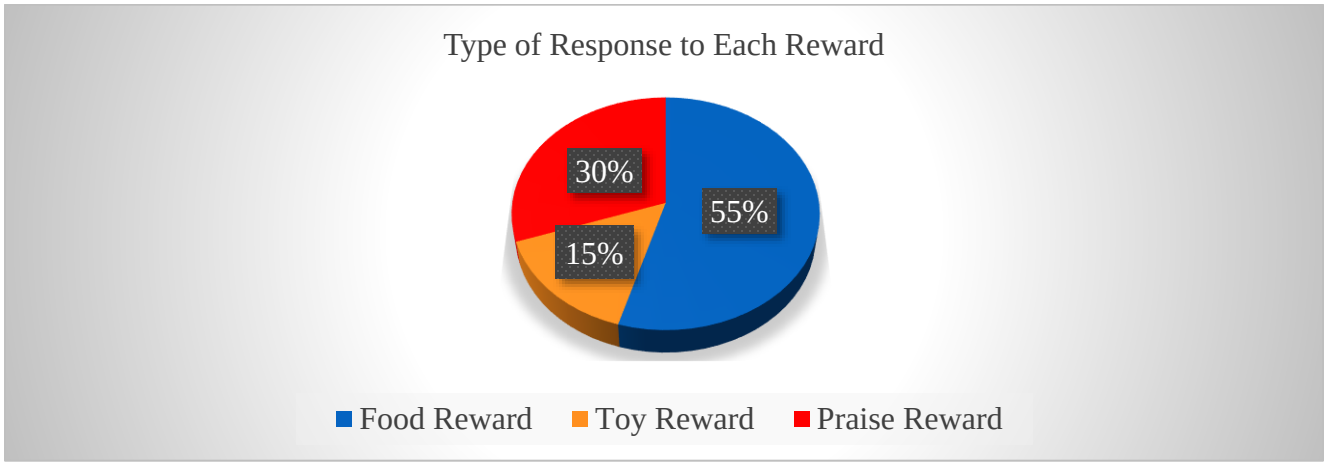

Figure: 2 Comparing the amount of times the response responded to each reward

Conclusion:

My hypothesis was correct. The initial problem was finding out which reward dogs responded the best to, and, after the experiment was conducted, it is proven that the food reward caused the best responses.

The subject responded to the food reward 36% of the time. The subject responded to the toy reward 10% of the time, and the praise reward was responded to 20% of the time. However, these results were not entirely accurate, due to a variable outside the control of the experiment.

There were many sources of possible error in this experiment. The experiment did not have adequate time to complete, due to the subject becoming injured, and unable to participate. In addition to the injury, other sources of possible error include the subject's unwillingness to perform the commands, the rewards may not be the subject's favourite reward (different type of treat or different toy), and the fact that the subject may not want that reward at that moment. Dogs are very fickle creatures, and the subject of this experiment is very stubborn, and does not always respond to something it enjoys because it simply does not desire that reward at that moment. Humans are also not able to be 100% sure of a dog's preferences, so it is possible that other rewards would have been preferred by the subject. In addition, not all dogs are created equally, so what this subject responds to may not work as well for a different dog.

Application

This information can be used to train the subject to perform various tasks in the future. Now that it is known what the subject responds to, it will be easier to train the subject to follow different commands. When the subject is able to follow certain commands with a high degree of effectiveness, more opportunities arise in which the subject can participate in, as the subject will be able to respond effectively when needed to.

References

Myth Busting: Dogs That Aren't Food Motivated. (2011, December 19). Retrieved from http://springforthdog.com/dogblog/myth-busting-dogs-that-arent-food-motivated

Todd, Z. (2013, July 31). The Importance of Food in Dog Training. Retrieved from http://www.companionanimalpsychology.com/2013/07/the-importance-of-food-in-dog-training.html

Top 10 Reasons to Train Your Dog. (2014, January 23). Retrieved from http://www.greatplainsspca.org/top-10-to-train-your-dog/

Reading Various Types of Books Can Help People Mentally and Emotionally.

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Abstract

Some people think that reading is a waste of time and that it's something that is not needed in the future. Reading is a key factor of life and without it, life won't turn out so great. Read any book or reading tool and write down emotions and knowledge that was gotten from that book. The book can be a fiction book, but a lessoned learned could be that lovers will do anything to get together once again. It could be a non-fiction book and the information gained could be about the different types of bugs in the world. No matter if the book is fiction or non-fiction, something will come from it. No matter the age, gender or race, reading can benefit anyone at any time.

Introduction

Reading is important because it helps in everyday life and can be used in the future. No matter what type or genre of the book someone is reading, the information in the book will help in the future. This problem is important because most people in the world think that reading is a waste of time. They think that when reading, nothing can be learned from it. Reading helps in everyday life. Reading helps us to understand more words and gives us knowledge. If reading a medical health book, by reading it helps people understand the stuff and information they need to know so they know how to act if someone needs medical health. Reading helps us learn new words and gives us new experiences that people then use in their everyday life. Reading is important because it leads people to a great future. Reading school books and learning from them gives us information that will be great for the future. Reading for fun also helps us in the future because learning from the books about words or history helps by realizing how the world is or what a word means. Books give us great knowledge that can be used for so many things.

So, how can reading help people emotionally and mentally? Well, If, people were to read more often than, rather than going on their electronics, then they would have a strong brain and a better future because reading effects both. When reading, information is gained by the words that are read. If they do not understand a word, then by searching up the word and finding its meaning, new information

is obtained and then more things become easier to understand. Reading effects people's future because by reading the new and interesting information, people use that information to go far in life and understand better things.

Methods

Start by grabbing a book or any type of reading source. Then read that book or that reading source for about 30 minutes. After doing that, record the emotions felt when reading that book or reading source. Then write down information that you learned or think that will be helpful in the future. Next, grab an electronic and play it or use it. Then, do the same procedure as for the book. Write down the emotions felt in a separate chart and the things and knowledge gained from the electronic. The independent variable in this case is the type of the thing being used. In this case, the object must change from a reading source to an electronic. The dependent variables are how much information gained and emotions felt for the reading source and how much information gained and emotions felt when using the electronics. One of the controlled variable is the amount of reading that you are doing. This is controlled because the time must be the same for each subject. If one subject read for more than 30 minutes, then the subject would have gained more information and felt more emotions. If the subject read less than 30 minutes, then the subject would not have enough time to gain any knowledge or feel any emotions. Another controlled variable is the things that the subject needs to write down, which in this case are the emotions felt and knowledge gained. This must be controlled because that is what this experiment is about. The difference between emotions and knowledge when reading a reading source or when using electronics. If this changed, then the whole experiment would change. The last controlled variable is that it must be a reading source and an electronic. This is controlled because the whole experiment is about the difference between reading sources and electronics. If this was not controlled then the experiment would not be about the value of reading but about something way different.

Results

When looking at the results, it shows that when reading, so many different emotions and feelings go through every person no matter the age or the gender. In Table 1, it shows that when reading, the person doing the action will always feel calm and will enjoy the thing that they are reading. On the other hand, in Table 2, when playing the electronics, they would mostly feel angry or upset or sometimes neutral so they won't feel any emotions at all. Another thing that the data shows is that when a person is reading, they will learn new things that they didn’t know before and that will help them in the future. Also, the book or whatever that person was reading will give life lessons that will help that person in the future. When using the electronics, the subject either learns nothing or something that will only be useful in a video game.

Subject	Name of Book	Emotions Felt	Knowledge/ Lesson
1	*The Giver* (Lois Lowry)	Unhappy, Sad	Life isn't the way it seems
2	*Crossed* (Ally Condie)	Emotions that the characters felt	Love is so strong
3	*Ultimate - Bug - Opedia* (Darlyne A)	Excited, enjoys reading	A lot of cool facts about bugs
4	*Balto and the Blue Dawn* (Mary Pope Osborne)	Enjoys book, Calm, Happy	Nothing specific

Table 1 – The emotions that the subjects felt and the knowledge they learned when reading.

Subject	Type of Electronic	Emotions Felt	Knowledge/ Lesson
1	PS4 Destiny 2	Anger, Happy, Disappointment	How to work as a team in a game.
2	iPod	Neutral	Nothing
3	3Ds XL	Angry, Stressed, Frustrated	Nothing
4	2Ds XL	Angry, sometimes happy	Nothing

Table 2 – The emotions that the subjects felt and the knowledge they learned when using their electronics

Discussion and Conclusion

Yes, the hypothesis was correct because by looking at the data, it shows us that reading is in fact an action that makes people calm and less stressed. It also gives people knowledge and ideas that they didn't know before. Also looking at the data, it shows that when playing electronics, the emotions that the people felt was mostly anger or frustration. This shows that reading is a better and less loud task since you are calm and not angry and frustrated. Reading is also a way to gain new information and ideas. Looking at the data, when the people were reading, they gained information and lessons that could be useful in life. But when they played the electronics, they didn't learn anything that will benefit them in the real world. So, reading is not a waste of time and will be great help in life since it gives people information and ideas that they did not know before and helps you with your emotions.

The results relate to the original question because it shows that when people are reading, the reading source helps control the emotions which is a way reading can help emotionally. It helps a person calm down if they are angry and helps the person get rid of stress. When reading, the mind is focused on the words and events occurring in the book that they will forget about their problem and go in the world of reading. That then relaxes the brain which is constantly thinking about something that the person doesn't want to think about. In Table 1, subject 4 feels calm and happy when reading versus in Table 2, they feel angry. When angry, emotions aren't controlled but all over the place which doesn't help the person emotionally. When calm and happy, the emotions are controlled which leads to the opposite, and helps the person emotionally. It also shows that reading can give life lessons and knowledge, which helps mentally. In Table 1, subject 3 learns a lot of information about bugs whereas in Table 2, they learn nothing that will be

useful in life. This helps mentally because when learning new information, it gets stored into the brain and can help mentally by using that information in the future for whatever purposes. The data supports the hypothesis because it shows that reading is more important than using electronics. By doing the experiment, it shows that when reading, emotions are controlled and knowledge is learned. When using electronics, emotions aren't controlled and not any specific knowledge is learned. By looking at that, reading does effect people emotionally and mentally.

Application

This information can be applied to other fields of studies because say if someone is studying the brain and how it works. That person can consider that reading helps people mentally. Then that person can figure out how does the brain use that information that it gets from reading in everyday life. Also, if a person comes to them with a headache or brain problem, the person studying the brain can think that is reading the cause to that or not?

Another way this information can be applied to a different field is for a psychologist. If a psychologist gets a patient who experiences a lot of stress or can't control their emotions, the psychologist can use this information about reading helping control emotions. They can then help treat that patient by saying to them that if they ever can't control their emotions, then they should read a book which will help them control.

These results fit into the big picture because by getting information, the person will go far in life because they would have so much information. And life is the reason why people are alive. Also, by being able to control emotions, people won't flip out and get angry on things which would make them and the people around them feel better as a human being.

References

Davis, G. (December, 2016). Learn to Read, retrieved from http://www.learn-to-read-prince-george.com/why-is-reading-important.html

Douglas, J. (May 4, 2013). The Telegraph, retrieved from http://www.telegraph.co.uk/education/educationopinion/10035473/The-importance-of-instilling-a-need-to-read.html

Gaiman, N. (Tuesday, October 15, 2013). The Guardian, retrieved from https://www.theguardian.com/books/2013/oct/15/neil-gaiman-future-libraries-reading-daydreaming

The Best Angle at which Most Soccer Shots will be Scored

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Abstract

To discover the best angle at which the greatest amount of soccer shots will be scored. This experiment is greatly beneficial to soccer players because it gives them a strong understanding of knowing which angle is best to score to make a larger percent of goals. Five players will shoot a soccer ball at seven different angles to perceive which angle is best. As players move closer to the center angles of the soccer net, there is a larger surface area to shoot in, resulting in more shots being made. It is concluded that 60 degrees is the best angle at which most shots will be made because there is more area for shooting. Shooting in front of the net gives players a greater amount of area to shoot, and have a better chance of scoring. If shooting from another angle, players will not have as much room to shoot, giving a smaller chance of scoring because there is less surface area on that side of the net. With the information presented, it will benefit players when playing a game.

I. INTRODUCTION

Soccer is the most popular sporting activity in the world (Melvin Wong, 2016). It can be played anytime, anywhere, and by almost everyone. According to the International Federation of Association Football, 265 million people worldwide are actively involved with this sport. It is a very universal sport, and can bring many people and families together. More than 50% of non-blocked shots miss the target (Colin Trainer, 2013), so by completing this experiment, it may give soccer players enough knowledge resulting in more goals.

The topic selected is the relationship between soccer shooting and angles. The purpose of this project is to educate soccer players of all ages, with or without experience, whenever they play soccer. Understanding angles in soccer is important because it can help impact the learning and understanding of players when participating on the field, and help score a goal and win the game. The overall question for this project is, how does the angle of shooting a soccer ball affect the percentage of goals scored?

It is hypothesized that, if shooting a soccer ball right in front of the goal net, then a greater percentage of shots would be made, because there is a greater amount of surface area to shoot. If shooting from a wider angle such as 180 degrees, there is less space for the player to shoot on and it decreases the percentage of goal scoring. Shooting in the center of the net is also an advantage

because the goalie will not know which angle the ball is going to come from. An experiment will be conducted by having five players shoot from seven different angles, all 15-feet away from the net. The angle with the most amount of goals scored will be the greatest angle to shoot from during a game to score a high percentage of goals.

II. METHODS

The study conducted is completed outside on grass. Five players of all experience levels are asked to shoot a soccer ball from seven different angles, to conduct which angle is the best at which most shots will be made. A single soccer net that is 7.32 meters in length will be used. The angles will be 0 degrees, 30 degrees, 60 degrees, 90 degrees, 120 degrees, 130 degrees and 180 degrees. Each of these angles are placed 15-feet away from the soccer net with a marker/pylon. Each player is asked to shoot the soccer ball five times from each of the seven different angles, which has no goalkeeper. As players are shooting the soccer ball, a table is created to keep track of the angle, player's name and if the ball makes a successful goal or not.

The independent variable in this experiment is the angles at which the shots are taken. This variable is controlled because investigating these seven certain angles will support the data needed. The dependent variable is the number of goals scored. This variable is controlled because if each angle has a different amount of shots taken, results will not be accurate. Finally, the controlled variables are the size of soccer ball, kicking surface, type of soccer ball, temperature, weight of soccer ball, method of measurement and size of soccer net. These variables are controlled because if the experiment is done in many ways, all data conducted could be dissimilar. This experiment must be completed the same way throughout because one slight change can affect the results. An example of data that would be different is the kicking surface. This is because if kicking on grass compared to turf, there will be different data, since turf is easier to kick on. Keeping variables constant is also important because it will be easier to notice any major changes in the experiment. Without a controlled variable, there is no way to asses the changes in the experiment. Therefore, when conducting this experiment, all variables must be controlled.

III. RESULTS

The results of the current study show that as a player gets closer to the center angles of the soccer net, a higher percentage of goals will be scored. As the players in this experiment shoot at the seven given angles, the final angle that is concluded with the highest percentage of goals scored is 60 degrees, as there is a wide surface area to shoot on. Surface area space means the available range of the net open when kicking. When players are kicking from 0 and 180 degrees (the widest angles), it is very difficult because there is no available surface area to shoot into. Players will then need to know how to curve a soccer ball in the air.

Table 1- Data from the test subjects in the given experiment conducted

Angle of Shot	Amount of Goal Scored from Different Angles					Goals Made
	Person 1	Person 2	Person 3	Person 4	Person 5	
0 degrees	0/5	0/5	1/5	1/5	0/5	2
30 degrees	1/5	3/5	2/5	3/5	0/5	9
60 degrees	4/5	4/5	3/5	5/5	2/5	18
90 degrees	2/5	3/5	3/5	4/5	2/5	14
120 degrees	3/5	2/5	3/5	4/5	1/5	13
150 degrees	3/5	4/5	3/5	3/5	2/5	15
180 degrees	1/5	0/5	0/5	0/5	0/5	1

The data in Table 1 represents the test subjects undertaking the given experiment to see which angle would have the highest percentage of goals scored. As players kick towards the center angles of the goal, more shots are made. The highest amount of goals scored by the five players is at 60 degrees. The players shoot at the seven different angles five times, and the amount of goals made is recorded out of five. Player 4 had a successful 5/5 shots on net at 60 degrees.

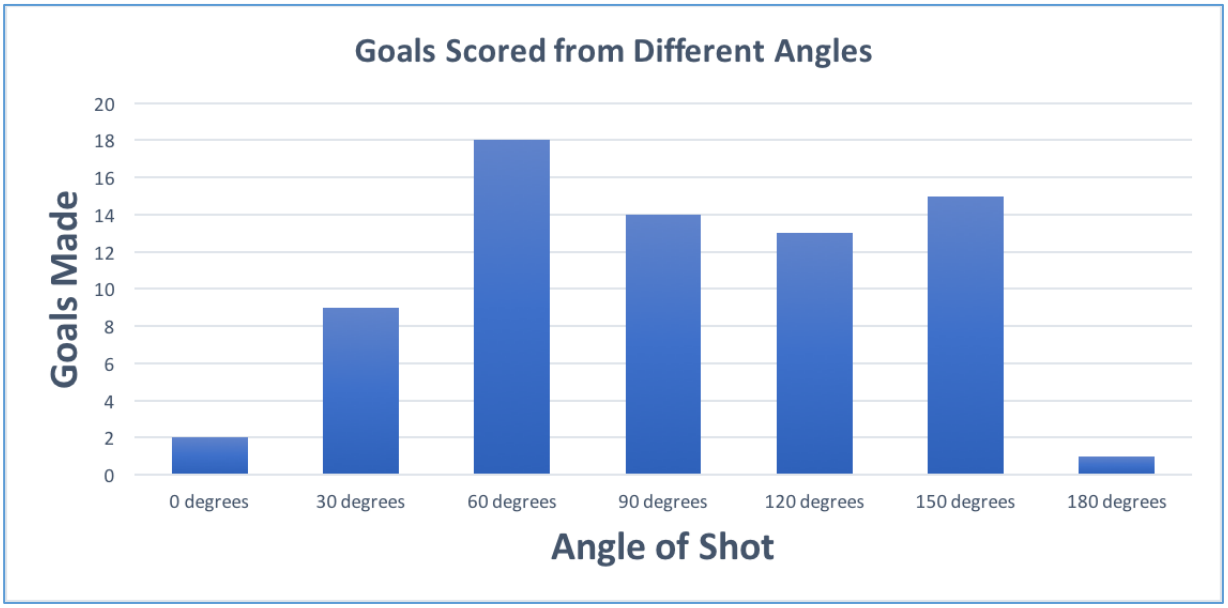


Figure 1- Summary of goals scored from seven different angles by five test subjects

The data in Figure 1 represents the final summative information of the test subjects shooting from the seven angles. As seen in the figure, 60 degrees is the highest angle at which most of the shots are made. The significant pattern seen is the angles closest to 90 degrees which are the center angles, have the highest percentage of shots made. Therefore, 180 and 0 degrees are the weakest angles to shoot at.

IV. DISCUSSION/CONCLUSION

The result of this initial study concludes that 60 degrees is the best angle at which most soccer shots will be scored based on the experiment conducted by five players. The hypothesis anticipated is partially correct, as it is stated in the hypothesis that shooting directly in front of the net will ensure a successful shot, but the final solution shows it is the angle slightly to the right of the center angle. It is shown that the farther one moves away from the center when scoring, there is a smaller chance of the ball going in the net. This shows correct because there is a smaller surface area for a player to shoot on.

The trend overall is that the farther a player moves away from the center, there is a smaller chance of the ball going in the net. The angle 60 degrees is very reasonable because it does not require much skill when kicking. Striking from the wider angles involve the ability to know how to curve a soccer ball in the air, which is extremely difficult.

During the experiment, it is perceived that the angles 180 and 0 degrees are the hardest angles to score at. These angles are directly on the sides of the two goal posts and it is very difficult to shoot from here. Wanting to shoot from these angles will need the knowledge of knowing how to curve the soccer ball in the air. The result expected for this experiment is the angle 90 degrees because it is directly in front of the net, giving a lot of surface area of the goal. Shooting at 90 degrees is difficult for some players because when kicking, they do not have control over the ball. Shooting from a slightly smaller angle from the center such as 60 degrees, gives the player a direct aim towards the direction of where to kick the ball. Shooting straight to the center angle gives the player a choice to shoot to the left or right side of the net giving an indecisive path to shoot. The results concluded are like those of other investigators who completed similar experiments. The information shown could be very beneficial to soccer players because it can help with the decision between which angle the player should shoot at to score a goal.

A problem that did occur during this experiment that may have changed the results is that out of the 5 testers, one player did not have much experience with

soccer, giving unsuitable results. Tester 4 seemed to have more experience when playing soccer since he/she scores an average of more goals. This could have had an impact on the results because some players had more experience than the others. If this experiment is to be done again, using soccer players of all the same experience level would make the results more reasonable.

Physics is also applied to kicking and shooting angles in soccer. According to Newton's first law of motion, if no force is applied to a ball, it will continue moving at the same speed and direction as it did before. When the ball is on the grass, it stays in its place, because no force is applied to it. However, after the ball is kicked, it will continue moving in the direction we kicked it. Its speed will drop progressively through the air due to friction because of the force applied on the ball. The ball will move in the opposite direction to its motion, but the direction of its motion will remain the same.

V. APPLICATION

This study shows that 60 degrees is the best angle at which most shots on goal will be scored. The information gained through this experiment can be very useful to many, but especially soccer players. A soccer player might have an open net during a game, and upon this conclusion can make that split-second decision of which angle to shoot from. Besides soccer, those playing sports such as hockey, football or basketball can benefit from this conclusion of knowing which angle is best to shoot from. This experiment can also be done to test soccer players shooting accuracy for preparation when playing a game.

I. REFERENCES

Trainor, C. (2013, July 23). The Enigma of Shot Placement. Retrieved January 18, 2018, from https://statsbomb.com/2013/07/the-enigma-of-shot-placement/

Wong, M. (2016, September 27). 5 Reasons Why Soccer is the Most Played Sport in the World. Retrieved January 18, 2018, from http://qoach.co/blog/5-reasons-soccer-played-sport-world/

The Perfect Basketball Shoot for High School Students

Nafis

SNC2DN-02

SNC2DN - Vincent Massey Public School, Windsor ON

Abstract

This experiment was conducted for possibly finding the best basketball shoot for shooting tree pointers and free throws for high school students. The findings for this experiment can help new basketball players have a guideline for best shooting results and could also possibly help veteran players improve their shoot. This experiment was conducted by having the 5 high school students shoot 3 three-pointers and three free throws, the free throw was shoot from the free throw line perpendicular to the net and the three-point shoot was from the three-point line perpendicular to the net. When analyzing the data, it was evident that having a high arc with a no jump movement in the free throw gave the best results, having a high arc gives the ball more surface area to hit giving an higher chance of the ball going in and having a no jump movement limits chances of too much power application. There were no evident patterns in the subject's shoots. There is no perfect shoot for the three-point shoot, the thing that made a good three pointer shooter is their consistency in their own shoot. To answer the original guiding question. The best shoot form for the free throw having a high arc and no jump movement will help tremendously and for the three-point shot and this also applies for parts of the free throw there is no perfect shot, the perfect shot is what works for the subject and they should keep practicing that shot until its muscle memory.

Introduction

This experiment was conducted for possibly finding the perfect shoot for three-pointers and free throws for high school students. The findings for this experiment is relevant because in the us over 26 million kids play basketball and of those 26 million 4.1 million plays on some sort of league and 5.8 million plays in school teams, for all those the

perfect basketball shoot can make a huge difference weather it be an acceptance to a college of league. The experiments findings can help new players have baseline shoot for best results or even help veteran players improve their shoots.

The guiding question for this experiment was; How does the ball's starting position effect a high school student shooting percentage, for 3 pointers and free throws.

It is hypothesised for best shooting results for a free throw, the ideal shooting position for a high school basketball player is having the bottom of the basketball right above their eyebrows, this way the shooter can still have the basket in their field of view. The elbows should also be at a 45-degree angle for most force. The feet be parallel to the basket, so the shot does not follow a curved path during flight. The feet should be pointed towards the basket, if everything is pointed towards the basket it makes it easier to aim at the basket. Hands should be palmed on the basketball so griping the ball is easy. Shooting should be done with ONLY 1 hand, this is more accurate than 2 hands. Snapping the elbow is crucial for most effective delivery of power for both free throws and 3 pointers. For the 3-point shoot shooters should have a nice arc in there shoot. Players should snap the wrist causing most power.

Procedure

Gather five high school students who have played basketball in some sorts before

Go to the same basketball complex three days a week (Friday, Saturday, Sunday) for 5 weeks. Use same net each week.

Have a person hold the camera parallel to the basketball net to maximize field of view.

Line up all the players on the free throw line and one by one tell them to shoot

Make sure the only variable changing is the shooter (Independent variable)

Record every players shoot in slow motion

Repeat free throws 3 times for each playe

Line players up on 3-point line, perpendicular to the basket

Record all the shots in slow motion

Have each player shoot 3 times over (not simultaneously, one after the other)

Export video on camera to computer and play video

Pause video at each player shot for both free throw and three pointers and measure elbow angles with protractor. Do this for **ALL** ten shots for each player from both distances.

Record data on a chart using MS office.

Independent Variables:

The independent in this experiment is the shooter. It is changes on purpose so observing different shooting styles and shooting releases angles can be measured for different players and be observed from the data, concluding the best shooting angle and style will be evident. This was changed so a wide variety of data cold be studied.

Dependent Variables:

The dependent variable in this experiment is the shooting angle which is measured, and the shooting style is observed. The angle will be measured using a protractor on the computer. This variable is what was being studied.

Controlled variables:

The controlled variables in this experiment is the basketball, the basketball court, camera, basketball net and shooting distances & positions. It is very important that the ball is the same for all shooters because a different ball can affect results drastically due to a balls weight grip style and material.

Results

Subject 1

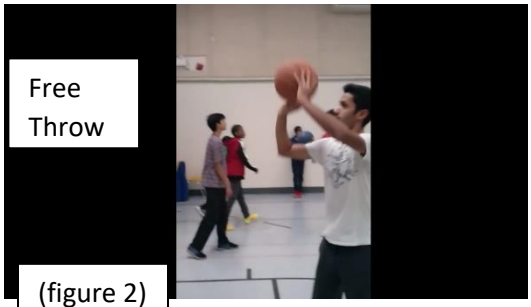
Elbow Shooting angle: 100 – 120 degrees

Free Throw: 0/3

3 Pointer: 3/3

Notes: very consistent shot, not a lot of arc (figure 1), good use of legs

(Figure 1)



(figure 2)

Subject 2

Elbow Shooting angle: 90- 100

Free Throw: 2/3

3 Pointer: 0/3

(figure 3)

3 pointers

(figure 4)

Free Throw

Notes: good arc on ball, not very good follow through, needs to make sure he can see basket (don't block vision with ball), (as seen in figure 3 and 4)

Subject 3

Free Throw: 1/3

Elbow Shooting angle: almost always 90 degrees

3 Pointer: 0/3

Notes: shot is too vertical hands not positioned perpendicular to each other (figure 5) , ball blocks shooters face, starts the ball low down this caused a lot of air balls (figure 8).

(figure 5)

3-pointers

(Figure 7)

Free Throw

(figure 8)

3-pointers

Subject 4

Elbow Shooting angle: 90 – 115 degrees

Free Throw: 2/3

3 Pointer: 1/3

(Figure 9)

3 pointers

(figure 10)

Follow through

(Figure 11)

Free throw

Notes: very consistent shooting form, great follow through (figure 10) lengthy shot, great arc, good use of legs, hands positioned perpendicular to each other (figure 11).

Subject 5

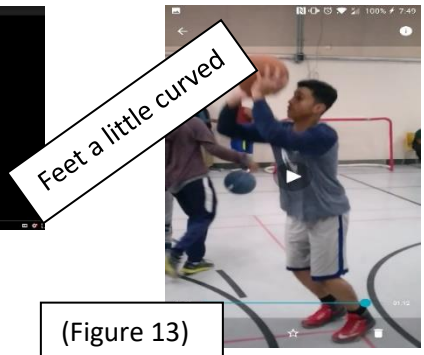
Elbow Shooting angle: 90 - 115

Free Throw: 2/3

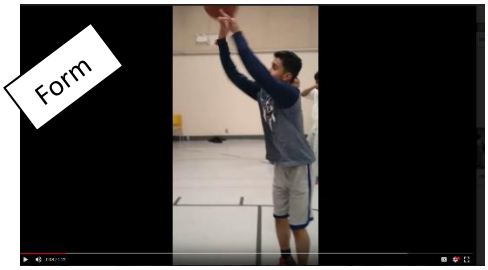
3 Pointer: 1/3

Notes: Free throw shot had great arc and high release point (figure 14), likes to have feet a little curved to the side (figure 15), not very consistent on 3-point shot, great FOV of basket.

(figure 12)



(Figure 13)



(figure 14)

Discussion/conclusion

After analyzation of the data, these are the findings that was found. All the shooters that had a free throw average over 2/3 all had high arcs for shooting, the arc of a free throw is a big factor for a high school making a free throw shot, even when other aspects of shooting were not present like proper hand positioning, use of legs and shoot follow throw, the player still made the free throw. When shooting free throws, players who jumped had a lower free throw average compared to the non-jumpers. When analyzing the three point shoots the data reviled that all the 3-point shooters that had a 3-point average 2/3 or over all had a shooting angle over 100 degrees, this shooting angle was bigger than the ones who missed their shoots. One of the biggest trends in the best 3 pointer shooters was that their shoot was consistent through all 3 shoots they took. Some trends that were noticed for some of the not as skilled shooters the ones that scored 1 free throw and 1 three pointer average were; the ball covered their line of vision for both the free throw and three pointers, these shooters also air balled more shoots compared to the other shooters. One problem I noticed in one of the worst shooters was that the subject always had the ball bellow the waist before shooting, and his hands were not perpendicular to each other like all the other shooters.

The hypothesis stated in the previous weeks was mostly incorrect, Here's why. To answer the original problem lets the free throw will be highlighted first with the three-point following right after. In the hypothesis, it was stated that the snapping of the wrist was the best way to get most power for both the free throw and 3-point shoot, that is incorrect the snapping of the wrist is fine for three-point shoot but snapping of the wrist caused too much unnecessary power for the free throw shoot which was not needed. After conducting the experiment new information came forth, having a high arc on the free throw shoot was very crucial on success because having a high shoot makes it so the shooter can have more surface area to hit. Not jumping during the free throw was a big factor on shoot percentage, this is due to the fact that the free throw is a relatively close range shot and jumping creates unnecessary extra force which is not needed causing a shooter to miss. Next let's cover the three-point shoot. The shooting angle that all the best shooters in the experiment had was all in between 100 – 120 degrees this is way more than my 45 degrees, the reason for that is having a wider shoot allows more time to shoot which results in more power, but having a soot that is around 45 degrees creates the opportunity to have more surface area for the ball to hit, the high school player shoots were compared to the NBA players shoots and it was seen that the NBA players all had high shoots because the could create enough force, most high school students are not that developed yet to create that much power thus they compensate with a wider shoot. Having a consistent shoot is very important for a 3-point shoot, all the good shooters all had a very consistent shot even if it didn't have other components of a shot like follow through, being consistent for the three-point shoot is very important because three-point shoot is a long-range shoot with little room for error, so shooting a shoot that a player knows works for them all the time is giving the highest chance for success. The key to best results for the three-point shot is consistency. A component that was evident for both the free throw and 3 pointers was a good shoot follow through, this helps the player visual where the ball needs to be all the good shooters in the experiment did it and also NBA players, also having a visual of the net is a big factor for success on any shot in the game of basketball, because to for a player to know how much power to put they need to be able to see the distance they are from the basket to have the best chance of success. In conclusion the original scican question had been answered, for a free throw having a high arc and no jump movement will help tremendously, and for the three-point shot and this also applies for parts of the free throw there is no perfect shot, the perfect shot is what works for a subject and the subject should keep practicing that shot until its muscle memory.

Application

The findings in this experiment can be applied to human kinesthetics, for studying how the human body moves and why it does the way it does. This information can be used for other sports like

football because both sports have a similar throwing motion. This information can also be used by companies to help develop an basketball program that improves shooting mechanics.

The findings in this experiment can also be used by the public. Kids who love basketball but don't have a staring guideline on how to shoot can use the findings in this in experiment, the findings can also help players who already play basketball tweak their shoot by improving to the findings of this experiment.

What the results in this experiment can teach us is that is in life do what u think is right for you and do that thing consistently and good things will follow. A great man once said success isn't always about greatness, it's about consistency, consistent hard work leads to success. Greatness will come.

References

Holland, K., & Schoen, J. W. (2014, November 14). Fantasy football: College scholarship myths busted. Retrieved January 18, 2018, from https://www.cnbc.com/2014/10/13/think-athletic-scholarships-are-a-holy-grail-think-again.html

Haefner, J. (2015, June 3). Site Search. Retrieved January 18, 2018, from https://www.breakthroughbasketball.com/fundamentals/shooting-technique.html

Allen, T. (2015, November 23). 3 Cues for Better Basketball Shooting. Retrieved January 18, 2018, from https://www.usab.com/youth/news/2012/08/3cues-for-better-basketball-shooting.aspx

Podmenik, N., Supej, M., Coh, M., & Erculj, F. (2017, January). The effect of shooting range on the dynamics of limbs angular velocities of the basketball shot. Retrieved October 18, 2017, from http://go.galegroup.com/ps/retrieve.do?tabID=T003&resultListType=RESULT_LIST&searchResultsType=SingleTab&searchType=BasicSearchForm¤tPosition=3&docId=GALE%7CA500499865&docType=Article&sort=Relevance&contentSegment=&prodId=GPS&contentSet=GALE%7CA500499865&searchId=R2&userGroupName=ko_k12hs_d27&inPS=true

Erčulj, F., & Štrumbelj, E. (2015, June 3). Basketball Shot Types and Shot Success in Different Levels of Competitive Basketball. Retrieved October 19, 2017, from http://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0128885

U. (n/a). Dr. Michael Khan (Dean). Retrieved November 17, 2017, from http://www.uwindsor.ca/kinesiology/471/dr-michael-khan-dean

U. (n/a). Dr. Michael Khan (Dean). Retrieved November 17, 2017, from http://www.uwindsor.ca/kinesiology/471/dr-michael-khan-dean

The Effect Dehydration has on Athlete Performances

Omar

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SNC2DN-04

Abstract

This experiment was conducted to find the best way possible to enhance player performances to achieve results wanted while knowing if being hydrated has a big effect on performances. The reason why this is so important is because everyday athletes are looking to get good performances. If anyone is in high school, they will be looking to get good games because if you want to play anything at a college level or even get a scholarship, great performances are needed to get scouted. Even professional athletes need good performances, so they could get playing time and even be regarded as one of the best. The way the experiments will be played is playing two games of basketball, one being hydrated, and the other being dehydrated. Results will be taken and then compared after, comparing how good the results were playing hydrated compared to playing dehydrated. The results were expected. Playing hydrated brought out better performances compared to playing dehydrated. Playing hydrated, brought quickness and more stamina compared to dehydration. Playing dehydrated brought out the lazy performances and fatigue. In conclusion, playing dehydrated will affect your performances. In fact, it was a major negative effect. Water is very helpful. Not only for athletics. Remember to always drink water.

Introduction

The reason why it is important to find out the answer is for the simple fact that people want to perform well. Exceed expectations. To be able to reach these levels they will be willing to do anything and knowing that water can improve your performances is a big boost in searching for answers to reach peak performances (Ryan 2008). Dehydration is a very familiar topic. Water has a distant connection to stamina and energy, but not a direct connection. Also, with experience and knowledge, be hydrated should have a negative on performances. The question is though, by how much? So, the big question is “Does dehydration influence player

performances for athletes?". The hypothesis is, if the amount of water in a body changes then, there level of play would change because, with the absence of water then it could lead to fatigue, meaning performances won`t be as good. Water can help lower fatigue because, it`s used with energy, so with the absence of water, energy levels could possibly drop making fatigue occur. Also, this is bad because, pushing yourself when tired, it`s unhealthy resulting in getting sick or, injuries by pulling something. In conclusion the hypothesis for this whole project is that dehydration does have an effect on player performances.

Methods

During the procedure/experiment, play two games of king`s court. King's court is, one player who plays another player in basketball. The winner stays on and a new player comes on and plays the winner. First player that gets five wins, wins the whole thing. The first game was played dehydrated (drink no water an hour before and during the game) and the other game was played hydrated (drink water whenever wanted). Compare results from first game of king's court to the second game of king's court. Write the results and differences. The independent variable is the amount of intake of water. The dependant variable is the results of the player performances. Finally, the controlled variable is the playing of basketball. The reason why playing basketball is the controlled variable is because, the only sport that is being tested on. It's not like the first game of king's court was basketball but the second game of king's court was soccer. The playing of basketball always stays as that. That is why basketball is the controlled variable.

Results

As the results show in table 1 and table 2 there was a major difference for the player who played dehydrated and hydrated. Table 1 shows that the player who played dehydrated only managed one-win game, that means he suffered many loses. In table 2 the player who played hydrated just for that game got five wins. So, he won the game in a whole. The results were very convincing and the differences between the first game and the second for the test subject were big. He managed to win five games while hydrated compared to just one win while dehydrated. In the second game he managed to have very few losses. In conclusion for the results, dehydration influences player performances. In fact, it has a major negative effect as you can see by the results of both games.

Dehydrated table

Player name	Wins
Nafis	5
Omar	1
Adel	4
Henry	2

Table 1

This table shows the amount of wins each player got while the player highlighted in orange was playing dehydrated.

Hydrated table

Player name	Wins
Nafis	4
Omar	5
Adel	2
Henry	1

Table 2

This table shows the amount of wins each player got while the player highlighted in orange was playing hydrated.

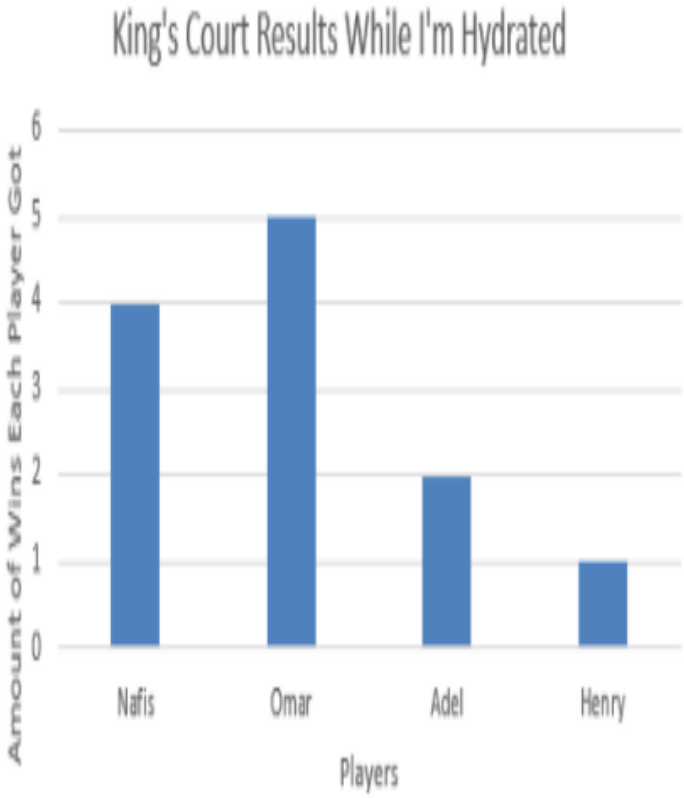

Figure 1

Results in a bar graph of game played hydrated results of king's court

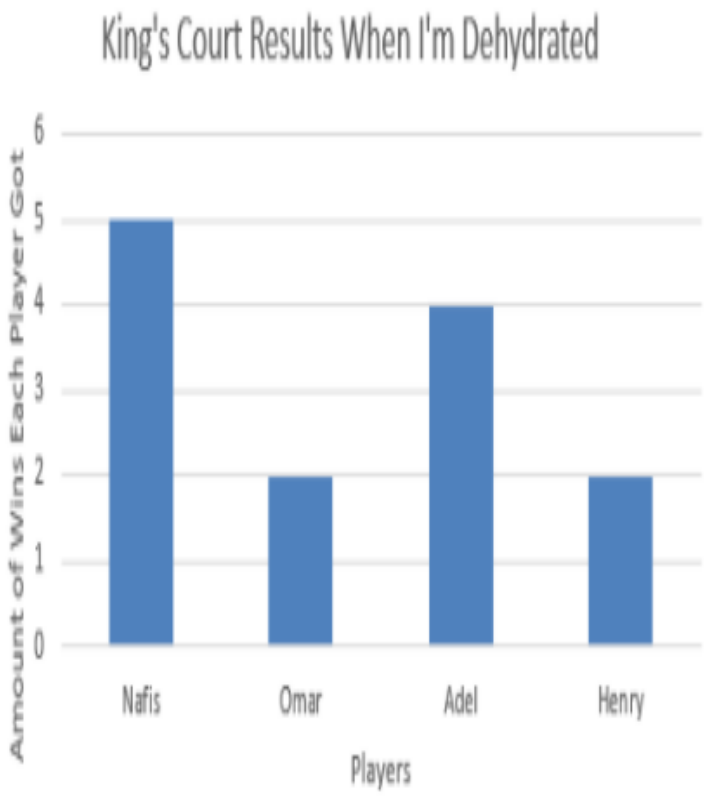

Figure 2

Th results of the game played dehydrated of king's court

Discussion/Conclusion

My hypothesis was correct. The initial question in the beginning was, "Does dehydration influence your performances during physical activity?". My hypothesis stated that water does affect player performances in a negative. It stated that my results would be better while I was hydrated. Now after gathering all my data from experiments, I can say that dehydration does affect your performances during physical activity. It in fact it has a negative effect on performances. So, in conclusion dehydration does has a major negative impact on athlete performances. Also, from researching online the information that is presented shows that playing dehydrated will bring the factor of being lazy and fatigued leading to really poor performances. Hydration brings in the factor of being active and quickness. When you're lazy you make poor passes and decisions (Jeukendrup, 2013). When you`re active you're a lot more effective and useful to the team and you will get noticed more from scouts or college coaches. In now way were the results unexpected. This was what the hypothesis also mentioned. Water is a really helpful thing. Remember to drink water if you're participating in anything athletically to achieve results you want.

Application

The way the results will help people and help in other fields is that it proves that water is helpful in many ways. One way is that now people have the knowledge that water is very helpful for athletic purposes. Now athletes and many people will be aware about this and drink water a lot to reach results they want (Khan, 2015). This is not the only way water will help. Being dehydrated really affects people's spirit and effort. This will really affect people's thinking and results they will get on tests/quizzes/exams because if you're too dehydrated to give any effort there will be no effort in finishing or answering questions at full capacity (Nutrition, 2015). The way the public and scientific community will use this information in useful ways. Now with the knowledge that water is helpful in many ways they can implement it in their lives. Also, anytime anyone has a soccer game for

example game you start drinking as soon as the day before Barr (1999). Some people might think just during the game they should drink water but if you want even more potential then you can even start a whole day before. There are many ways you can implement water in your life in a positive way. The way the results fit into the big picture is that water is very important. The reason why we are all living is because of water. Water is what is why we live. In almost everything we do is because/have to do with water. This is another way water is helpful. It can help you achieve results you want athletically.

References

Ryan, M. (2008, August.). Fluid requirements during exercise. Retrieved from http://go.galegroup.com/ps/advancedSearch.do?method=doSearch&searchType=AdvancedSearchForm&userGroupName=ko_k12hs_d27&inputFieldNames[0]=AU&prodId=GPS&inputFieldValues[0]=%22Monique Ryan%22

Khan, M. (2015, March.). Dr. Michael Khan (Dean). Retrieved November 16, 2017, from http://www.uwindsor.ca/kinesiology/471/dr-michael-khan-dean

Jeukendrup, A., & Gleeson, M. (2013, September.). Dehydration and its effects on performance. Retrieved January 18, 2018, from http://www.humankinetics.com/excerpts/excerpts/dehydration-and-its-effects-on-performance

Barr, S. I. (1999, April). Effects of dehydration on exercise performance. Retrieved January 18, 2018, from https://www.ncbi.nlm.nih.gov/pubmed/10198142

Nutrition, E. (2015, April 15). How Hydration Affects Performance. Retrieved January 18, 2018, from https://www.acefitness.org/education-and-resources/professional/expert-articles/5397/how-hydration-affects-performance

The Effect of Music on a Student's Concentration and Efficiency

Sahan

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Abstract

Music is arguably one of the most influential things in our lives due to the fact that it's everywhere. Understanding how music affects our concentration is very important to our daily lifestyle and can be used in our current day education system to aid in student's concentration and efficiency. The experiment done to find how subjects were affected by music was conducted by giving several participants three puzzle. The first puzzle was given to the subject to allow them to create a strategy. The second puzzle was timed and the third puzzle was time but with the addition of music. The data showed that with music 6 out of 8 participants did much better thus showing that music can increase the speed and efficiency of a student. Though the data states that music increases efficiency it should be said that music's effect on the brain is a very complex idea and should not be taken lightly. Using the data retrieved by this experiment shows us that music can make a drastic changes in someone's behaviour and focus, the next step is to find a way to manipulate the music to increase people's efficiency and focus

Introduction

This experiment is based around the application of music while people work. If people were able to understand how their music affects them they would be able to choose whether or not music is helping or hindering their productivity. Obviously music is mostly interpreted by the right side of the brain but then why can some people run faster when listening to fast paced music. How does something so meaningless affect not only our brain but or body? This just begs the question how does listening to music affect a person's concentration, and their efficiency to finish a task? If an experiment is conducted and it is found that music does affect a person's concentration and efficiency drastically increases student's efficiency then education systems would be able to implement music into individual student's careers to further increase their potential. On the flip side if music is found to decrease a student's efficiency then education systems would be able to stop students from freely listening to music while working to increase their chances of success.

Methods

First step of the experiment is to get volunteer to an environment where there is no chance for them to be startled or stressed out in any way. Then give the volunteer a practice puzzle (4*4), this will allow the

subject to get devise a strategy for the next two puzzles. After the completion of the practice puzzle hand the volunteer a new puzzle, this time the volunteer should be timed. After the completion of this puzzle record the time it took them to finish the puzzle and ask the volunteer to put on a pair of headphones. Using the headphones the volunteer will listen to the current most popular songs to ensure that the subject is familiar with the music. While the volunteer listens to the music time them finishing the last puzzle with the addition of music. After completing the last puzzle record their time.

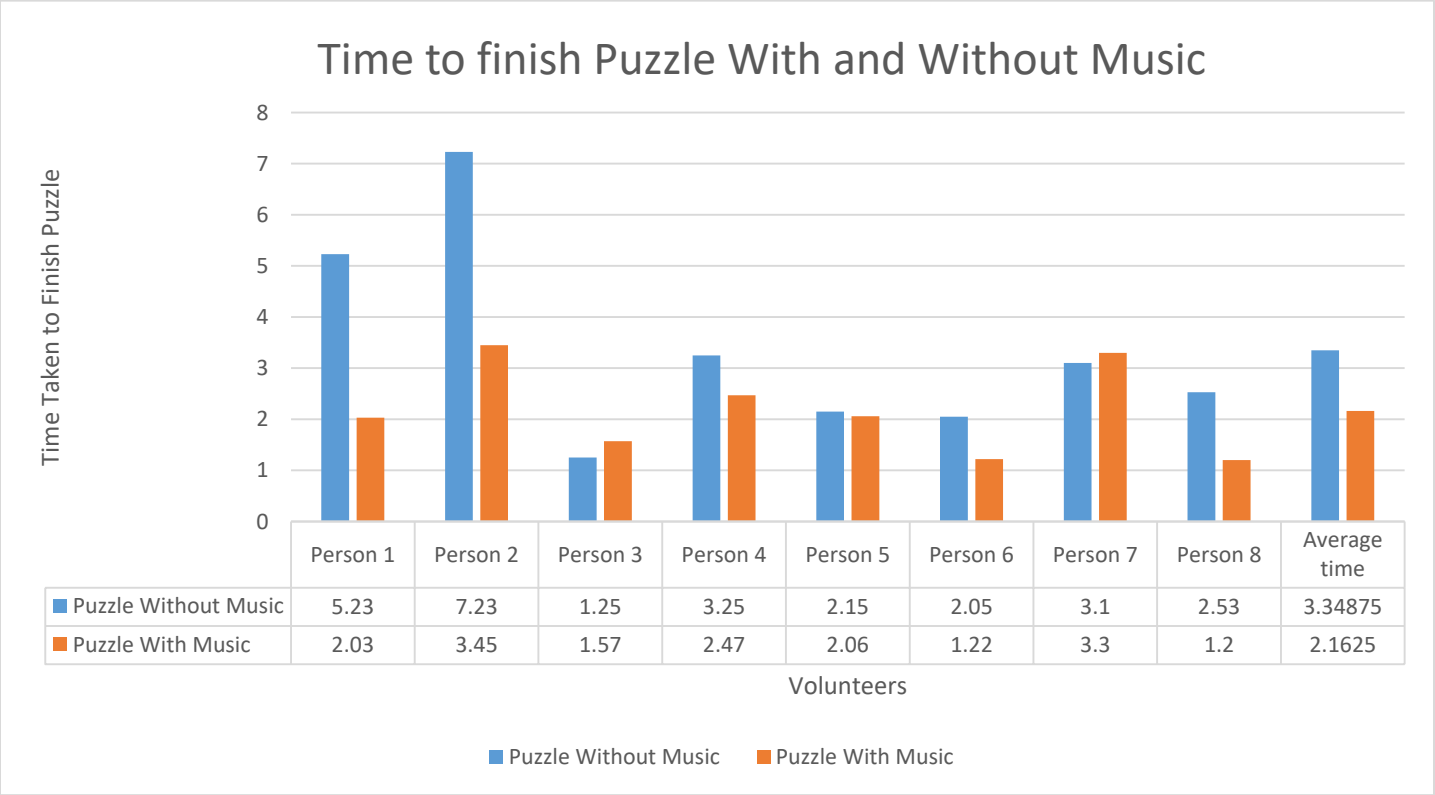
The independent variable in the experiment is what the subject is listening to. This is because it doesn't depend on any other outside variable.

The dependant variable is the speed in which the subject can complete the puzzle. This is because it depends on the subject and how he/she is affected by what he/she is listening to.

The controlled variables consist of the type of music, setting, audio quality, puzzle difficulty and age of volunteers. These had to be controlled because if not controlled the resulting data from each individual test would not be comparable to each other.

Results

Table 1



	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Average time
Puzzle Without Music	5.23	7.23	1.25	3.25	2.15	2.05	3.1	2.53	3.34875
Puzzle With Music	2.03	3.45	1.57	2.47	2.06	1.22	3.3	1.2	2.1625

The graph visually shows the reader how subject's time differed from attempt to attempt. The graph also displays how the different people had different reactions to the puzzles. One can clearly see person 1 had a much more faster time when listening to music then when note listening to music unlike person 5 who's only showed a slight change. The chart at the bottom shows the exact times in decimals instead of time. (Ex. 2.36 = 2:36)

Discussion/Conclusion

Purely looking at the data we can observe that 6/8 participants took a much less time to finish the puzzle when listening to music than taken to finish the puzzle without music. Looking at the final average time we can see that there is almost a minute difference between the two which clearly shows that listening to music did make a significant difference. This proves that music not only makes a substantial difference in student's concentration and efficiency but if used properly could increase a student's potential.

This data is not completely accurate however due to the fact that the way music affects the brain is a very complex idea and isn't as easy to solve as a math problem. When taking in all of the unknown variables and all of the uncontrollable variables we should always assume that the conclusion reached could be a fluke.

When trying to improve the accuracy of the experiment there are plenty of different paths to take. The most effective would be to not only test the patient for efficiency but also look for things such as heart rate, blood pressure when listening and not listening to music. This would give much more insight into how we are effected by music due to the fact that it is almost impossible to be in control of things such as our heart rate. Thus leading to more pure and untampered results.

Application

The knowledge gained from this experiment could be used and implemented into education systems around the world. Music could be implemented into people's lives at an early age so they can have more time to find the benefits of music. This could result in more student not listening to music that distracts them from their current task at hand leading to more student being successful and focused on what they're doing.

The application of music doesn't stop there however. If and when we truly begin to understand how music affects the brain on a cellular level it could lead to different treatments in the medical field and could give scientist the ability to detect and treat mental disorders earlier on in.

Understanding music and its effects on the brain could lead to endless possibilities. In the present time music is used as something to bring people together to listen or to enjoy to their favourite songs. Once we begin to look past this and find the

true use of music as not only a source of entrainment music could not only be an important tool in the evolution of humanity it could be our salvation.

Reference

Elana Goodwin, January 31, 2015 :https://www.uloop.com/news/view.php/149570/Do-Or-Dont-Studying-While-Listening-To

https://www.brighthorizons.com/family-resources/e-family-news/2010-music-and-children-rhythm-meets-child-development

Emily Gersema, June 20, 2016 :https://news.usc.edu/102681/childrens-brains-develop-faster-with-music-training/

Lawson, M. (2017, August 1). Music as medicine. School Band and Orchestra, 20(8), 4. Retrieved from http://go.galegroup.com/ps/i.do?p=PPFA&sw=w&u=ko_k12elm_d27&v=2.1&it=r&id=GALE%7CA503467766&asid=d45beb3d4462b80ab30fbb0e1e5f4ba4

Kuan G, Morris T, Terry P (2017) Effects of music on arousal during imagery in elite shooters: A pilot study. PLoS ONE12(4): e0175022. https://doi.org/10.1371/journal.pone.01750

Solar Potenetial Energy Storarge & UV Filter Hybrid

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A hybrid system was created to produce electricity using solar photovoltaic means and store it in the form of potential energy. This was done to prevent further damage to our ozone layer which is done by what the majority of the world uses which is fossil fuels and stores the energy in batteries which releases harmful emissions into our atmosphere Simultaneously, excess totally dissolved salts such as fluoride, bromide, and chloride will be removed using a RO process to prevent diseases caused by too many contaminants in water such as fluorosis. To decrease the large sums of people in equatorial areas suffering from diseases caused by lack of clean water such as cholera, dysentery, and salmonella a UV filter using natural sunlight to remove pathogenic microorganisms has been created.

How to create a system that can produce electricity and store it through the means of renewable energy sources? Is it possible to simultaneously extract totally dissolved salts from contaminated water in areas using surface and ground water and have the ability to kill pathogenic microorganisms by using natural resources to make a hybrid system?

Is it possible to produce electricity and store it using renewable energy source and also simultaneously extract totally dissolved salts and kill pathogenic microorganisms by using natural resources? This is very important as

solar and potential energy is very efficient and economically friendly

Importance

The combination of solar and potential energy is very efficient and economically friendly because solar panels do not require frequent replacement and there are no harmful emissions released, this would be a helpful technology in rural areas as approximately 16% of the global population doesn't have access to electricity (Fabian Kęsicki, Molly A. Walton/ World Energy Outlook: Energy Access Database). Fluorosis is a condition that is difficult to eradicate and found in large sums in developing countries arising due to an intake of water with amounts of fluoride—a totally dissolved salt— if it is higher than 1.5 ppm on a daily basis it can lead to osteosclerosis, ligamentous, bone deformity, and neurotoxicity in adults(WHO: Water Related-Diseases), (Marge Dwyer/Impact of Fluoride On Neurological Development in Children). A common technology used to prevent this is reverse osmosis filtration units that pushes water through a semi- permeable membrane to remove dissolved inorganic solids like fluoride. A new technology that is growing in the market is UV disinfection which kills pathogenic microorganisms by damaging their DNA, to make this technology even more cost-effective you can use natural sunlight

instead of artificial as sunlight has wavelengths between 240 nm and 280 nm which are common in areas around the equator (Michelle Maclean/ Inactivation of Bacterial Pathogens following Exposure to Light from a 405-Nanometer Light- Emitting Diode Array).

PLK4 Heterozygosity in Mice Predisposes Mice to Hematological Changes

Sama

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Abstract:

The main purpose of this experiment was to narrow down what type of blood cancer mice may have with a one less copy of PLK4. Methods used consisted of submerging the samples in various solutions to help preserve the tissue samples, staining the samples for better recognition under the microscope, and cover-slipping to restrain any damage that could be done. Results show that the cells were disfigured and overgrown. In addition, there was an increment of spleen Lymphocyte numbers and a slight increment in Neutrophil numbers. In conclusion, the results prove that the cancer in the mice is primarily linked to the Myeloid Stem Cell category as shown by both increments of the Neutrophil and Lymphocyte numbers.

Introduction:

PLK4 is an important gene expression in the human body and is often referred to as the 'master regulator' of centriole duplication in mitosis. The importance of this question is that by looking at the spleen and bone marrow tissue, it can be determined what correlations can be made with the hematology of the mice with the one less PLK4 copy. The mice can be used as a model to find the types of cancer that relate to the missing copy of the gene. If there is one less copy of the plk4 gene development in mice then it can impair the duplication of the centrioles, specifically in spleen and bone marrow tissues (resulting in a type of blood cancer native in the spleen) because it can act as a carcinogen in the making of the blood cells.

Methods:

There are three main processes that occurr within the experiment:

- ➢ Fixation and processing of the mouse spleen tissue
- ➢ Hematoxylin and Eosin stain
- ➢ Cover-slipping

Fixation and processing: Prepare the Neutral Buffered Formalin (NBF) overnight and once done submerge the tissue for two and a half hours. Then re-submerge the tissue in different percentages of Ethanol (70% and 95%) for an hour each. Lastly,

once done place tissue in Xylene for 2 hours and embed the tissue in hot Paraffin for an hour.

Hematoxylin and Eosin Stain: Place tissues, using tweezers, in xylene to deparaffinize in 2 sets of two minutes. Then submerge tissue in different amounts of Ethanol (100%,70%,50%) for 2 minutes each. Next, place the tissues in a Phosphate buffered saline (PBS) for 15 minutes and then 10 minutes after on the Hematoxylin stain. Once done, place tissue in a 0.1% Sodium Bicarbonate (referred to as the blueing step) for 15 min and then quickly place the tissue in distilled water for 30 seconds. Afterwards, submerge the tissue in Eosin stain for 30 seconds and then re-submerge in 95% ethanol. Lastly, place the slides once again in the xylene for 2 sets of two minutes and store overnight.

Cover-slipping slides: Prepare a Permount solution and once done gently add the solution onto the slides. Then gently place a slide on top of the tissue slide. Once done, place the slides on a slide warmer (heated to 70ºC) and leave for 20 minutes.
Make sure to check the bubbles and if the bubbles have moved far enough away from the tissue, move on. If not, leave for another 10 minutes and check again. Once done, turn the slide warmer down (to 50ºC) and leave it for an hour. Lastly, turn off the slide warmer and leave the slides to cool overnight. It is now prepared to look at the slides under the microscope.
The independent variable was the genotype of the mouse (Wild-Type or Heterozygous). The dependent variable was the phenotypic effects seen as a result of the genotype of the mouse, this included any changes observed in the hematology of the mouse. The controlled variables were making sure the mice were aged approximately 18-20 months, fed the same foods and lived in the same ons.

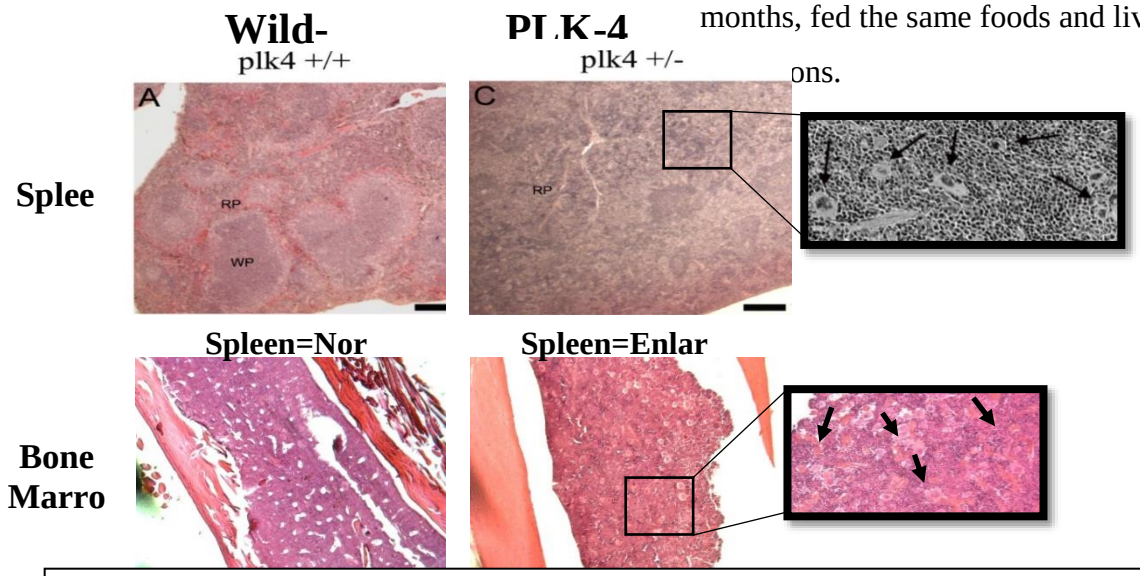
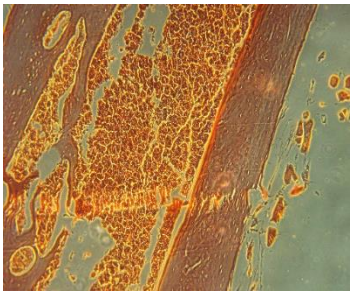
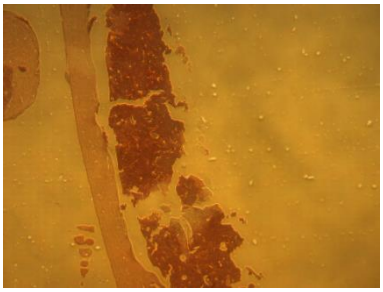


Figure 1. The chart above shows the comparison of the spleen and bone marrow of the Wild-Type (labeled on the left) and Heterozygous (labeled on the right) mouse.

A closer inspection revealed that within the enlarged spleen; hyper-cellular bone marrow can be observed (indicated by the arrows) (Images courtesy by Brayden Labute)



PLK4- Wild-Type Mouse (Bone Marrow) 87amaleHp3_100px



PLK4-Hetreozygous Mouse (Bone Marrow) 72BHp2_50px

Figure 2. The two pictures shown above are the comparison between the normal bone marrow sample (left) and the enlarged bone marrow (right)

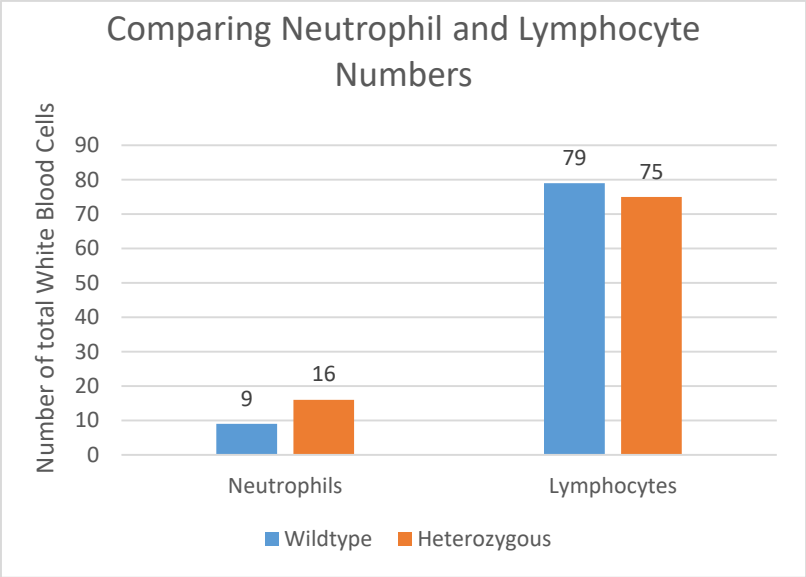


Table 1. The chart above compares the Neutrophil and Lymphocyte numbers in the normal and cancerous mice tissue samples (Table courtesy of Brayden Labute)

Results:

Ten mice with enlarged spleens and one-less copy of the gene expression PLK4 were compared with the normal Wildtype mice (controlled group) using microscopic lens. There were 226 mice in total (Wildtype: 98, Heterozygous: 128) and it was found that 30% of the PLK4 Heterozygous mice had enlarged spleens in comparison to the 6% of the Wildtype mice (Figure 1).

Observations revealed that the cells in the Heterozygous tissue sample were not evenly distributed; some had formed atop one another, overgrown, and closer look revealed an increment in centriole duplication due to an increase in PLK4 levels (Figure 2).

Experimental results (Table 1) showed that the number of circulating white blood cells in the Wildtype mice was 5.2x109 /L while the Heterozygous samples showed an increment in the numbers of white blood cells of 5.8x109 /.

In addition, a comparison between the percentage of the white blood cells, specifically looking at the Neutrophils, and the Lymphocytes has been performed and results showed that the Wildtype mice has a percentage of Neutrophil less than 10%. While, it was 16% in PLK4 Heterozygous. The percentage of the Lymphocytes in Wildtype mice was higher (~ 80%) compared with that in the Heterozygous mice (~75%). According to these results, the Neutrophil percentage directly correlates with the spleen cancer in the mice with one-less PLK4. It is important to mention here that there could have been some error associated with the experiment such as incorrect concentration of solutions during the staining of the slides process, a slightly change of temperature in the staining solution, and uncertainty of the measurements.

Discussion/Conclusion:

The results/findings aligned with the hypothesis, there is a significant increment in centriole duplication in the Heterozygous mice cells, which led to a higher count of white blood cells as seen from the results mentioned above. Based on the data, the increment of Neutrophil percentage in the Heterozygous mice showed that the cancer these mice have are predominantly linked to Myeloid Stem Cell category. This information narrows down what type of cancer the mice with one less PLK4 can have. For further studies, the data found from the Heterozygous mice can be compared with patients who similarly have the same one less copy of PLK4.

Application:

The results of the experiment can lead to a better understanding of the microscopic proteins and gene expressions embedded within a human cell as they show that a decrease in one expression can result in drastic changes to the tissue or organ as a whole. Scientists can then apply these observations as a basis of what other decreased gene expressions may result in.

Acknowledgements:

The analysis/discussion of the experimental results were discussed with Mr. Brayden Labute, Ph.D candidate, in the Department of Biological Sciences at the University of Windsor.

References:

H., JW. (2016, May 10). Dr. John Hudson. Retrieved January 14, 2018, from http://uwindsor.ca/biology/dr-john-hudson-0

Wong, Y. L., Anzola, J. V., Davis, R. L., Yoon, M., Motamedi, A., Kroll, A., Oegema, K. (2015). Reversible centriole depletion with an inhibitor of Polo-like kinase 4. Science, 348(6239), 1155-1160. doi:10.1126/science.aaa5111

Morettin A, Ward A, Nantais J, and Hudson JW (2009). Gene expression patterns in heterozygous Plk4 Murine Embryonic Fibroblasts. BMC Genomics 10:319

Sharma, N., Vaid, R., Dev, K., & Sourirajan, A. (2017). Polo-Like Kinase (PLK). Encyclopedia of Signaling Molecules, 4100-4106. doi:10.1007/978-3-319-67199-4_101760

Effects of Modifying Elements of Architecture on Emotional State

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Abstract

The question investigated in this project is how modifying elements of architecture affect one's emotional state. Answering this question is important because people are continuously surrounded by architecture and its many elements. During the procedure of this project, participants are each shown a set of images of modifying elements of architecture. Participants are asked to record the emotions they feel in response to each of the images they observe. Emotions participants feel are either positive, negative, or mixed. The connection between the brain's ability to regulate emotions and also be aware of surrounding spaces is how modifying elements of architecture affect how one feels. People should be aware of this connection to design spaces using certain elements, to be able to bring forth change in their lives, in the form of positivity.

I. INTRODUCTION

This project's purpose is to understand the effects modifying elements of architecture (colour, light, ceiling height, and space) have on one's emotional state. This is something important to understand as people are continuously surrounded by architecture and its many elements. In fact, according to studies, "citizens of modern societies spend 90 per cent of their time in a building", (Gander, K. (2016, April 19)). People should be aware about the influences, both subtle and strong, that something so prevalent like architecture, has on their emotional state, (Berg, N. (2016, November 16)). To understand these influences, both subtle and strong, this project investigates the following question: how do modifying elements of architecture, affect how one feels?

If people were to be shown images of modifying elements of architecture found in buildings, then they would experience different emotions, because certain regions of the brain, which regulate emotions, are also aware to the arrangement of the spaces people occupy, (Bond, M. (2017, June 6)). The connection between the brain's ability to regulate emotions and also be aware of surrounding spaces, leads humans to experience certain emotions in response to certain surroundings.

II. METHODS

Begin by placing 9 desks in a row, with chairs. Next, place an image of a modifying element

of architecture, a blank piece of paper, and a pencil on each of the desks. Then, assign each participant a desk. Next, ask the following question: “how does the image in front of you make you feel?”, allowing the participants 1 minute to look at the picture, and record their answer on the blank piece of paper. Then, signal the participants to move to the desk on their right, once the minute is up. Participants must repeat these steps, until they have recorded their answers for each image.

The independent variables of this experiment are the images of modifying elements of architecture. The dependent variables of this experiment are feelings. The controlled variables of this experiment are the set of images of modifying elements of architecture, amount of time, and the environment. If the set of images were to not be controlled by varying in colour scheme, size, or position, then emotions participants feel may be influenced by those elements, rather than the modifying elements of architecture in the images, which is what this experiment is intended to test for. If the amount of time given to each of the participants to observe and record their answers were to not be controlled, some participants may be affected by the modifying elements of architecture for longer or shorter periods of time, which could influence the intensity of the emotions they feel. If the environment in which this experiment takes place were to not be controlled, varying in the amount of space, lighting used, or noises within, then emotions participants feel may be influenced by those elements, rather than the modifying elements of architecture in the images, which is what this experiment is intended to test for.

III. RESULTS

The following Table is referred to as Table 1.

Table 1 Responses of the Participants to the following Modifying Element of Architecture: Colour

Modifying Element of Architecture:	**Feelings Associated with the Modifying Element of Architecture:**
COLOR- **A WARM COLORED ROOM** 	• Uplifted • Creative • Heartwarming • Excited
COLOR- **A NEUTRAL COLORED ROOM** 	• Mysterious • Alert • Simplicity • Sadness
COLOR- **A COOL COLORED ROOM**	• Calm • Homely

	• Relaxed • Interested

The following Table is referred to as Table 2.

Table 2 Responses of the Participants to the Modifying Element of Architecture: Light

Modifying Elements of Architecture:	**Feelings Associated with the Modifying Elements of Architecture:**
LIGHT- **NATURAL LIGHT** 	• Positive • Concentrated • Relieved
LIGHT- **ARTIFICIAL LIGHT** 	• Isolated • Irritated • Captivity

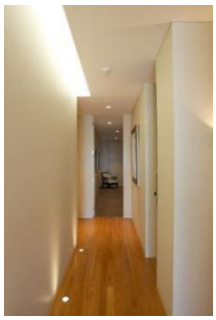
The following table is referred to as Table 3.

Table 3 Responses of the Participants to the Modifying Element of Architecture: Height

Modifying Elements of Architecture:	**Feelings Associated with the Modifying Elements of Architecture:**
HEIGHT- **A HIGH CEILING** 	• Active • Free • Overwhelmed
HEIGHT- **A LOW CEILING** 	• Discomfort • Fearful • Discouraged

The following Table is referred to as Table 4.

Table 4 Responses of the Participants to the Modifying Element of Architecture: Space

Modifying Elements of Architecture:	**Feelings Associated with the Modifying Elements of Architecture:**
SPACE- **AN OPEN SPACE** 	• Welcomed • Curious • Imaginative ○
SPACE- **A CONFINED SPACE** 	• Confused • Nervous • Close mindedness

IV. DISCUSSION/CONCLUSION

The hypothesis is correct. Certain regions of the brain, which regulate emotions, are also aware to the arrangement of the spaces people occupy. The connection between the brain's ability to regulate emotions and also be aware of surrounding spaces is how "modifying elements of architecture" such as colour, light, ceiling height, and space, affect how one feels. When participants are shown images of various modifying elements of architecture they experience different (positive, negative, and mixed) emotions, due to this connection. Positive emotions participants feel include: relieved, calm, and uplifted. Negative emotions participants feel include: discomfort, discouraged, and fearful. Mixed emotions participants feel include: alert, mysterious, and overwhelmed.

The most significant results include the emotions participants feel in response to the images of modifying elements of architecture. Participants experience positive emotions when shown images of a warm colored room, a cool coloured room, a room with natural light, and an open space. Participants experience negative emotions when shown images of a room with artificial light, a room with a low ceiling, and a confined space. Participants experience mixed emotions when shown images of a neutral colored room, and a room with a high ceiling. Also, of all the "modifying elements of architecture", colour, space and light had the most effect on the participant's emotions.

This data supports the hypothesis as participants experience different emotions (positive, negative and mixed) in response to images of modifying elements of architecture.

A problem that may occur is that if any participants are emotionally impacted by a certain situation, prior to taking part in the experiment. This may lead to the responses of the participant(s) to be influenced by their prior situation, affecting the results of the experiment.

V. APPLICATION

The general public could use this information to design surroundings they are often exposed to such as their houses, workplaces, and schools, using certain elements to feel more positive emotions, such as uplifted, creative, and relaxed. The data collected from this experiment demonstrates to the general public that they too are capable of controlling how they feel, by being aware of their surroundings, and the modifying elements of architecture within them. These modifying elements of architecture include: the height of the ceiling, the amount of space, the type of lighting used, and colour. Being aware, and using one's awareness to bring forth a desired change in the form of positivity is key!

VI. REFERENCES

Babakhani, R., Islamic Azad University. (2017, January 30). Color and Light in Architecture and Its Effects on the Spirits of Space Users in a Psychological View. Retrieved October 18, 2017, from https://www.omicsonline.org/open-access/color-and-light-in-architecture-and-its-effects-on-spirits-of-space-users-ina-psychological-view-2168-9717-1000184.pdf

Berg, N. (2016, November 16). Can Your City Change Your Mind. Retrieved October 5, 2017, from

https://www.curbed.com/2016/11/16/13637148/design-brain-architecture-psychology

Bond, M. (2017, June 6). The Hidden Ways That Architecture Affects How You Feel. Retrieved October 5, 2017, from

http://www.bbc.com/future/story/20170605-the-psychology-behind-your-citys-design

Fiacconi, C. (n.d.). Retrieved November 15, 2017, from

https://www.uoguelph.ca/psychology/users/chris-fiacconi

Gander, K. (2016, April 19). How Architecture Uses Space, Light, and Material to Affect Your Mood. Retrieved October 5, 2017, from

http://www.independent.co.uk/life-style/design/how-architecture-uses-space-light-and-material-to-affect-your-mood-american-institute-architects-a6985986.html

Kim, J. (n.d.). The Kim Lab. Retrieved November 15, 2017, from

http://www.junchulkimlab.com/

Sabah, D. (2014, September 8). Scientists Demonstrate Colors' Effects On Human Behavior. Retrieved October 19, 2017, from

https://www.dailysabah.com/health/2014/09/07/scientists-demonstrate-colors-effects-on-human-behavior

The Effects of Anime on the Stress of the Average Teenager

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ABSTRACT:

This research looks at the stress of the average teen and how it's affected by the exposure to Tv Shows, specifically anime. The goal is to show that TV shows have an impact on the stress levels of a high schooler. The first phase involves a survey conducted by a class asking several questions. The final phase is that of an experiment consisting of watching anime for a series of days to measure stress the increase and decrease of stress levels. Upon further examination and through experimentation, it will be proved that anime reduces stress of the typical teenager.

Introduction

Stress has become a very common thing amongst teens. Teens in high school are expected to figure out their path and future whilst completing copious amounts of assignments, and in the end, this builds stress. In fact, a lot of teens feel the pressure of competition from their peers, pressure from their parents or just plain old pressure to succeed. It is no wonder 44% of kids from 8-17 deal with stress. Needless to say, that is a very large percentage. When dealing with stress most teens either slept too much or too little, are constantly on social media and don't feel as hungry. The average teenager is very much affected by the stress of school.

This experiment is interested in discovering; what is the effect of anime on the average teenager? If the average teenager is exposed to anime on a regular basis then their stress levels will decrease. As teenagers are completing high school, it's ascertained that they will face stressful times, more times than not. Anime provides a sort of escapism for them. For that short hour or two, they can immerse themselves in another world and leave the stress of their day behind. After a couple episodes, a teen might find themselves laughing, or smiling and that little positivity will be just the thing to make their day a little brighter and help them continue to strive towards their goals.

Methods

A survey is conducted by a grade ten class, consisting of 30 students. The survey includes many factors, all with the objective of gaging the stress levels of a grade ten class. Following that, 4 tests subjects are given a test, based on their answers, their stress levels are known. Finally, an experiment is conducted. Restrictions being that the anime watched by all test subject remaines the same. The show being Mahouka Koukou No Rettousei and is watched with English subtitles. After one week, the data collected is processed and compared to see the changes in stress levels.

The survey contains question such as the number of hours of sleep each student has on a typical school night, amount of extracurriculars they partake in, and the rating of their stress levels from one to five during an average school night. Once the survey results are recorded, 4 test subjects are chosen to do a test and then do an experiment. The test consists of many questions. A few examples being; how long it takes to fall asleep at night, how they manage their school life, extracurriculars and personal responsibilities, how often they do de-stressing

activities and if they consider winding down to their favourite shows a form of stress relief. Now, the last question that is asked ties into the next step they are assigned. After completing the test, the subjects are asked to do an experiment. This experiment consists of watching 25 minutes of anime a day for 7 consecutive days. The anime is called Mahouka Koukou No Rettousei. Along with that, subjects have to write down their stress levels prior to, after and the next morning of watching the anime. This is repeated every day for the 7-day block. The data is then collected upon completion and compared for further analysis.

The dependent variable are the test subjects. The independent variable is the stress levels of theThe independent variable is dependent on the test subjects as the stress levels of each subject is that of their own. The stress levels of the test subject relates to the show watched, so all variables relates and affect one another.

Results

Graph 1

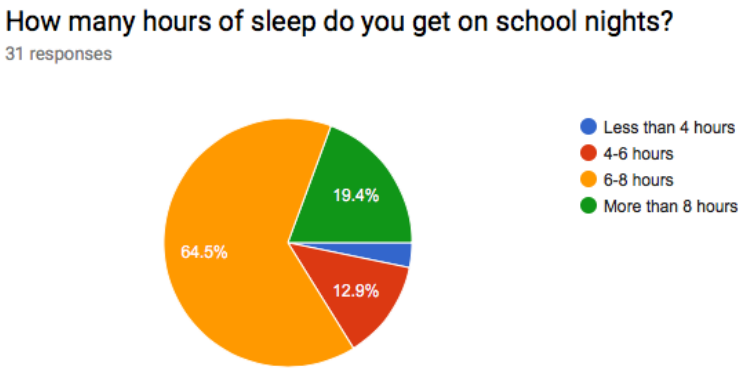

Figure 1:

This is a graph from a survey done on a grade ten class. Most kids get a recommended amount of 6-8 hours of sleep a day and very few suffer from little sleep.

Graph 2

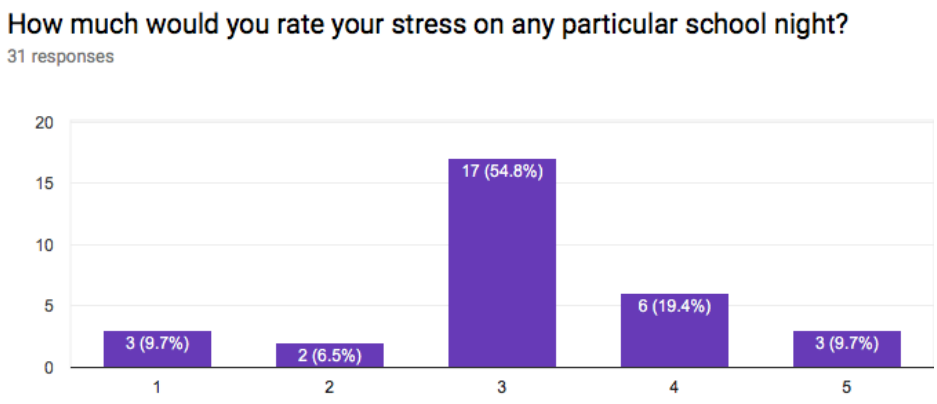

Figure 2:

This is a graph from the survey conducted a grade ten class. It shows that the most common level of stress is a 3 on any school night.

Graph 3

Figure 3:

The majority of the subjects say that they rarely do de-stressing activities. These activities can play a major role in your day if one is having a stressful day.

Graph 4

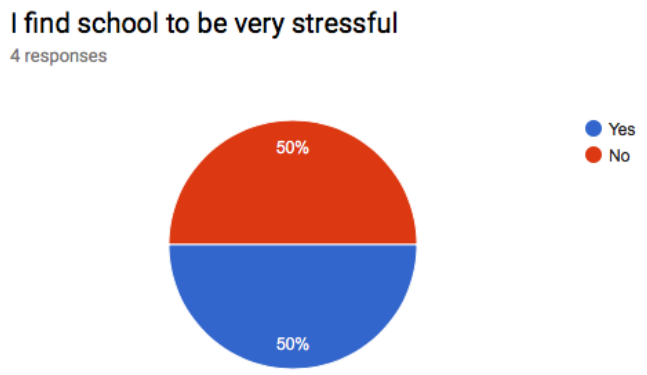

Figure 4:

When responding if school is stressful, half the subjects say no, while the other half answer yes. This shows that the stress of school depends on the subject specifically.

Graph 5

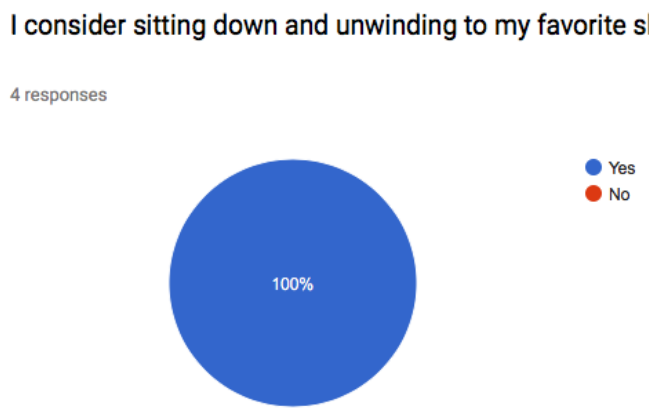

Figure 5:

This graph shows that each subject is in agreement when answering that TV shows are a form of stress relief.

Table 1

Day 1	Before watching	After watching	Next morning
Gyan Sinha	5	2	1
Abuk Chan	3	2	1
Maria Farooqi	4	3	2
Seren Hej-Al	4	2	1

Day 2	Before watching	After watching	Next morning
Gyan Sinha	4	1	1
Abuk Chan	4	2	1
Maria Farooqi	3	2	2
Seren Hej-Al	3	1	2
Day 3	Before watching	After watching	Next morning
Gyan Sinha	4	1	4
Abuk Chan	3	2	2
Maria Farooqi	4	2	2
Seren Hej-Al	4	1	2
Day 4	Before watching	After watching	Next morning
Gyan Sinha	4	1	5
Abuk Chan	3	3	2
Maria Farooqi	2	1	2
Seren Hej-Al	5	1	2
Day 5	Before watching	After watching	Next morning
Gyan Sinha	1	1	1
Abuk Chan	4	3	2
Maria Farooqi	4	3	3
Seren Hej-Al	4	1	2
Day 6	Before watching	After watching	Next morning
Gyan Sinha	3	2	2
Abuk Chan	2	1	1
Maria Farooqi	2	2	2
Seren	3	1	1
Day 7	Before watching	After watching	Next morning
Gyan Sinha	2	2	2
Abuk Chan	4	3	3
Maria Farooqi	1	1	2
Seren Hej-Al	3	1	1

Figure 6:

This table shows the stress levels of the subjects before and after watching anime for the first time. All subjects recorded starts off with moderate to high stress level but in the end, the stress levels lessens.

Discussion/Analysis:

The experiment analyzes 4 test subjects. There were a few patterns in individual responses, all subjects mostly have a stress level of 4 before watching anime but lowers to that of 2 or 1 after watching anime. On November 20th, all subjects have a relatively low stress level of 2 or 1 before watching anime and most drops to 1 or stays the same. As established in the survey, 2 of 4 test subjects find school stressful while the other two do not. However, all subjects respond in affirmation when asked if unwinding to their favourite shows serves as a stress reliever. As anime is a type of show, it can be said that it is a form of stress reliever by what the collected data shows. All but one test subject finds the anime soundtrack to be a factor of decreasing their stress.

The hypothesis: "If the average high school student in grade ten is exposed to anime on a regular basis, then their stress levels will decrease," is proven correct. The experiment, consisting of 4 students watching anime for a 7-day period, records that each student have a decrease in stress. The effects of anime on teenagers are that of a positive outcome. 4 test subjects that experiences high

stress levels conducts an experiment and listens to an innovation, relative to anime. They encounter a feeling of calmness and they enjoy themselves while watching anime and listening to an anime soundtrack. The experiment shows that the overall effect of anime on a teenager are of decreasing stress levels, increasing concentration and general happiness.

Application:

This information will be useful to the study of psychology as it is a new form of release. When individuals go to psychologist, they go to find a solution to their problems, such as stress. This method of stress relief is enjoyable and can make a difference to those in need of it. The public could use this as well. Watching TV shows to de-stress is a way that would get many interested and a lot more people would be willing to give it a chance. Stress isn't something new, it isn't a problem that has just sprouted up. Many people have to deal with it for generations, and it is hard for individuals to find something that helps. This tactic can be that one thing that someone needs. TV shows may not reduce everyone's stress and that is ok, but what matters is that one person that it might affect. At the end of the day, changing even just one person's life for the better is one step further to a greater future.

References.

Villanueva, S. (2015, Dec 8). Teenage Stress. Retrieved on: Jan 18 2018. Retrieved from: https://www.psychologytoday.com/blog/how-parent-teen/201512/teenage-stress

Youth Health and Wellbeing. (2016, Nov 16). Stress In Teenagers. Retrieved on: Jan 18 2018. Retrieved from: http://raisingchildren.net.au/articles/teenagers_stress.html

The Most Ideal Sleep-Schedule in Terms of Efficiency and Quality

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Abstract

The purpose of the experiment is to find the most ideal sleep schedule that will help with the daily performance of adolescence at school. With all the stress and anxiety the people in the modern world experience, sleep time is limited to only a few hours each night. With the few hours of sleep students tend to get, it is very important to find a way that allows adolescence to get the most out of their sleep and rest in an efficient way. The experiment involves experimenting with three different sleep schedules; the first sleep schedule is to sleep in 4 sleep cycles at once, the second schedule requires sleeping in 2 segments of 2 sleep cycles, and the last schedule is set at 3 segments of 1 sleep cycle. The result for the experiment proves that sleeping for a long time at once is the best way to get well-rested and that sleeping in small segments does not help improve sleep, but will cause sleep deprivation. Sleeping and resting are essential parts of a human's life; adolescence needs to let their body and brain rest for as long as they need in order for themselves to grow physically and mentally.

Introduction

In the fast-pace society today, it is important to know the most efficient way to perform tasks, and the same thing goes for sleeps. Every human spends a large portion of their life sleeping. As the society introduces stress and heavy workloads, the sleeping hours for a human are limited. By experimenting different ways to sleep, people will be able to rest in the most efficient way every day, despite of all of their worries. In other words, knowing the right way to sleep is essential for a human's success. So, what is the most ideal sleep schedule when considering the depth and efficiency of sleep?

If a person's sleep schedule was changed into small segments, then their daily performance will improve, because everyone's sleep falls in a cycle of 5 stages: 1, 2, 3, 4 and REM (Rapid Eye Movement). The first cycle takes about 90 minutes and the rest of the cycles in the night take about 2 hours. Every night, the human body goes through the sleep cycle 4 times. From the 5 stages, only stages 3&4 involve deep sleep; this is the time when one's sleep drive is reduced and their brain waves are at their slowest (delta waves). During stages 3&4, it is almost impossible to wake up; this stage basically shuts down the brain and the human body is completely locked((The 5 Stages of Sleep. (2016, June 13). Retrieved from http://2breathe.com/the-5-stages-of-sleep)). As the night progresses, the amount of time a person spends in deep sleep decreases and the stage of REM increases in time (5

Stages of Sleep: Your Sleep Cycle Explained. (2017, February 8). Retrieved from https://bedjet.com/blogs/sleep-blog/5-stages-of-sleep). Based on the theory, the most important part of one's sleep is the first sleep cycle, which is the first 90 minutes of their sleep. In theory, people should sleep in small segments of 90 minutes (Stages of Sleep and Sleep Cycles. 2017, August 28). Retrieved from https://www.tuck.com/stages/).

Methods

The subject of the experiment will always start sleeping between 10:00pm to 11:00pm each night and will wake up between 7:00am to 8:00am each morning. First, a sleep schedule to sleep for 4 cycles at once is set up for the experiment, the subject does not need to wake up through-out the night. Then, a second sleep schedule is set up to sleep in 2 sleep cycles at a time. The subject has to wake up 1 time during the night, alarms will be set between 1:30am to 2:30am and stay awake for 2 hours, and then the subject starts sleeping again and wakes up in the morning. Lastly, the third sleep schedule requires the subject to sleep in 1 sleep cycle each time. The subject has to wake up to the alarm between 11:30pm to 12:30am, stay awake for 2 hours, and then start sleeping again. Between 3am to 4am, alarms will be going-off again and the subject has to wake up again and stay awake for 2.5 hours, and then the subject continues sleeping again. The subject sleeps until the morning when they're supposed to wake up. The experiment requires the subject to sleep in each sleep schedule 3 in a row; which takes the subject 9 days to sleep through all of the 3 schedules. To avoid any discrepancy, the whole process is to be repeated 3 times, sleeping in the same order; which means that the whole experiment takes 27 days.

The independent variable is the different sleep schedule. The dependent variable is the subject's quality of sleep and daily performance.

The first controlled variable is the person doing the experiment; different bodies react differently with the changes they're experiencing, so whole procedure of the experiment needs to be experimented with one person to see an accurate representation of the effect of different sleep schedules on a person. The fitness watch that is monitoring the subject's sleep should also stay constant; because different watches might interpret the subject's sleep differently and transfers data differently. The control variable should also include the amount and type of work observed in daily performance, people performs some tasks better than other tasks, if the type of work is different when evaluating daily performance, it would be unclear if the reason was the person itself or the effect of sleeping on a different schedule. Lastly, the time the subject starts sleeping for the night and wakes up in the morning are also control variables, because the human body reacts differently with each part of the day.

Results

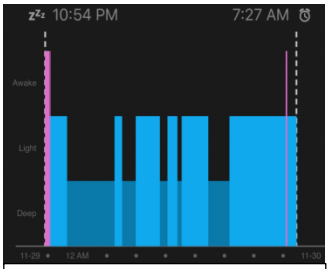

Figure 1 – what the first sleep schedule looks like in a graph when tracked with a fitness watch.

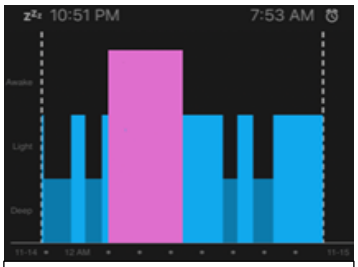

Figure 2 – what the second sleep schedule looks like in a graph when tracked with a fitness watch.

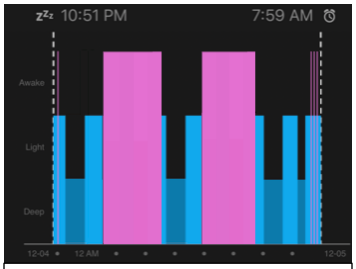

Figure 2 – what the third sleep schedule looks like in a graph when tracked with a fitness watch.

In the three figures above, the pink-coloured bars represents when subject is awake, the light-blue bars represent when the subject is in light-sleep mode, and the dark-blue bars represent when subject is in deep-sleep mode.

Table 1 – First set of 9 days

	Method 1	Method 2	Method 3
1st day	Deep Sleep: 3h 29min Light Sleep: 5h 17min Awake: 0h 14min	Deep Sleep: 3h 02min Light Sleep: 3h 31min Awake: 2h 05min	Deep Sleep: 1h 56min Light Sleep: 2h 38min Awake: 4h 03min
2nd day	Deep Sleep: 3h 34min Light Sleep: 4h 51min Awake: 0h 5min	Deep Sleep: 2h 58min Light Sleep: 3h 16min Awake: 2h 15min	Deep Sleep: 2h 16min Light Sleep: 2h 12min Awake: 4h 01min
3rd day	Deep Sleep: 3h 05min Light Sleep: 4h 38min Awake: --	Deep Sleep: 2h 47min Light Sleep: 4h 06min Awake: 2h 09min	Deep Sleep: 2h 03min Light Sleep: 2h 28min Awake: 3h 56min

Table 2 – Second set of 9 days

	Method 1	Method 2	Method 3
1st day	Deep Sleep: 4h 05min Light Sleep: 4h 46min Awake: --	Deep Sleep: 3h 17min Light Sleep: 3h 06min Awake: 2h 46min	Deep Sleep: 1h 39min Light Sleep: 2h 37min Awake: 4h 15min
2nd day	Deep Sleep: 3h 49min Light Sleep: 4h 54min Awake: 0h 6min	Deep Sleep: 2h 48min Light Sleep: 4h 30min Awake: 2h 47min	Wasn't able to wake up at the alarm.
3rd day	Deep Sleep: 3h 26min Light Sleep: 4h 42min Awake: 0h 15min	Wasn't able to wake up at the alarm.	Wasn't able to wake up at the alarm.

Table 3 – Third set of 9 days

	Method 1	Method 2	Method 3
1st day	Deep Sleep: 4h 26min Light Sleep: 3h 32min Awake: --	Wasn't able to wake up at the alarm.	Wasn't able to wake up at the alarm.
2nd day	Deep Sleep: 3h 16min Light Sleep: 3h 58min Awake: --	Wasn't able to wake up at the alarm.	Wasn't able to wake up at the alarm.
3rd day	Deep Sleep: 3h 23min Light Sleep: 4h 58min Awake: 0h 5min	Wasn't able to wake up at the alarm.	Wasn't able to wake up at the alarm.

During the first set of 9 days (Table 1), although the subject is doing everything correctly, the deep-sleep time did not increase. The result for the second set of 9 days (shown in Table 2) is similar to the first; however, subject is not able to wake up during the middle of the night for 3 nights. During the third set of 9 days (result shown in Table 1), the subject is not able to wake up to the alarms through-out the night at all.

Emotionally, the subject feels tired when sleeping in small segments, throughout the day, the subject feels their eye-lids getting heavier. The experiment also causes the subject to experience grumpiness throughout the day with no intention to laugh at jokes. Along with grumpiness, the experiment also decreases the subject's level of concentration when doing independent work

Conclusion/Discussion

Through the experiment, it shows that the hypothesis is not correct. Using the theory in the hypothesis, it is hypothesized that sleeping in smaller segments would help improve/increase the deep-sleep time while increasing the number of hours to do work. However, through the experiment, it shows that it would take a long time to completely adjust to sleeping in small segments and sleeping in segments has no significant positive impact on the number of deep-sleep hours. According to the experiment, sleeping the "traditional" way (8h/night) works the best for a normal human. Not only is sleeping a time for the brain to rest, but it is also a time for the rest of the human body to repair itself, Depending on the state of the human body, sleep can also be lengthened; if a person's sick, they need to get more sleep. In the experiment, the first sleep-schedule has more deep-sleep time and less feelings of fatigue throughout the day.

As the number of sleep time decreases in each schedule, the amount of deep-sleep time decreases too. When sleeping for 8 consecutive hours each night, the time spent in deep-sleep was between 3-4.5 hours. As the experiment moves on to sleeping in segments of 2 sleep-cycles, the deep-sleep time decreases to 2-3.5 hours. The result for deep-sleep

get worse when sleep separates into 1 segment each time, it ranges from 1h56min to 2h37min. When the person is sleeping in segments (method2 & method3), it possibly causes their daily performance to change negatively, since the person feel fatigue through-out the day. As the experiment progresses onto its 2nd and 3rd week, the person is not able to wake up to the alarm at all in the middle of the night and slept through the whole night. This could be a result of sleep deprivation from waking up in the middle of the night too much. Based on the results, the hypothesis is not correct, throughout the experiment, the importance for light-sleep time is ignored, but when referring back to the sleep-cycle, light-sleep is what humans spend more than half of their sleep in. However, the incident could also be a result of improper judgement. Before the start of the experiment, the subject sleeps in the schedule of 8 hours per night for close to12 years of their life, this action could cause their biological clock to be framed and hard to be adjusted in a matter of days.

Application

The experiment benefits the general public by proving that a lot of sleep is needed for a human to get well-rested. It emphasizes the importance of sleep, especially for a student's progress in school. This experiment hopefully helps scientists with studying the brain activity and cell reproduction of humans during sleep time. In the bigger picture, sleep is one of the most important aspects of a human's life, it is important to do it right for the benefit of the human body.

References

- Stages of Sleep and Sleep Cycles. (2017, August 28). Retrieved from https://www.tuck.com/stages/
- The 5 Stages of Sleep. (2016, June 13). Retrieved from http://2breathe.com/the-5-stages-of-sleep
- 5 Stages of Sleep: Your Sleep Cycle Explained. (2017, February 8). Retrieved from https://bedjet.com/blogs/sleep-blog/5-stages-of-sleep

Students Who Listen to Slow Beat Music While Doing Math Homework Preform Better

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Abstract:

Music has taken over many student lives to the point many listen to it while doing homework. However, many do not know what is best type of music to listen to avoid making frequent mistakes and finishing it quick. An experiment tests which type of music is better for timing and accuracy. In the first test the subjects were to listen to a slow beat song, and complete a series of math questions. It is then followed by the second test that is the same as the first except they were to listen to a fast beat song. During each test, the song plays at the same moderate volume; a stopwatch is to start to record how long it takes to finish each test per subject, and their accuracy during the testing. The test concludes that while listening to slow beat music the subjects preform better in time and accuracy compared to the fast beat music.

Introduction:

Many students hate the very thought of homework and would prefer to do something more entertaining. To keep themselves engaged in their work students listen to songs while completing their homework. Many listens to slow beat music, such as classical, to fast beat music, such as EDM. An experiment conducts which type is best to listen to while doing homework.

Many people listen to music while doing homework. Not many know what type is the best to listen for avoiding mistakes and completing work quickly. Research has shown that music can make repetitive work enjoyable, improve efficiency, and sometimes improve mood (Ciotti, 2015). This experiment conducts what students should listen to while doing homework. It tests the subjects on a slow beat song and fast beat.

Generally, when people listen to music it is to block out sounds around them and to keep them relaxed (Popomaronis, 2016). The brain has two attention systems, unconscious and conscious; the unconscious attention span relies on the 5 senses which makes it work faster and more distracting (Burnett, 2016) to hear unfamiliar noises. Music can also increase or decrease heart rate depending on the music that is being heard (Crisanti, 2015). By these facts alone, it can be concluded that music helps block out noise and improves work ethics and fast beat music improve the time and accuracy it takes to finish homework.

If music helps one stay more focused and can alter ones' heartbeat, then different types of music can have an affect on how quick a person is able to complete a task correctly because it can slow down the heartbeat, make one tired and the brain less active, or speed it up, improve brain activity, and be energizing.

Method:

Before the experiment starts the subject must fill out a form. The form is split with before the experiment questions and after the experiment questions. Each subject will be given two tests. In the first test the subject must listen to a slow beat and complete a series of math questions, 100 to be exact. During the time it takes them to complete the questions, they are timed.

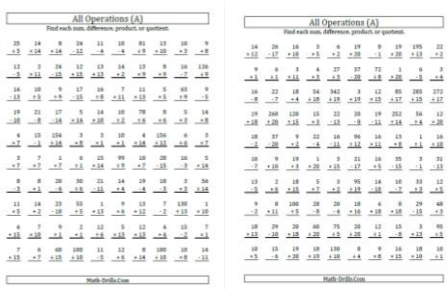
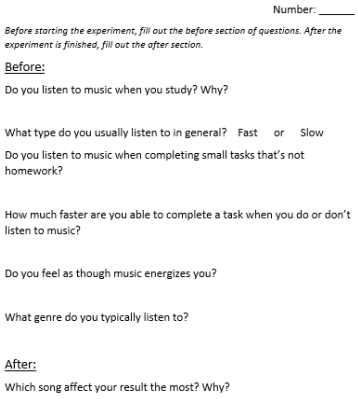


Figure 2 A) and B) A) [left] is the first test the subjects take and B) [right] is the second one

After the first test is complete, the subjects must take the second test. The second is the same as the first, except they are to listen to a fast beat song instead. After the subject is done completing each test, stop the stopwatch and check the answers to the questions; the examiner then records the time and accuracy. The song that is chosen for the slow beat song is Hello and the one for the fast beat song is Believer; all very popular.



Number: _____

Before starting the experiment, fill out the before section of questions. After the experiment is finished, fill out the after section.

Before:

Do you listen to music when you study? Why?

What type do you usually listen to in general? Fast or Slow

Do you listen to music when completing small tasks that's not homework?

How much faster are you able to complete a task when you do or don't listen to music?

Do you feel as though music energizes you?

What genre do you typically listen to?

After:

Which song affect your result the most? Why?

Figure 1 The questions the subjects are to answer before and after experiment

The controlled variables are the tests and the songs the subjects listen to. Every two tests need a new subject, making it the independent variable, and with every new subject the time and accuracy changes, making that the dependent variable.

Result:

In the questions the subjects answered prior to the experiment only a 1/3 listen to music while doing homework, and the majority prefer listening to pop music compared to any other genre.

Table 1 The time and accuracy of the subjects while listening to the slow beat song (*Hello* Adele) in the first test

Performance of the Subjects in the Second Test		
Participate (#)	Time (minutes)	Correct Answers (/100)
1	7:43	95
2	4:33	98
3	6:00	99
4	7:58	93
5	4:31	94
6	4:20	94

Table 2 The time and accuracy of the subjects while listening to the fast beat song (*Believer* Imagine Dragons) in the second test

Performance of the Subjects in the Second Test		
Participate (#)	Time (minutes)	Correct Answers (/100)
1	10:53	93
2	10:56	89
3	10:17	93
4	21:20	90
5	10:31	92
6	7:41	96

After the subjects did the second test they all agree that the second song had more of an impact on their results compared to the first because it was more distracting.

Conclusion:

The hypothesis is proven wrong by the given experiment. It was can fast beat music help complete tasks faster and more correctly compared to slow beat music. The initial purpose of this experiment was to find the best type of music to listen to when doing homework or completing tasks. After preforming the experiment, the second song affects the subjects' results the most.

The data concludes that out of the one hundred questions there are, no subject got perfect. The first song, *Hello*, has many long pauses between the lyrics. It took the shortest time to complete and it also got the most number of correct answers. The

name of the second song, *Believer*, has a fast-paced beat and is more rhythmic compared to *Hello*. The second test requires more attention because the scrap sheet of paper was used more, and the test subjects murmured to themselves while conducting it; this could be why the second song took the longest to complete, and got the least number of correct answers. All the subjects agree the second song was the most distracting as well.

Some errors that were made to the experiment have an influence on the results. The subjects could also have been tested in other subjects to get more accurate results. Different subjects require different amount of attention, and concentration. The subject that the test subjects are experimented on is math because it is the easiest to be tested on, but if the subjects have had done a test in Science or English the results would differ. The subjects should also listen to more than one song when testing for the slow beat and fast beat test. With at least three songs it gives the subjects an average of what their timing and accuracy is of every test. The location of the room the subjects were tested in was not the ideal testing location, which could have influence on the test subjects' concentration too. Only a 1/3 of the people tested on listened to music while they worked on homework; it would have been better to get a variety of music listeners and non-music listeners. With these errors the test subjects' results are not definite because their focus was only on one subject, there weren't any patterns for each of the subjects for each type of music they listened to, and their lack of focus because of the location of the experiment.

Application:

Although the test results are not accurate, it states that the best type of music to listen to when doing homework is a slow beat music. With this information new and improved methods of studying can be created as well as finding ways for students with learning differences, anxiety, ADHD find ways to help them stay calm and focused. Further research can develop how different lobes of the brain react to music, and get a better understanding of how human behaviour reacts to it too.

References:

Burnett D. (2016). *Does music really help you concentrate*? Retrieved on 21 September 2017 from

https://www.theguardian.com/education/2016/aug/20/does-music-really-help-you-concentrate

Ciotti, G. (2015). *How Music Affects Your Productivity*. Retrieved on 21 September 2017 from

https://www.helpscout.net/blog/music-productivity/

Crisanti, A.J. (2015). *Does Listening to Music Affect Ones Heart Rate*? Retrieved on 21 September 2017 from

http://sites.psu.edu/siowfa15/2015/09/18/does-listening-to-music-affect-ones-heart-rate/

Popomaronis, T. (2016). *What Listening to Music at Work Does to Your Brain (It's Pretty Amazing)*. Retrieved on 21 September 2017 from

https://www.inc.com/tom-popomaronis/do-you-listen-to-music-while-working-heres-what-it-does-to-your-brain-and-its-pr.html

Schäfer, Thomas. (2016, March 17). *The Goals and Effects of Music Listening and Their Relationship to the Strength of Music Preference*. Retrieved on 19 October 2017 from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0151634

Team, Revelle. (2016, Aug 12). *How Different Genres of Music Affect Your Mood*. Retrieved on 18 October 2017 from https://www.connollymusic.com/stringovation/different-genres-of-music-affect-your-mood

How does Drawing help express thoughts and feelings

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Abstract

The question being investigated is how drawing helps express thoughts and feelings. It is important to know how drawing helps express thoughts and feelings to better understand the drawer and their pictures, as well as to be able to express one's own thoughts and release their feelings onto a sheet of paper. To find the answer to this question an experiment was conducted. Three to four people of different age groups were asked to express an emotion by drawing, within a time limit. After the experiment it was shown that the drawings for the same emotions were similar. Seeing that the drawings were similar to one another for the same emotion being expressed shows that if someone wanted to express a feeling in their drawing, it is easier for them and for others to understand them rather than using words.

Introduction

One of the easiest and satisfying ways to expressing thoughts and feelings is by drawing. Hiding one's feelings can lead to anxiety, depression and even physical unhealthiness. It can also cause problems with one's personal and professional relationships. By drawing, expressing those thoughts and feelings is done easily. According to Cathy Machioldi, an expert in the field of art therapy, when it comes to releasing emotions, visual art/drawing has the advantage of being nonverbal, enabling one to express emotions that may be difficult to put into words.

It is important to know how drawing help's express one's thoughts and feelings. There are people who can't find a way or don't know how to use the proper words to express some of their inner feelings. It is hard to explain what we are feeling and going through sometimes. Expressing these feelings can be a very important thing for repressing these emotions (1). Adults have learned over the course of time that using art or drawing to express some of the most inner most feelings that they have trouble expressing to the world can be a very therapeutic experience (1).

If one is feeling happy, then the drawing will seem bold, cheerful, decorative and filled with bright warm colors because, when one is feeling happy they would draw a picture that expresses their feeling and shows that they are in a bright mood, but, if one is sad, then their drawing will be dark, show unhappy things (tears, sad person, or anything depressing) and unpleasant to look at, because one's drawing will express one's feelings. (2)

Methods

For the experiment subjects were asked to go to a quiet calm place before starting. To begin the subjects must choose an emotion to express in the drawing. Different subjects of different ages were asked to do this experiment. Some emotions the subjects can choose to do are happiness, sadness, anger/madness or fear/anxiety. After selecting the emotion to draw they have 15 minutes to draw. At the end, after finishing the drawing, subjects were asked to think and reflect on the drawing. They were also asked these types of questions, which colors did you use? What type of lines and patterns did you use? Were there any people, pets or landscapes in your drawing? Does your drawing relate to yourself? Does your drawing express the emotion you selected?

The Independent variable (what changed in the experiment) was the emotion drawn. Each few subjects were asked to express a different emotion. The subjects were asked to express a different emotion. The dependent variable (what was observed and measured) was the types of lines, colours, patterns, and objects used. After the subjects were done drawing they were asked to think about how their drawing looks and what they used to express the emotion. The controlled variable (what was kept the same) were the materials used (pencils, color pencils and paper) and the time of day to draw (anytime but before going to bed).

Results

Figure1

For Happiness (refer to figure 1) all the drawings

were bright cheerful

colors. In the drawings there was a smile emoji, hearts, peace sign, rainbows, words that bring happiness, and other things people find that makes them happy.

Figure 2

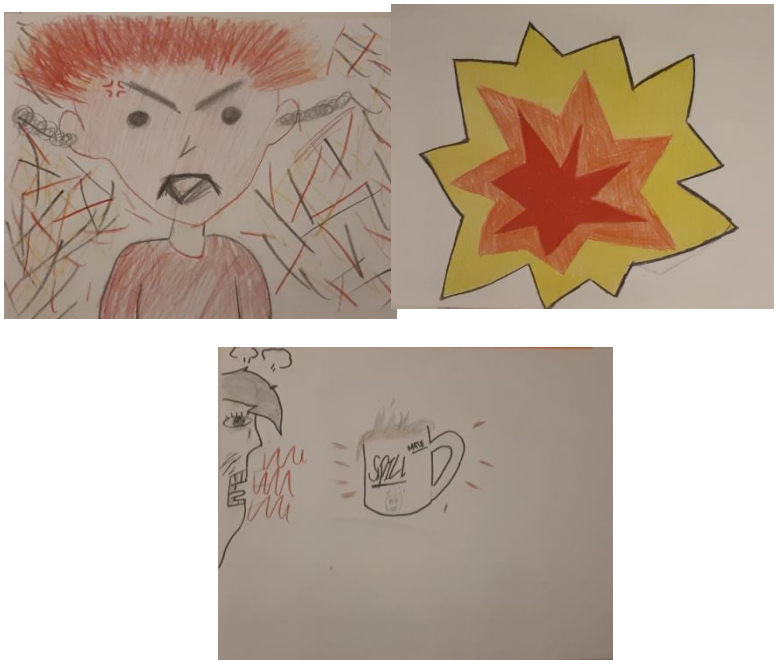

Figure 3

For sadness (refer to figure 2), all the drawings used dark colors, mostly black and blue. These colors represent sadness. In one of the drawings there is a grave, which represents sadness. In the second drawings there is a girl sitting on the swing alone in the rain which represents sadness. In the last drawing there is a girl's sad face, in the bottom of her hair it is colorful to represent that all the happiness in her is disappearing

For Anger/madness (refer to figure 3), all the drawings are mostly red. Red is the color that represents anger. The colors black and yellow are also present. In two of the drawings, there is an angry face and they used messy, hard zig-zag and straight lines as well as steam coming from the ears, frown marks and pointy hair in one picture. In the last drawing there is a shape with pointy zig-zag lines.

Figure 4

For Fear (refer to figure 4), the most used color is black. Black is a color of death and fear. In all of the drawings there is something scary and a scary situation that would cause the person to be in fear. In one of the drawings there are hard straight messy lines to make the drawing look intense and scary.

Discussion/Conclusion

In the hypothesis, it stated that if one is feeling happy, their drawing will be bold, cheerful, and filled with bright colors and if one is feeling sad, their drawing will be dark and show unhappy things. The hypothesis was correct. Drawing does help express thoughts and feelings. Some people can't find a way or don't know how to use the proper words to express some of their feelings. It is sometimes hard to explain what we are feeling and going through, but by drawing you are able to express that and others will be able to understand and know what you are feeling since drawings are not really hard to understand. Therefore, drawing helps express those feelings and thoughts.

In the data collected, all the 3-4 drawings for each emotion were all similar. They used the same colors and have similar lines and drawings. For happiness, bright and cheerful colors were used and happy drawings. For sadness dark colors were used and sad drawings. For fear, dark colors were used and there were scary drawings. Finally for anger the color red was used most and there were pointy and zigzag lines. This suggests that when expressing the same emotion through drawing there will be similarities and patterns. These results have also been reported by other investigators.

While conducting the experiment a few errors and problems arised. In the procedures it did not state when the subjects should draw the drawing. The time of day one decides to draw does effect the output of the drawing. Another problem was that a few subjects didn't color the drawings because it was not stated in the procedures. The drawings need to have color to be able to see how there are colors that express emotions.

Application

This information can be applied to other fields of study. This study can help kids with autism to make it easier to communicate to others by drawing. The general public or scientific community can use this information to help those who can't express themselves by words. This information can help those people and give them another alternative to explain themselves.

References

1. Artsz.org. (n.d). Retrieved October 05, 2017, from http://www.artsz.org/childrens-art-feelings/
2. Popescu, R. (2014,March 24). How To Help Your Child Express Her Emotions Through Drawing. Retreieved October 05, 2017, from http://beingraluca.com/help-child-express-release-emotions-drawings/