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SNC2DN

Vol. 4 Issue 2

June 2019

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The Effects of Gaming on Sleep and Daily Routines

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Abstract

The purpose of this study was to see how gaming and screen time affects sleep and how it can lead to sleep deprivation and lack of time management. Multiple participated in the experiment, they gamed at a certain time each day and recorded how long was gamed, hours of homework done, stress level, and how long was slept. Each of these surveys were written the morning after. When the experiment concluded, the results and patterns were different than what was expected, which was when the participants game, they should've seen negative affect in their sleep cycle.

I. INTRODUCTION

Answering the problem was important because it could determine how the time that they gamed affected their sleep. This research could help figure out how to prevent health problems such as fatigue, migraines, that are caused by lack of sleep as well as other things.

How does gaming at different at different times of the day affect a person?

If the health of a person, physically and mentally was related to the number of hours of sleep a person gets every day, then people who got more hours of sleep would have better health and grades. This is because getting enough sleep can help physical health, mental health, safety and quality of life. Sleep helps support growth and development in children and teens, studies have shown that enough sleep improves learning.

(Mental Health America, 2014).

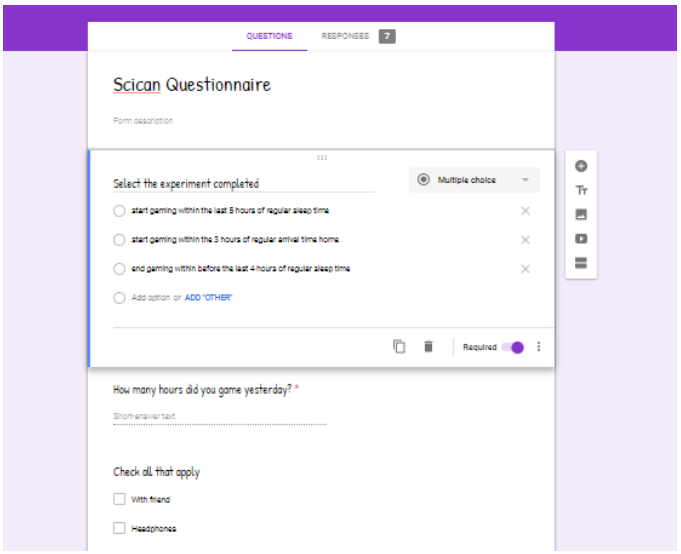
II. METHODS

In the morning, the amount of sleep and the amount of homework from the night before was measured, recorded (graph 1) and the questionnaire (Survey 1) was completed. The individual would go through his/her day normally as they usually would. When the subject had gotten home, they would have to follow the experiment they were attempting at that time. If the subject chose "start gaming within the last 5 hours of regular sleep time", they would have to record their sleep time of a usual day, subtract 5 and start gaming from then. If the subject chose "start gaming within the 3 hours of regular arrival time home", they would have to get home from school and start gaming within three hours from then. If the subject chose "end gaming within before the last 4 hours of regular sleep time", they would have to record their sleep time of a usual day, subtract 4 and end gaming from then.

Survey

1. How many hours did you game yesterday?
2. How much did you sleep yesterday?
3. How long was homework done for yesterday?
4. How stressed are you? Rate that stress.
5. Do u think gaming affected your sleep? Why?

Questionnaire: Given to participant to finish when awake the next day.



In this experiment, the independent variable was the time range of gaming since this was constantly changed throughout the experiment and the experiment didn't depend on any other variables. The dependent variables were sleep, and routine affected. The controlled variables were the following: same chair, same volume level for headphones, same bed to sleep on, same environment, and same routine. These were controlled variables since these were all needed to be able to compare all the results at the end of the experiment. If different weight scales were used, the weight change won't be as accurate.

III. RESULTS

# of Hours Gamed	# of Hours Slept the night before	# of Hours spent on homework	Rate of stress
2.5 hours	6.5	2	5
1.5 hours	7	3	3
2 hours	8	1.5	2

Table 1: Participant's experiment 1 results

# of Hours Gamed	# of Hours Slept the night before	# of Hours spent on homework	Rate of stress
2 hours	7	2.5	3
2 hours	8	3	4
1 hours	8	3	3

Table 2: Participant's experiment 2 results

# of Hours Gamed	# of Hours Slept the night before	# of Hours spent on homework	Rate of stress
1.5 hours	6	1	2

Table 3: Participant's experiment 3 results

Figure 1: Graph shows results from two questions asked gain with each participant.

IV. DISCUSSION AND CONCLUSION

The hypothesis was mainly wrong, since people actually ended up still having the time to do homework and sleep at around their usual sleep time. It seemed as though people who gamed at different timings had planned their day out to prevent lacking. Because I only asked them to game for 1.5 hours, it affected my results. Melatonin is used to regulate sleep cycles and is produced in the pineal gland in the brain. Melatonin didn't get affected because it is normal for children to play this much so it's supposedly okay for children to be gaming for 1.5 hrs (Sleep Junkies, 2019). On the health side, this caused a lot of migraines, fatigue and depression, but wasn't recorded. When the participants were asked how they think gaming affected their sleep, they only answered with words like: "it helped me", and "it didn't come it the way of work". This could mean that gaming doesn't have that much of an impact on gaming.

An outlier in the data was in 1 participant who slept for 8 hours and was still affected by gaming that late. They blamed it on their 'time taken falling asleep'. This could have happened because the individual was cutting time out of his day sleeping so routine was affected when gaming came into it. There may have been errors such as using beds or chairs, going to sleep too early or forgetting to do questionnaire in time, etc. Each individual has a different body, different routine, and different amounts of sleep needed.

V. APPLICATION

This information can be applied to us in our daily lives and maybe even parents for the future for their children. It could also help people to keep routines sharp and beneficial. My results were a little different than what I thought they would be like (errors might have affected)

VI. REFERENCES

Get Enough Sleep. (2014, February 04). Retrieved June 2, 2019 from http://www.mentalhealthamerica.net/get-enough-sleep

Sleep Junkies, (2019). Retrieved June 1, 2019 from https://sleepjunkies.com/video-games-habits-sleep/

TV, Video Games at Night May Cause Sleep Problems in Kids, (June 27, 2011). Retrieved June 10, 2019 from http://healthland.time.com/2011/06/27/tv-video-games-at-night-may-cause-sleep-problems-in-kids/

Effects of a Distraction on the reactionary response of a Visual Stimulus

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Abstract

This project teaches students of the dangers of multitasking on the road and will let participants complete different activities in front of a reactionary stimulus and the results will be recorded. The results have shown an average of a 27 percent increase of the subject's reaction time.

I. INTORDUCTION

With a growing epidemic of driving and texting incidents, it's clear that texting and driving is harmful to not only you but the people around you. Fines of texting and driving have been spiking up to $1000 (CBC, 2018) to deter drivers from texting and driving. This project explores how distractions effect the reaction time of subjects. If the reaction times of reading and typing are compared, texting driving will be around 500ms more compared to a reaction test where the subject's full undivided attention was given.

II. METHODS

The subject must thoroughly understand the procedure before they are tested. The reaction timer should be set up along with the phrases the subject is to type on their phone. The subject is to click the reaction timer whenever ready, and to click again when the visual stimulus is perceived. The result is recorded in a table. This trial is to be repeated three times. Have the subject complete the reaction time experiment again, coming from a phrase bank shown on screen. The reaction time of the subject should be recorded again. This trial should be repeated three times.

All subjects should be tested during the same time of day, this is to factor out alertness as much as possible from different reaction times. Age must remain the same as younger children have better dexterity and that may pose an unfair advantage to older ages. The size of the phone may make typing harder if letters of the touchscreen keyboard are more cramped, Using the same size phone is necessary. The button must be the same to stop mis-clicking or posing an unfair advantage to other subjects.

III. RESULTS

Figure 1.1

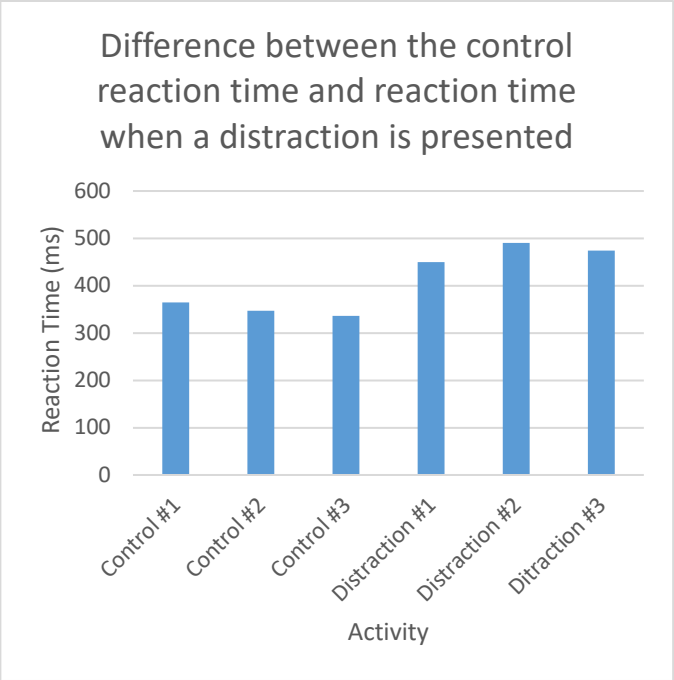
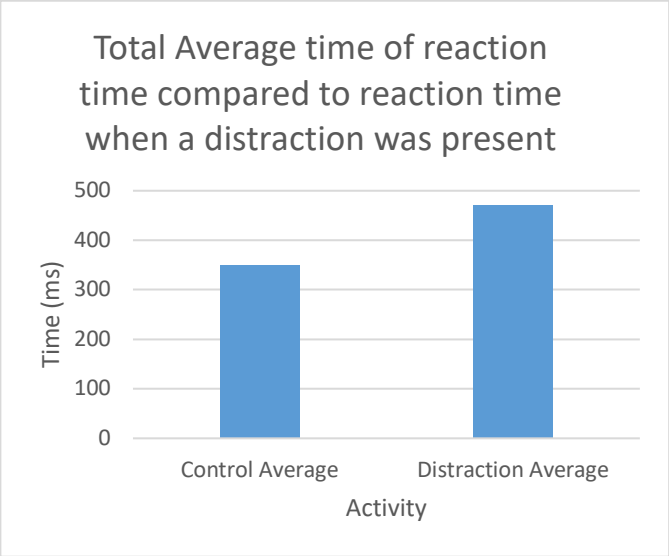


Table 1.2



As seen from Chart 1.2 a 26% increase can be observed. Distraction averages have raised by 122ms compared to the control. In figure 1.1, a 150ms increase can be observed comparing the average of the third control with the average of the first attempt of the distraction. It increases another 43ms from distraction #1 - #2, and then a 19ms drop comparing distraction average #2 to the distraction #3. The controls in chart 1.1 also steadily decrease by 15-25ms each time.

IV. DISCUSSION AND CONCLUSION

"If the reaction times of reading and typing are compared, texting driving will be around 500ms more compared to a reaction test where the subject's full undivided attention was given."

Although this theory was correct, the increase between the control and distraction was not anywhere near an extra 500ms (which would be more than a 100% increase). Referring to chart 1.2 the increase between the control and the distraction averaged only by 26% (127ms).

In chart 1.1 the controls steadily decrease by 15-25ms. This observation can be explained as the subjects getting used to the reaction test. The same pattern happens when the distraction test is done 3 times, which can also be explained as the subjects getting uses to the reaction test. A surprising pattern shown in chart 1.1 was the ~25ms jump from the average control times between distraction one, and two. This might be from the subject concentrating at

typing the sentence more than concentrating on reacting to the visual stimulus.

V. Application

This study mainly focuses on the study of human body movement when a stimulus is presented. Many real-life applications can stem from this study, as the study revolves on simulating driving and measuring the effects of texting and driving. More research can be done, as the effects of smoking, alertness and other factors can be explored.

VI. References

Rhett Allain (June 14, 2017) *Physics proves no one can safely text and drive* Retrieved from https://www.wired.com/story/physics-proves-no-one-can-safely-text-and-drive/

CBC (Dec 31, 2018) Tougher Penalties for repeat distracted drivers Retrieved from https://www.cbc.ca/news/canada/ottawa/distracted-driving-texting-ontario-penalties-1.4939223

The Best Formation to Use for a Soccer Team Full of Players of Average Athletic Abilities

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Abstract

Soccer managers are paid millions of dollars every year to set up their teams tactically in the best way possible to win games, and this all starts with the formation they choose to put their team into, based on the special abilities of their players. This purpose of this project was to find the most effective formation for a group of players with only average abilities, and no one special. To help determine this, five test subjects of a diverse range of athletic abilities were tested on their speed and endurance. This was done with two experiments, one being a sprint to measure the speed, and the other having test subjects run for as long as they could until they were tired, measuring their endurance and stamina. The results of these experiments, along with calculations, helped to prove that the best formation is 4-3-3. This means that whoever is given the task of managing a soccer team should put their team in a 4-3-3 formation, unless they have special reasons to do otherwise.

I. INTRODUCTION

Soccer managers are some of the highest paid people in the world, pretty much anyone who manages a big team is a millionaire. In fact, according to a Forbes article from back in 2014, the average salary of the top ten highest paid soccer managers for that year was $11.3 million (Smith, 2014). When someone is making that kind of money, people likely want to know if they deserve it. Tighe (2012) says in his article where he studies different soccer formations that it's important to gauge how modern managers think about the game, in order to analyze their tactical formations. Therefore, to test how well these managers think, the question is: what is the most effective soccer formation? My hypothesis is that if all formations are compared, then the best formation should be one with 4 at the back (4 defenders, 6 players elsewhere), because most professional soccer managers use 4 at the back with their teams.

II. METHODS

For the first experiment, test subjects were given however much time they wanted to prepare their bodies in whatever manner they chose, whatever they thought would get them into their peak condition for a short-distance sprint. The test subject would then run the set distance as fast as they can, while being timed by someone supervising the experiment. The supervisor who timed the experiment would calculate the speed by dividing the distance run by the test subject by the amount of time they took to sprint that distance. This process was repeated each time with each test subject. For the second experiment, test subjects also had to self-prepare themselves, this time though to run for as long as they could until they got tired and had to stop. The subjects then did their running, and the supervisor of the experiment measured the distance they ran and

the amount of time they spent running. This process was also repeated each time with each test subject.

In experiment 1, the independent variable was the person running, the dependent variable was their speed, and the control variables were the condition of the runner, to make sure everyone could get their best result, and the distance needed to be sprinted, as different distances may change the speed of the runner. The independent variable and control variables were the same for experiment 2, but the dependent variables were the distance that they ran and the amount of time they spent running.

III. RESULTS

After all the test subjects completed experiment 1, the average time it took all of them to run the set distance of 29.4 m was calculated, and ended up being 5.77 seconds. From there, the average speed was calculated, and was 18.3 km/h.

Table 1: Each test subject's individual numbers for experiment 1, along with the final average

Person Running	Time	Distance	Speed
Subject 1	5.7 seconds	29.4 m	18.5 km/h
Subject 2	6.21 seconds	29.4 m	17 km/h
Subject 3	5.41 seconds	29.4 m	19.5 km/h
Subject 4	5.32 seconds	29.4 m	19.9 km/h
Subject 5	6.23 seconds	29.4 m	16.75 km/h
Average	5.77 seconds	29.4 m	18.3 km/h

The speeds ranged from 16.75 km/h to 19.9 km/h, and in the end that mean of 18.3 km/h is a pretty decent speed.

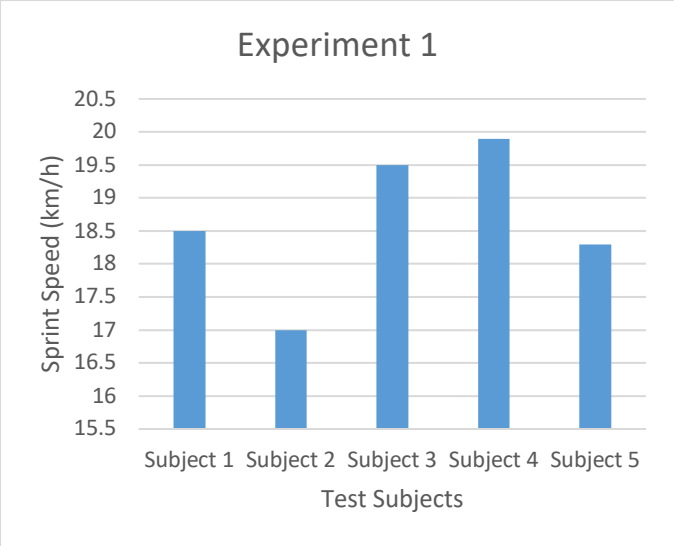

Figure 1: A visual comparison of everyone's speeds

Experiment 2 concluded that the average distance test subjects could run until they got tired was 2.1 km. The average amount of time they could run for until getting tired was 1 minute and 54 seconds.

Table 2: Each test subject's individual numbers for experiment 1, along with the final average

Person Running	Distance Run	Amount of Time Run
Subject 1	1.8 km	1 minute 27 seconds
Subject 2	2.1 km	2 minutes

Subject 3	2.4 km	2 minutes 15 seconds
Subject 4	1.6 km	1 minute 16 seconds
Subject 5	2.6 km	2 minutes 32 seconds
Average	2.1 km	1 minute 54 seconds

The distances ranged from 1.6 km to 2.6 km, and the amounts of time ranged from 1 minute and 27 seconds to 2 minutes and 32 seconds.

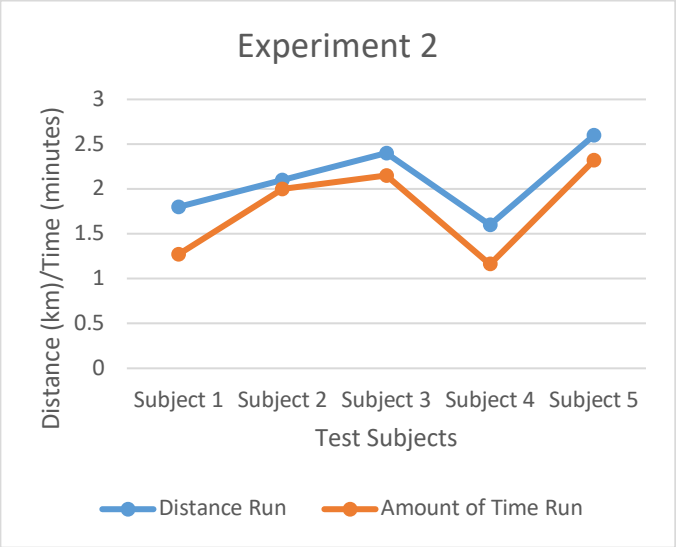

Figure 2: A visual representation of everyone's distances run (blue), and amounts of time run (orange)

IV. DISCUSSION AND CONCLUSION

90m

Figure 3: A diagram showing all the different regions

of a soccer field where players will be positioned

To produce a conclusion from these results, a long explanation is needed about how these numbers will work in formations. So, the length of a soccer game is 90 minutes, the average speed that people could run in the experiments was 18.33 km/h, the average amount of time that people could spend running until they got tired was 1 minute and 54 seconds, the average distance that people could run while maintaining their speed before having to stop was 2.1 km. This is what needs to be remembered. Now, the main difference between different soccer formations is that some formations focus on packing the wings with more players, while others focus on packing more players centrally, mostly in midfield. With the area of each section being 1.2 km, and the distance

that people could run before getting tired being 2.1 km, it can be said that a player could run in two sections for roughly two minutes. This means that if there is a midfielder playing in left midfield and another playing in right midfield, they can easily roam between both the central midfield and the wing. Because of this, the 4-3-3 formation (4 defenders, 3 midfielders, 3 attackers) emerges as a favourite, as the left midfielder and right midfielder are each capable of playing in both central midfield and the wings, and it provides balance as there will be two central defenders who are rooted in central defence, one central midfielder who is rooted in central midfield, one central attacker who is rooted in central attack and on each wing there are two wingers (left/right defender + left/right attacker) who will be roaming the wings, as well as sometimes move in centrally, either on defence to stop someone, or when attacking to move into the penalty area and either take a shot or pass the ball to the central attacker. The speed of the players also further supports the 4-3-3 formation, because players who play on the wings need to be fast enough to be able to sprint from the defensive side of the field to the offensive side to create a goalscoring opportunity, and then if the opposition defence stops the attack and goes on a counterattack, the wingers need to be able to sprint back and go on defence. With a speed of 18 km/h, the players are able to run the length of the field back and forth in 48 seconds, which is more than fast enough to be able to stop the opposition before they go all the way to the goal. If the players were not fast enough, then a formation with less wingers and more midfielders might've been better, like a 4-4-2 or a 4-5-1, but since the players are fast enough, 4-3-3 prevails. In conclusion, 4-3-3 is the best formation for people of average athletic abilities. This means that my hypothesis that a formation with 4 defenders would end up prevailing was correct, as the 4-3-3 formation ended up being the best. Some soccer teams use formations with 3 defenders or 5 defenders, but I found those formations to be unbalanced, and they didn't work too well with the data that I have. I found the formations with 4 defenders to provide the most balance and the left and right defenders also serve as wingers. From there, it was a question between whether 4-3-3, 4-4-2, 4-5-1, 4-2-4, or 4-1-5 would be the best formation, 4-3-3 ended up prevailing.

V. APPLICATION

This information could be important for recently hired soccer managers who are managing a new team. Essentially, if they're in a situation where they have to quickly set up their team for an upcoming game, their best bet is to put their team in a 4-3-3. Of course, they might end up finding a different formation to be more effective afterwards based on the skillset of their team, but in the beginning, 4-3-3 is the best option. 4-3-3 is possibly already the most used formation in soccer, with many of the top division teams playing most of their games in that system, including both teams who played in the European Champions League final (Liverpool vs Tottenham), so the application of this is already being seen. This information could potentially come in handy in sports that function similarly to soccer,

such as basketball or hockey, sports which require players to get into certain positions for optimal ball movement. They could find their sport's version of the 4-3-3.

VI. REFERENCES

Behravan, I., Zahiri, S.H., Razavi, S.M., Trasarti, R. (2019). Finding Roles of Players in Football (Soccer) Using Automatic Particle Swarm Optimization-Clustering Algorithm. Retrieved March 27, 2019, from https://www.liebertpub.com/doi/10.1089/big.2018.0069

Coggin, S. (2019). A Guide to Soccer Formations. Retrieved March 13, 2019, from

https://www.thoughtco.com/guide-to-formations-3557662

Smith, C. (2014). Soccer's Highest-Paid Coaches. Retrieved March 13, 2019, from

https://www.forbes.com/sites/chrissmith/2014/05/07/soccers-highest-paid-coaches/#331e109a38fa

Strauss, A., Sparks, M., Pienaar, C. (2019). The Use of GPS Analysis to Quantify the Internal and External Match Demands of Semi-Elite Level Female Soccer Players during a Tournament. Retrieved March 27, 2019, from

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6370966/

Tighe, S. (2012). 15 Tactical Formations and What They're Good for. Retrieved March 13, 2019, from

https://bleacherreport.com/articles/1375589-15-tactical-formations-and-what-theyre-good-for

Methods that Allow Students to Memorize Piano Pieces Efficiently

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Abstract

What is the most efficient method to memorize a piano piece? In this experiment, two different memorization techniques were tested on piano students with a minimum of level 6 Royal Conservatory of Music experience. Each method was tested with a level 1 Royal Conservatory piece and each student was giving a maximum of two minutes of learning the piece before starting the timer. After testing the first method of memorizing in measures forwards then backwards on five students, there was an average time of 7 minutes and 51 seconds. While with the second method of practicing at a slower tempo, the same five students had an average time of 9 minutes and 16 seconds. Method one had an average that was 1 minute and 25 seconds faster than the average time of method two. Overall, this proved that method one was more efficient in memorizing a piano piece. When students followed method one they were able to more effectively and efficiently memorize the given piano piece.

I. INTRODUCTION

It is important to find an efficient way of memorization because memory exercises help students focus and have many other long-lasting brain benefits (Wormeli, 2018). Not only is memory important in music, but it is also the foundation for higher thinking and problem solving (Smith, 2012). It keeps the brain active and constantly helps students by challenging them, helping learn new concepts, and igniting creativity (In Praise of Memorization, n.d.). Memorization provides exercises to the brain, developing mental industriousness and the ability to focus and pay attention intensely (Klemm, 2013). Additionally, experts say that there is growing evidence that musicians have structurally, and functionally stronger brains compared to non-musicians, and memorization is one of the key aspects to playing the piano (Alleyne, 2014).

It is also important to prioritize time to determine what needs more time and how to minimize time spent on less important tasks (Dinkel, 2011). So, what is the most efficient method to memorizing a piano piece?

If a player follows method one to memorize a piano piece then the player will be able to more efficiently memorize the piano piece than using method two, because method one is more popular and recommended among teachers, other students and adjudicators.

II. METHODS

The experiment was conducted on 5 different students with minimum level 6 Royal Conservatory of Music experience. On day one, method one was tested. Each student was given the instructions and procedure to method one and the level 1 piano piece to memorize. For each method, a different piano

piece was used but both pieces were from the same level and same length. Each student had a maximum of 2 minutes to

learn the piece. When the student felt comfortable with the notes and felt ready to start memorizing or the 2 minutes were up, the timer was started and the student tried to memorize the piano piece as quickly as possible with following the method. The timer was stopped once the player was able to play through the entire piece with no major mistakes and a maximum of 3 minor stumbles/hesitations. The steps were repeated with all 5 students. On day two, the same procedure was repeated, instead using the method two instructions.

When students followed method one instructions, students were informed to memorize the piece by one or two measure chunks. The students memorized the piece forwards (starting from the start of the piece), then backwards (starting from the end of the piece, but not literally going "backwards", instead only starting from the last measure. Ex. Last measure, last two measures, etc.)

For method two, students were informed to start playing the given piano piece at the regular, indicated tempo (speed) by using a metronome. After playing through and trying to memorize, students lowered the tempo by 4 beats per minute (bpm). The students continued to lower the metronome until the piece was memorized.

The controlled variables in this experiment were the piano players' experience, since each student had to have a minimum of level 6 Royal Conservatory experience. Since different pianos have different characteristics and the surroundings can heavenly influence the student's performance, the same setting was used for each method and each player (same piano keyboard and same surroundings).

III. RESULTS

After experimenting both methods in two days, the average time for both methods was calculated. Method one had an average time of 7 minutes and 51 seconds, while method two had an average time of 9 minutes and 16 seconds. Method one proved to be 1 minute and 25 seconds quicker than method 2.

Table 1: This table shows the time each player took to finish memorize the first piano piece using method one. At the bottom of the table there is the average time of all five players for this method.

Method 1: (forwards and backwards playing)

	Time	Additional Info
Player 1	5 min. 48 sec.	• Found the backwards playing really help • "Was very easy" • Not stressed
Player 2	7 min. 21 sec.	• Measure by measure was too tedious • Relaxed- looking
Player 3	8 min. 36 sec.	• "one of the quickest times I've memorized something"
Player 4	10 min. 09 sec	• Hard to memorize the accidentals • Shaky leg movement
Player 5	6 min. 42 sec.	• "very easy" • Red cheeks

Average time: 7 min. 51 sec.

Table 2: This table shows the time the five players took to memorize the second piece with method two. At the bottom, the average time used on method two is shown.

Method 2: (slow tempo)

	Time	Additional Info
Player 1	7 min. 57 sec.	• "Slow tempo helped recall the notes and made me think more"
Player 2	6 min. 43 sec.	• "I got very frustrated and annoyed" • "too tedious"
Player 3	10 min. 22 sec.	• Relaxed and Calm looking • "kind of annoying"
Player 4	14 min. 44 sec.	• "Harder to memorize than the first one"
Player 5	7 min. 15 sec.	• "easy again"

Average time: 9 min. 16 sec.

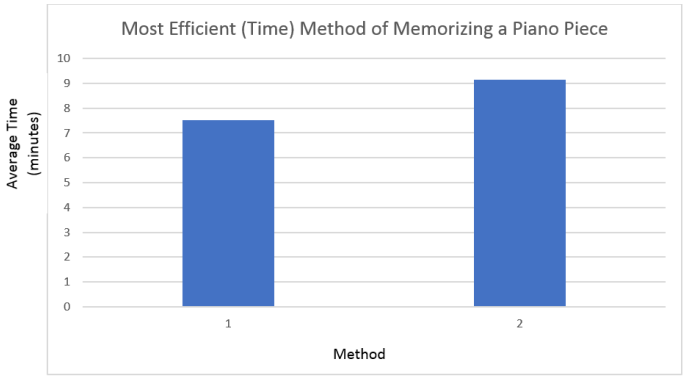

Figure 1: This figure demonstrates the average time for both methods of memorization tested for each player to memorize the piano piece, comparing the two methods.

IV. DISCUSSION & CONCLUSION

The hypothesis was correct. Although the average time difference between both methods was only 1 minute and 25 seconds, method one proved to be more efficient. However, for both methods, there were numerous statements from the players after completing the experiment, that both methods were very helpful and felt easier to memorize both pieces overall. Method one was the most recommended among teachers, students and other professionals in the music industry.

In the research and scientific background information found during this experiment, all research states that the best way of memorizing something is through recalling and making connections. When the brain is constantly working through memory exercises on a certain piece, the student will know the information and will have a less change of losing that piece of information (Wormeli, 2018). It is important to use different senses (visuals, finger feeling, etc.) in memorizing a music piece (Marvuglio, 2018). The effects of prioritizing and planning time are that many people feel more structured and organized. It helps to determine what needs more time and how to minimize time spent on less important tasks (Dinkel, 2011).

An area of error, could be the unique preference every student has. Since every student learns differently, different students may prefer different methods. Another error, could be the selection of piano pieces used for each method. A player might prefer learning one piece over the other due to the key signature, the melody or the rhythm used in each piece. Both pieces were different which could have caused one piece to be easier to learn than the other.

V. APPLICATION

More methods could be tested to further the research found in this experiment. Additionally, the "method"

of not using a method could have been tested to compare the results and how effective the use of memorization techniques really are. Memorizing piano pieces or musical pieces are also very similar to memorizing information for school or exams. Researchers or teachers in education can benefit this field by teaching their students on how to more effectively memorize information. By using the most effective method proven in this experiment, students in school that are studying for a test can use the method to more efficiently and effectively memorize and recall the information and study notes.

VI. REFERENCES

Alleyne, R. (2009, October 27). Playing a musical instrument makes you brainier. Retrieved March 15, 2019, from https://www.telegraph.co.uk/news/science/science-news/6447588/Playing-a-musical-instrument-makes-you-brainier.html

Dinkel, A. M. (2011, April 29). Time Management: Organization and Prioritizing. Retrieved June 13, 2019, from https://www.laboratoryequipment.com/article/2011/04/time-management-organization-and-prioritizing

In Praise of Memorization: 10 Proven Brain Benefits. (n.d.). Retrieved March 14, 2019, from https://www.bestcollegesonline.com/blog/in-praise-of-memorization-10-proven-brain-benefits/

Klemm, W. (2013, May 25). Memorization is Not a Dirty Word. Retrieved March 15, 2019, from https://www.psychologytoday.com/us/blog/memory-medic/201305/memorization-is-not-dirty-word-2

Marvuglio, M. (2018). Three Degrees of Memory Systems for Music Memorization. Retrieved on March 27, 2019 from https://www.berklee.edu/bt/191/lesson.html

Smith, M. (2012, November 21). Why memorising facts can be a keystone to learning. Retrieved March 14, 2019, from https://www.theguardian.com/teacher-network/teacher-blog/2012/nov/21/memorising-facts-keystone-learning-psychology

Wormeli, R. (2018, February). Memorization Still Matters. Retrieved from https://www.amle.org/BrowsebyTopic/WhatsNew/WNDet/TabId/270/ArtMID/888/ArticleID/889/Memorization-Still-Matters.aspx

Characteristics of the Placebo Effect as Seen through Energy Levels of Test Subjects Given Placebos.

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Abstract

Since the 1811 placebos have been documented and widely recognized as having a potentially powerful effect on health and behavior, yet our understanding of the phenomenon is limited. This experiment aimed to explore how the placebo effect changed the energy levels of subjects. They were induced by placebos thinking they ate caffeinated chocolate. This helped explain the perceived benefit subjects felt when no such benefit could be attributed. Two types of chocolate were made, one with added caffeine and one without. 12 test subjects were divided into 3 groups, the 1st (control) group took caffeinated chocolate the entire 4 days, the second group ate caffeinated chocolate for the first two days and then were given placebos for the last 2 days, and the 3rd group was given the placebo the entire time. All test subjects were told they were given caffeinated chocolate. Subjects were asked 15 – 20 minutes later on a scale of 0 to 4 how energized they felt form eating the chocolate. Then, at the end of the day they were asked if the chocolate made their day feel more energetic or not. The 2nd group's energy levels started out around 4 and after given placebos dropped to around 2, lower than the control, but higher than the 3rd group. The 3rd group showed a slight increase over the 4 days. Both 1st and 2nd group reported that their days were all more energetic, while the 3rd group only reported that on one day.

I. INTRODUCTION

Placebos have been around for a long time, used by wise physicians and quack doctors alike, but it is only recently that we have realized the importance and necessity the placebo effect has in experiments to distinguish the effects of a drug from the effects of a suggestion, and to obtain an unbiased result. The results of the placebo group provide an important baseline on which to compare the treatment group. This experiment tests out the characteristics of the placebo effect using caffeine and placebos, then asking for energy levels from tests subjects. As of why this phenomenon happens, there is no solid evidence behind the placebo effect, but there are many theory's trying to explain it.

One possible explanation is that taking the placebo triggered a release of endorphins. Endorphins act as the brain's own natural painkillers, which may explain why the placebo effect is most prominent in clinical trials involving pain relief medicines. Researchers have been able to demonstrate the placebo effect in action using brain scans, showing that areas that contain many opiate receptors were activated in both the placebo and treatment groups. (Howick J, F C, Tsakok M, Watson R, Tsakok T, Thomas J, 2013) However, another clinical trial

suggests that the placebo effect doesn't exist at all. In this experiment patients given placebos showed very little difference than not being given any medication at all. The small outlying change in patient – reported outcomes could be explained by bias. The report states that the entire phenomena may just come from patients and test subjects trying to please researchers and doctors by making up the results they think the testers want to hear. When researchers and doctors hear changes in symptoms that cannot be explained by the contents of the placebo, they think that there was a physiological reaction and attribute it the placebo effect. The author of the paper concluded "There was no evidence that placebo interventions in general have clinically important effects. A possible small effect on continuous patient-reported outcomes, especially pain, could not be clearly distinguished from bias." (Hróbjartsson and Gøtzsche, 2014)

In this trial we test out the two theories. So just how powerful and effective is the placebo effect? Exactly how influential is it? The hypothesis is if test subjects are given non – caffeinated chocolate and told that they are being given caffeinated chocolate they will feel the same or down to 70% effectiveness of actual caffeine. This is because the placebo effect causes people to believe that the dummy pill is caffeine and is helping them gain more energy. In turn patients with this mental state may report elevated energy levels despite not taking the real drug.

II. METHODS

54 pieces of caffeinated and decaf chocolate were made each. Milk chocolate from Nestle and both regular and decaf instant coffee from Folgers was used the entire time to maintain similar flavor. Water was simmered in a saucepan. A bowl filled with 1 & ¾ cups of chocolate were held above the water and melted. When the chocolate was completely liquified, the bowl of chocolate was then taken off the heat and ¼ cup of instant coffee and ¼ cup of caffeine powdered was added into the chocolate and stirred thoroughly. The caffeinated chocolate was poured evenly into a mold making 18 pieces of chocolate. This was repeated 2 more times to make all the caffeinated chocolate. The same process happened for the decaf chocolate, but instead of adding instant coffee and caffeine powder, ¼ cup of decaf instant coffee was added instead for each batch. Decaf instant coffee was used to imitate the taste of real coffee, making the lie told more convincing, therefore more likely and prominently showcasing the placebo effect.

9 people of the same age group were gathered (14 – 17 years) and split into 3 even groups. They were given 3 chocolates in the morning for the next 4 days, and told to eat them throughout the day. All the subjects were told that they received caffeinated chocolate the whole time. The 1st group (control), group A, was given caffeinated chocolate the entire time, the 2nd group, group B,

was given caffeinated chocolate for the first two days and decaf chocolate for the remaining two days. The 3rd group, group C, was given decaf chocolate the entire time. 20 minutes after eating they were asked on a scale of 0 – 4 how much more energized they felt. At the end of each day

they were asked if the chocolate made their day feel more energetic overall or not. The control group was the 1st group who took caffeinated chocolate the entire time, this was to compare the results of the placebo. With the results from the real drug it provided a solid bar on which the effectiveness of the placebo could be measured. Independent variables included age group, as different aged people may respond to the caffeine differently and be more or less responsive to the placebo effect due to different mental states seen in different ages. The constant of 3 chocolates a day stayed equal for all test subjects so they all have the same amount of caffeine / exposure to the placebo effect. All instructions and information given to each subject were exactly identical to keep from suggestive bias. The independent variable was the type of chocolate and the dependent variable was the energy level of the test subject.

III. RESULTS

The results were gathered after 12 days, 4 days for each group. The chart below shows the average energy levels for all the chocolates and test subjects across the 4 days. Each point on the graph represents the average of all 3 chocolates in all 4 test subjects. A more detailed representation can be seen through the charts. Average overall day energy level was taken from the majority response.

	Day 1 – Energy Level	Day 2– Energy Level	Day 3– Energy Level	Day 4 – Energy Level 4
Chocolate 1	4	4	2	4
Chocolate 2	3	3	3	3
Chocolate 3	3	4	4	3
Overall Feeling	YES	YES	YES	YES

REPORTED ENERGY LEVELS OF SUBJECT A1

Table 1: Energy level on a scale of 0 – 4, reported by test subject A1, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. A1 was given caffeinated chocolate all 4 days.

REPORTED ENERGY LEVELS OF SUBJECT A2

	Day 1 – Energy Level	Day 2– Energy Level	Day 3– Energy Level	Day 4 – Energy Level 4
Chocolate 1	2	2	2	4
Chocolate 2	1	0	3	3
Chocolate 3	1	0	4	3
Overall Feeling	YES	YES	YES	YES

Table 2: Energy level on a scale of 0 – 4, reported by test subject A2, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. A2 was given caffeinated chocolate all 4 days.

REPORTED ENERGY LEVELS OF SUBJECT A3

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Chocolate 1	4	4	3	3
Chocolate 2	4	4	4	4
Chocolate 3	4	3	4	3
Overall Feeling	YES	YES	YES	YES

Table 3: Energy level on a scale of 0 – 4, reported by test subject A3, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. A3 was given caffeinated chocolate all 4 days.

REPORTED ENERGY LEVELS OF SUBJECT B1

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Chocolate 1	4	4	4	2
Chocolate 2	4	4	3	3

Chocolate 3	4	3	4	2
Overall Feeling	YES	YES	YES	YES

Table 4: Energy level on a scale of 0 – 4, reported by test subject B1, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. B1 was given caffeinated chocolate for the first 2 days and placebos for the last 2 days.

REPORTED ENERGY LEVELS OF SUBJECT B2

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Chocolate 1	4	4	3	3
Chocolate 2	2	3	0	3
Chocolate 3	2	3	1	1
Overall Feeling	YES	YES	NO	YES

Table 5: Energy level on a scale of 0 – 4, reported by test subject B2, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. B2 was given caffeinated chocolate for the first 2 days and placebos for the last 2 days.

REPORTED ENERGY LEVELS OF SUBJECT B3

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Chocolate 1	4	3	3	3
Chocolate 2	4	3	3	2
Chocolate 3	4	4	4	2
Overall Feeling	YES	YES	YES	YES

Table 6: Energy level on a scale of 0 – 4, reported by test subject B3, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. B3 was given caffeinated chocolate for the first 2 days and placebos for the last 2 days.

REPORTED ENERGY LEVELS OF SUBJECT C1

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Chocolate 1	3	3	3	2
Chocolate 2	2	3	2	3
Chocolate 3	3	3	2	2
Overall Feeling	YES	YES	YES	YES

Table 7: Energy level on a scale of 0 – 4, reported by test subject C1, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. C1 was given placebos for all 4 days.

REPORTED ENERGY LEVELS OF SUBJECT C2

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Chocolate 1	1	0	2	2
Chocolate 2	0	1	1	3
Chocolate 3	0	1	0	2
Overall Feeling	YES	YES	YES	YES

Table 8: Energy level on a scale of 0 – 4, reported by test subject C2, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. C2 was given placebos for all 4 days.

REPORTED ENERGY LEVELS OF SUBJECT C3

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Chocolate 1	1	2	1	2
Chocolate 2	0	1	1	0
Chocolate 3	1	0	1	1
Overall Feeling	YES	YES	YES	YES

Table 9: Energy level on a scale of 0 – 4, reported by test subject C3, 15 to 20 minutes after eating each chocolate. Answer on whether the chocolate made their day more energetic overall. C3 was given placebos for all 4 days.

AVERAGES OF ENERGY LEVELS ACROSS ALL GROUPS

	Day 1 – Energy Level	Day 2 – Energy Level	Day 3 – Energy Level	Day 4 – Energy Level 4
Completely Caffeinated	2.89	2.89	2.89	2.89
	Overall - Yes	Overall - Yes	Overall - Yes	Overall - Yes
Stopped Half Way	3.56	3.56	2.67	2.33
	Overall - Yes	Overall - Yes	Overall - Yes	Overall - Yes
Decaf	3.56	3.56	2.67	2.33
	Overall - Yes	Overall - Yes	Overall - Yes	Overall - Yes

Table 10: Average energy levels reported 15 – 20 mins after eating the chocolates. Average energy levels were taken by every chocolate that every test subject in a group ate that day. Average overall energy level is taken by majority.

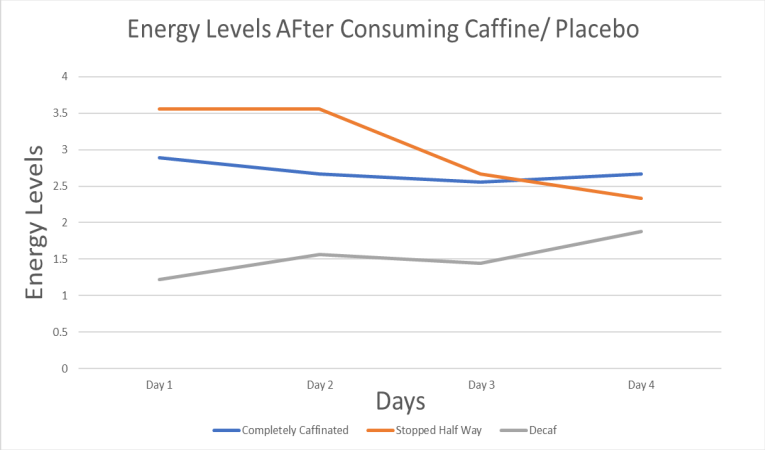

Figure 1: Average energy levels taken from table 10. Each point represents average energy levels after eating the chocolates. Overall energy levels are not shown.

IV. DISCUSSION & CONCLUSION

The hypothesis that if test subjects are given non – caffeinated chocolate and told that they are being given caffeinated chocolate they will feel down to 70% or decreased effectiveness of actual caffeine was mostly false. It applied only to the B group the first day they took placebos, where there was a 75% effectiveness.

From Figure 1, it was observed in the orange line that the placebos were most effective when taken right after the real caffeine. The energy levels of the orange line dropped as expected, but still stayed higher than the decaf (gray) line. An interesting detail observed was that the orange

line showed a decline over the 2 days the group B test subjects started receiving placebos. This seems to indicate that the longer a subject was taken off the caffeine and given a placebo, the less prominent the placebo effect got. This reflects with many clinical trials where placebos have consistently done better when combined with real medication (Beauregard, M. Mind does really matter: Evidence from neuroimaging studies of emotional self-regulation, psychotherapy, and placebo effect, 2017. Beth Israel Deaconess Medical Center. The importance of placebo effects to medical care, 2016) Among doctors it is most common to prescribe placebos along with medication to minimize side effects of the medication while still maintaining benefits from the placebo effect.

Another fascinating result is that the decaf group showed a steady incline throughout the 4 days. That may have come from the perceived truth becoming more solidified, shifting to a mental state with more belief in the placebo, therefore reporting higher energy levels.

As seen in Table 2, the test subject A2 had very low energy levels despite taking the real drug. This may be because their body did not respond to caffeine predictably. The anomaly caused the average energy level in the completely caffeinated group and the blue line in Figure 1 to be much lower than expected. This reflects a bias by sample size, since having such a small pool of data, one outlier will skew results far more than they should have. In a much larger sample size, these anomalies would be so few and far between that they wouldn't be able to significantly affect the data, like it did here. Another problem in the data is that all test subjects were not given specific times to eat the chocolates. Caffeine may be more effective at energizing people during certain times a day, which could have led to bias in the data.

Of group B, test subject B2 was least effective, but still relatively close to the other subjects in the group, who had similar results. Group C subject C1 was the most affected by the placebo phenomenon. The reported energy levels were all 3's and 2's even, seen in Table 3, even after taking decaf chocolate the entire time.

How does this solve the question of exactly how powerful is the placebo effect? The answer ranges greatly depending on the individual and the situation the placebo is placed in. Some people such as test subject C1, was extremely susceptive to the placebo phenomenon, while subject B2 was not. This shows that the effect varies greatly depending on the different mentalities of the subjects. Effectiveness of placebos can also be affected by what situation it is placed in. Placebos are much more effective when taken with real drugs as seen by comparing group B with group C. Time also plays a role in the power of placebos. In group B the longer they

were taken away from caffeine, the less powerful the placebo effect was. However, group C reported higher energy levels the longer they took placebos.

V. APPLICATION

Further research can be done by continuing this experiment for a longer period of time. Through this experiment, the new data could solidify the trends seen in this experiment. Different types of drugs may be tried in future experiments to get a bigger picture of the placebo effect that is not limited to caffeine.

This information would be most applicable in the medical field. When doctors prescribe placebos they may choose to use it alongside real drugs, as it is proved in this experiment that that is where placebos are the most effective. It may also help to know that the power of the placebo effect increases over time when giving straight placebos, meaning doctors and researchers may have to wait a bit for more prominent results to come out.

As for the general public, the placebo effect is completely based on the mentality of each subject. This translates the real world and goes to show that many things may come faster if a positive mentality is applied. The more belief put into resolving a problem, the faster the problem may be solved.

VI. REFERENCES

American Cancer Society. (n.d.). Placebo Effect. Retrieved March 17, 2019, from https://www.cancer.org/treatment/treatments-and-side-effects/clinical-trials/placebo-effect.html

Beauregard, M. (2017, February 09). Mind does really matter: Evidence from neuroimaging studies of emotional self-regulation, psychotherapy, and placebo effect. Retrieved March 28, 2019, from https://www.sciencedirect.com/science/article/pii/S0301008207000123Carvalho

Beth Israel Deaconess Medical Center. (2016, July 01). The importance of placebo effects to medical care. Retrieved March 13, 2019, from https://www.sciencedaily.com/releases/2015/07/150701171704.html

Caetano C., J. M., Cunha, L., Rebouta, P., Kaptchuk, T. J., & Kirsch, I. (2016, December). Open-label placebo treatment in chronic low back pain: A randomized controlled trial. Retrieved March 28, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5113234/

Cherry, K. (2018, November 14). What Causes the Placebo Effect in Psychology? Retrieved March 13, 2019, from https://www.verywellmind.com/what-is-the-placebo-effect-2795466

Howick J, Friedemann C, Tsakok M, Watson R, Tsakok T, Thomas J. (2013, May 15) Are Treatments More Effective than Placebos? A Systematic Review and Meta-Analysis. Retrieved 10 Jun. 2019, from https://doi.org/10.1371/journal.pone.0062599

Hróbjartsson, A., Gøtzsche, P. (2014, April 19). Placebo interventions for all clinical conditions. Retrieved 10 Jun. 2019, from https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD003974.pub2/full

Newman, T. (2017, September 07). Placebos: The power of the placebo effect. Retrieved March 17, 2019, from https://www.medicalnewstoday.com/articles/306437.php

How Pressure Affects an Athlete's Performance Level

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Abstract

The purpose of this experiment was to see how an athlete performed with and without pressure. This is important because it will allow athletes at all levels to see how pressure affects them and how they can cope with it. The experiment was performed by having 5 test subjects attempt to hit the crossbar of a soccer net without any pressure and then have them redo the experiment with added pressure. The number of crossbar hits for each test subject and each type of shot was recorded in a table. After reviewing the data, the majority of test subjects had a lower number of crossbar hits when there was pressure. This shows that added pressure had an overall negative effect on the athletes. This also demonstrates that it is important to understand how stress affects different people.

I. INTRODUCTION

This project will help athletes understand how pressure in sports works and how it may affect them. Knowing this will allow them to cope with it in a positive way if needed. It will also help them perform at a higher level whether they're dealing with stress or not. As Donald Tubesing said, "Stress is like a spice. Too little will produce a dull meal but too much may choke you". (No date). The question I will be answering is "How will pressure affect an athlete's performance level". The hypothesis made for this experiment was, "If an athlete playing soccer was put under pressure by taking shots with stakes, the performance level would be higher because the pressure would motivate them".

II. METHODS

The first step was to place the soccer ball on the penalty. The first player then took 5 shots at the soccer net. Every time they hit the crossbar, the number of crossbar hits went up by one. The number of crossbar hits out of 5 was recorded in the "Regular Shots" section for the corresponding player in the form of Hits/Attempted. The same player then took 5 more shots at the soccer net with a chance of winning a prize. The number of crossbar hits out of the 5 shots was recorded in the "Prized Shots" section for the corresponding player. The rest of the players repeated these steps with their results being recorded in their sections. The independent variable is the experiment were the prizes available. The dependant variable in the experiment was the number times the player hit the crossbar. The controlled variables were the soccer ball, the soccer net, the distance the shot was taken from and the field the shots were taken on.

These variables were controlled variables as if they were different for each player, some players would have an unfair advantage over the others. For example, if a shot was taken further away from the soccer net, it would be harder to hit the crossbar compared to if the shot was taken closer to the net.

III. RESULTS

The scores for each player was recorded in Table 1. It was seen that Player 1 got the same amount of crossbar hits with and without pressure while Player 3 got more crossbar hits with pressure compared to when there was nothing on the line. Finally, Players 2,4 and 5 were more successful when there was nothing at stake.

Table 1: Results for experiment

Player Number	Number Of Regular Shots (Hit/Attempted)	Number Of Prized Shots (Hit/Attempted)
Player 1	2/5	2/5
Player 2	3/5	2/5
Player 3	2/5	3/5
Player 4	4/5	3/5
Player 5	3/5	1/5

Figure 1 shows the average number of crossbar hits with and without pressure. The average for without pressure was 2.8/5 while the average for with pressure was only 2.2/5.

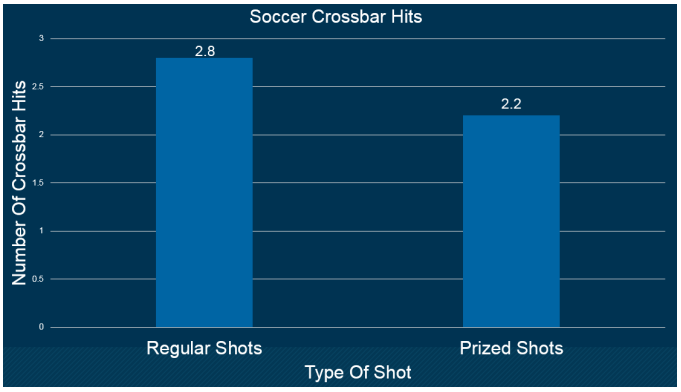

Figure 1: Average number of crossbar hits with and without pressure

IV. DISCUSSION & CONCLUSION

The hypothesis was incorrect as it stated that the athletes would perform at a higher level when there was pressure involved when they actually performed at a lower level. This is shown in the data as the average number of crossbar hits with regular shots was 2.8/5 whereas the average number of crossbar hits under pressure was only 2.2/5. The results were like this because stress can both enhance as well as lower an athlete's performance level (Cohn). In this experiment, the pressure had a negative impact on the majority of the players as the number of crossbar hits went down. Although pressure had a negative impact in this experiment, this may not be this case for every attempt of this experiment.

V. APPLICATION

Some further research that can be done to answer the question at hand is to add a loss factor to the experiment. This would add more pressure as the players would also have something to lose rather than

just having the pressure to win the best prize. This research and experiment can be used in the soccer field to see how different soccer players are affected by pressure situations. The soccer players could also use this to better cope with pressure if needed.

VI. REFERENCES

Cohn P, (No date), How Stress Can Affect Sports Performance, Retrieved on March 15, 2019 from www.peaksports.com/sports-psychology-blog/how-stress-can-affect-sports-performance/

No author, (No date), Under Pressure: Stress Management for the Athlete, Retrieved on March, 2019 from www.oksportsandfitness.com/StressedAthlete.php

How the Preferred Character Trait in a Best Friend Changes Throughout High School

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Abstract

The investigation of how high school students' preferred character traits in best friends developed over time led to a better understanding of young adults. An entire school's student population was invited to complete an anonymous survey with questions concerning their best friend preferences, which generated fascinating results that answered previous questions. Characteristics related to loyalty and trustworthiness were significantly favoured throughout all four grades. The more detailed and personal preferences, however, reflected each grade more accurately. Younger grades preferred easily identified traits – popularity and common interests – that belonged to a more outgoing friend. In contrast, older grades' chosen traits – maturity and reciprocity – were harder to recognize, and belonged to a more down-to-earth friend. These results led to the conclusion that, overall, students would gravitate towards students in the same age group, although younger students were more likely to become best friends with energetic and relatable people, while older students would choose more mature and reliable students as friends. This helped explain the dynamics among young adults, which would progress the understanding of the human population.

I. INTRODUCTION

According to Degges-White (2015), some people have an easier time making friends and maintaining those friendships, which certain personal characteristics, such as congeniality and integrity, facilitate. As it turns out, these relationships greatly impact our lives, and are as important as eating healthy and staying active. They help everyone learn how to forgive, be patient, and be happy (Author (2017)). It is known what makes a good friend and how important friends are, but understanding how a person prefers different characteristics in a friend over time is a new idea that should be studied.

This raises the question: How does the preferred character trait in a best friend change throughout high school?

Well, if grade nines', tens', elevens' and twelves' preferred characteristics in a best friend are compared, then the younger students (*grades nine and ten*) will favour more energetic friends that share interests, while the older students (*grades eleven and twelves*) will favour more down to earth, honest, and reliable friends.

This hypothesis forms because, looking at "Ten Things Your Kids Should Look for in a Friend" by All Pro Dad, the number one characteristic is *common values*, while "The 13 Essential Traits of Good Friends" lists *traits of integrity* first.

What really stands out is that the latter article does not have *common interests or values* listed anywhere. This proves that there could be a shift in values over time, perhaps even in the span of the four years spent in high school.

II. METHODS

This procedure was quite simple, as it relied mostly on the time and effort of other people to generate results.

The link https://docs.google.com/forms/d/e/1FAIpQLSfnh-B_TaZb8OGqKSRlog_rU76-uaMhN9HQUPf1caCgio0MfQ/viewform?usp=sf_link brought the investigator to the google form required for the survey. All instructions for the participants were stated clearly in the form.

After the survey was promoted with the link for two weeks, the acceptance of any more responses was turned off, and the answers organized in a spreadsheet by grade. This facilitated the comparison of results, and made any relationships or patterns in the data more evident.

In terms of variables, it was known that there are three types – independent, dependent and controlled.

The independent variable was the grade level of the responding student, while the choice of optimal personality trait in a best friend, the reasoning for their chosen trait and whether their own best friends possess the particular trait were all the dependant variables.

The form that was filled out and submitted, the environment, and the community from which the students who were completing the form belonged to were the controlled variables.

By keeping the form consistent for all students, they each received the same questions in the same order. This was important since, by shuffling the questions and having some students answer them in a different order than others, responses could have been less accurate. For example, if a student was asked whether their best friend possessed the most important trait before they stated what they believed the most important personality trait in a best friend was, they would tend to give a characteristic that described their best friend. This would have skewed the results, since the changes in the optimal personality trait in a best friend over time are what needed to be determined, not what the best character trait in the participant's currently

existing best friend was, and how that changed over time

The environment was also controlled. By answering questions individually behind a screen, identities were more protected and participants tended to respond more honestly. If these forms were filled out in person, the student may have felt more self-conscious, since their answer could have been judged by the investigator. By having a digital form, the students responded comfortably and privately wherever they preferred.

Finally, only Massey students' responses were measured. This was because the students learn and exist in the same community. As a result, more consistent results with clear relationships were generated. Take, for example, if a student in an impoverished community were to fill out this form, their answer would have probably been extremely different from those of the students at Massey. It would not have made sense to include their response in the experiment, since it would have had no relation to any other answer. Even a response from a student who attends a different high school, such as Holy Names, could have skewed results since that community is unlike Massey's. Controlling the community from which the results were measured also ensured that people of the proper age pool were answering.

Overall, these decisions were made and this process was closely followed to generate accurate results that could answer previously existing questions, as well as prove or disprove theories.

III. RESULTS

Table 1 is a section of all collected data to demonstrate how responses were recorded:

Table 1

Please select your current grade	What do you personally believe is the most important personality trait in a best friend?	Why do you believe that your chosen trait is the most important?	Do your current closest friends possess your chosen trait?
9	honesty/care	Friends shouldn't be hiding things from each other and wish for the well being of each other from the bottom of their heart.	No
11	Integrity	I think integrity is very important for a person to have because it says a lot about their character. Integrity is all about how you behave when you think nobody is watching. It is defined as being honest and having strong moral principles. This is important to me because I don't want a best friend who is dishonest, and can't say something to my face. I want to be friends with someone who is honest and has strong moral values which means they hold themselves up to a certain standard. I hold myself accountable to a high moral code and I would like to share the same set of good moral values as my best friend. I wouldn't want to be best friends with someone who believes killing people is good or with someone who is mean all the time.	Yes

Table 2 holds a summary of all the answers received from grade nines:

Table 2

Grade 9		
Total number of submissions	24	
Total number of chosen traits that fall under each of these categories	**Loyal** 10	**Humorous** 2
	Adventurous 0	**Unique** 0
	Honest 4	Kind 5

	Intelligent 0	**Other (specify)** -Popular x 2
Number of students whose closest friend possesses the chosen trait	19	
Number of students whose closest friend does not possess the chosen trait	5	

Table 3 holds a summary of all the answers received from grade tens:

Table 3

Grade 10		
Total number of submissions	66	
Total number of chosen traits that fall under each of these categories	**Loyal** 27	**Humorous** 5

	Adventurous 0	**Unique** 0
	Honest 12	**Kind** 16
	Intelligent 2	**Other (specify)** -common interests x 2 -communication -not obsessive
Number of students whose closest friend possesses the chosen trait	52	

Number of students whose closest friend does not possess the chosen trait	14

Table 4 holds a summary of all the answers received from grade elevens:

Table 4

Grade 11		
Total number of submissions	34	
Total number of chosen traits that fall under each of these categories	**Loyal** 16	**Humorous** 1
	Adventurous 0	**Unique** 0
	Honest 7	**Kind** 7

	Intelligent 0	**Other (specify)** -communication x 2 -maturity
Number of students whose closest friend possesses the chosen trait	31	
Number of students whose closest friend does not possess the chosen trait	3	

Table 5 holds a summary of all the answers received from grade twelves.

Table 5

Grade 12	
Total number of submissions	17

Total number of chosen traits that fall under each of these categories	**Loyal** 5	**Humorous** 1
	Adventurous 0	**Unique** 0
	Honest 7	**Kind** 2
	Intelligent 0	**Other (specify)** -communication -reciprocity

Number of students whose closest friend possesses the chosen trait	17
Number of students whose closest friend does not possess the chosen trait	0

Figure 1 is a visual representation of the percentage of students from each grade that took part in this study:

Figure 1

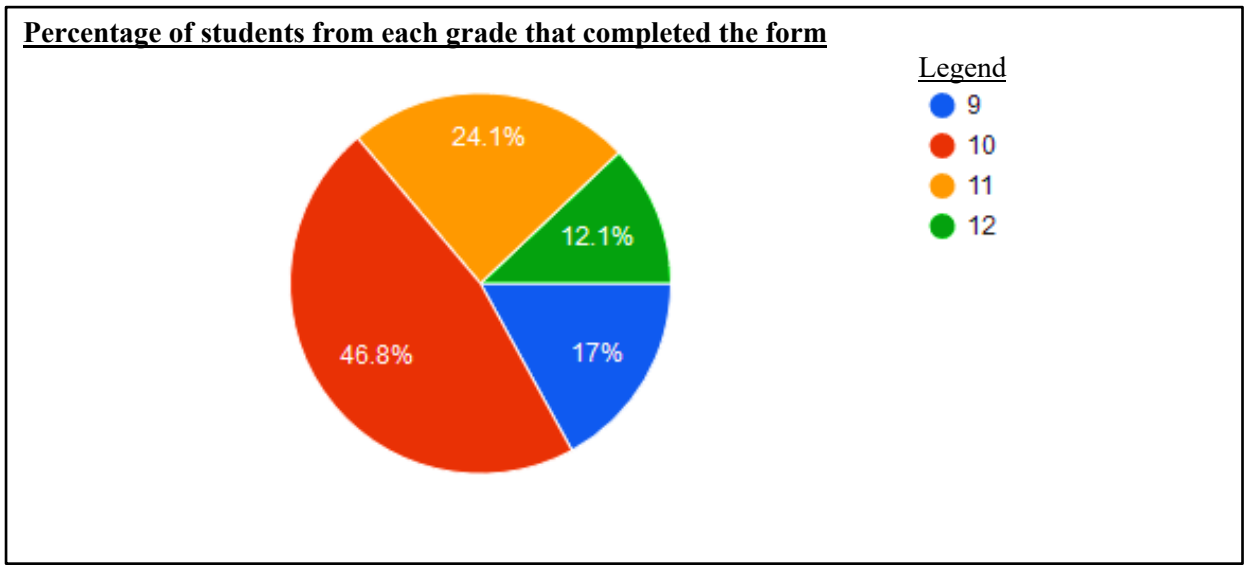


Figure 2 is a visual representation of the percentage of students whose close friends possessed their chosen trait:

Figure 2

Percentage of students with close friends that possessed their preferred best friend personality trait

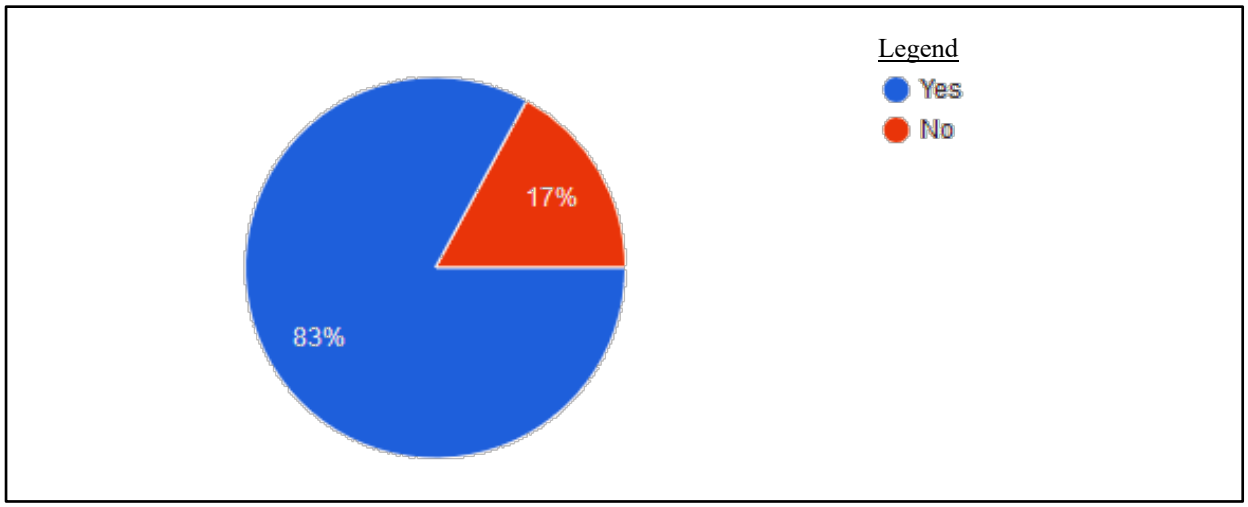


Figure 3 is a visual representation of the percentage of grade nine students whose preferred trait fell under each category:

Figure 3

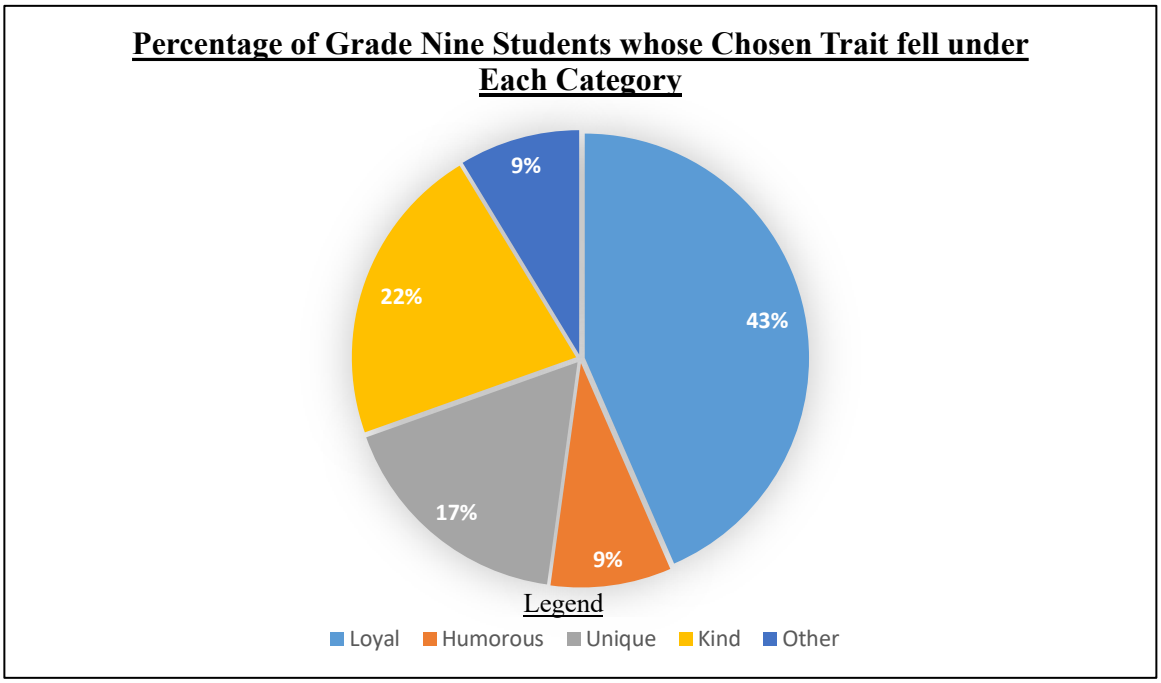


Figure 4 is a visual representation of the percentage of grade ten students whose preferred trait fell under each category:

Figure 4

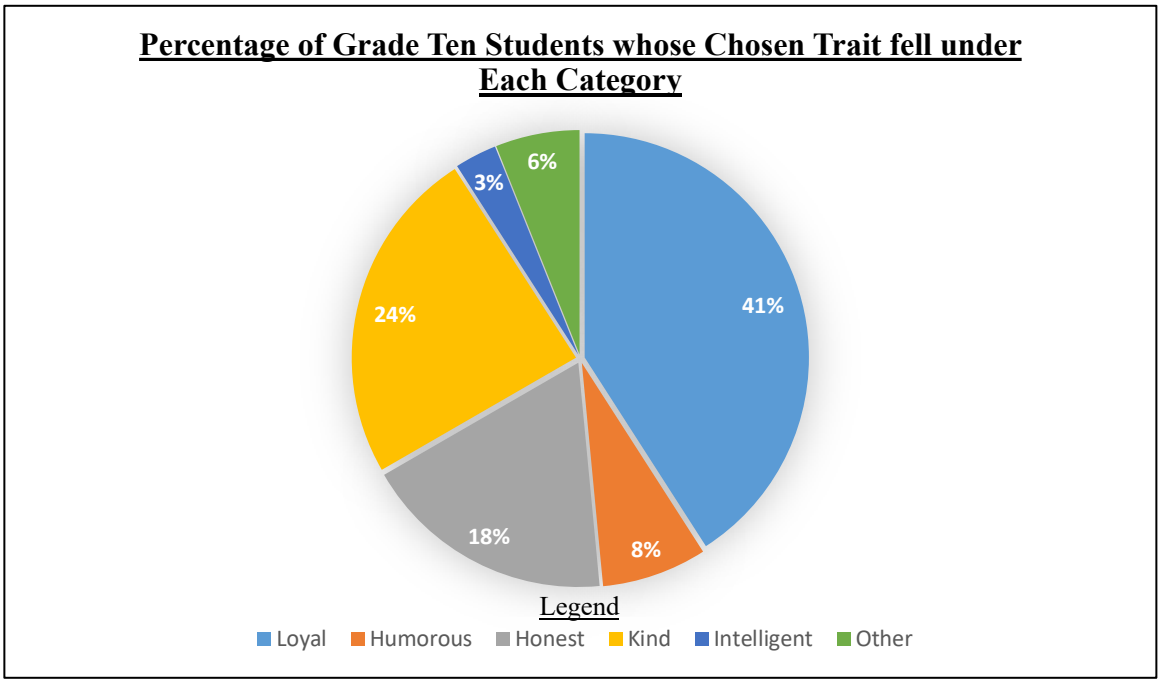


Figure 5 is a visual representation of the percentage of grade eleven students whose preferred trait fell under each category:

Figure 5

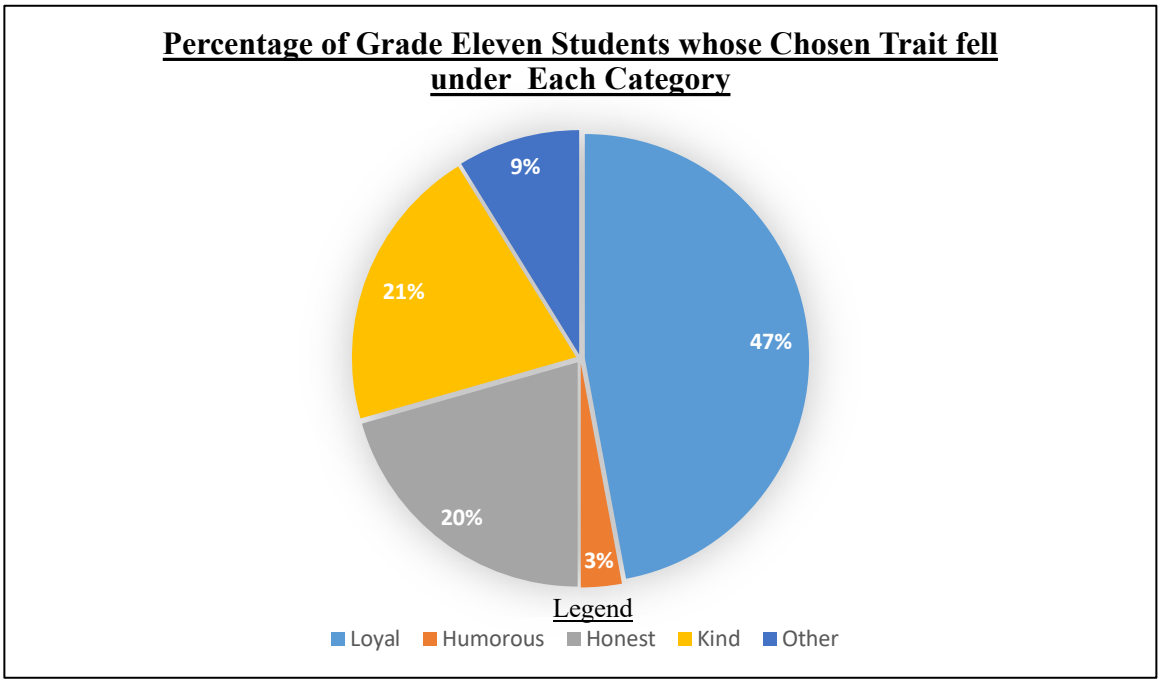


Figure 6 is a visual representation of the percentage of grade twelve students whose preferred trait fell under each category:

Figure 6

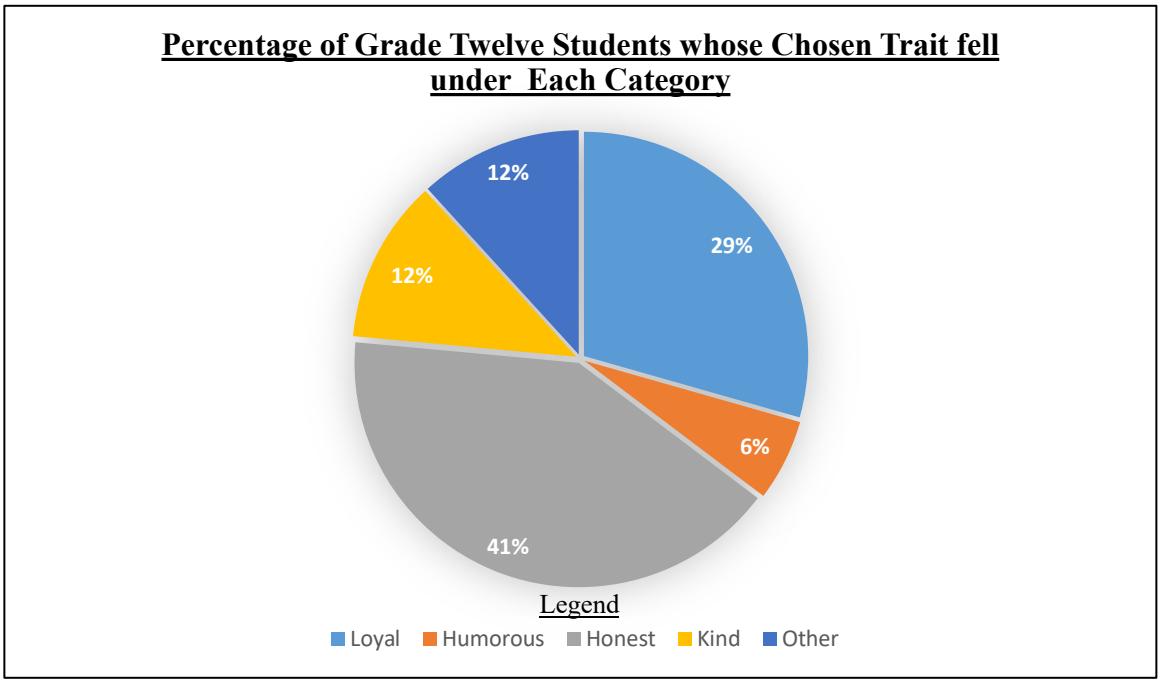
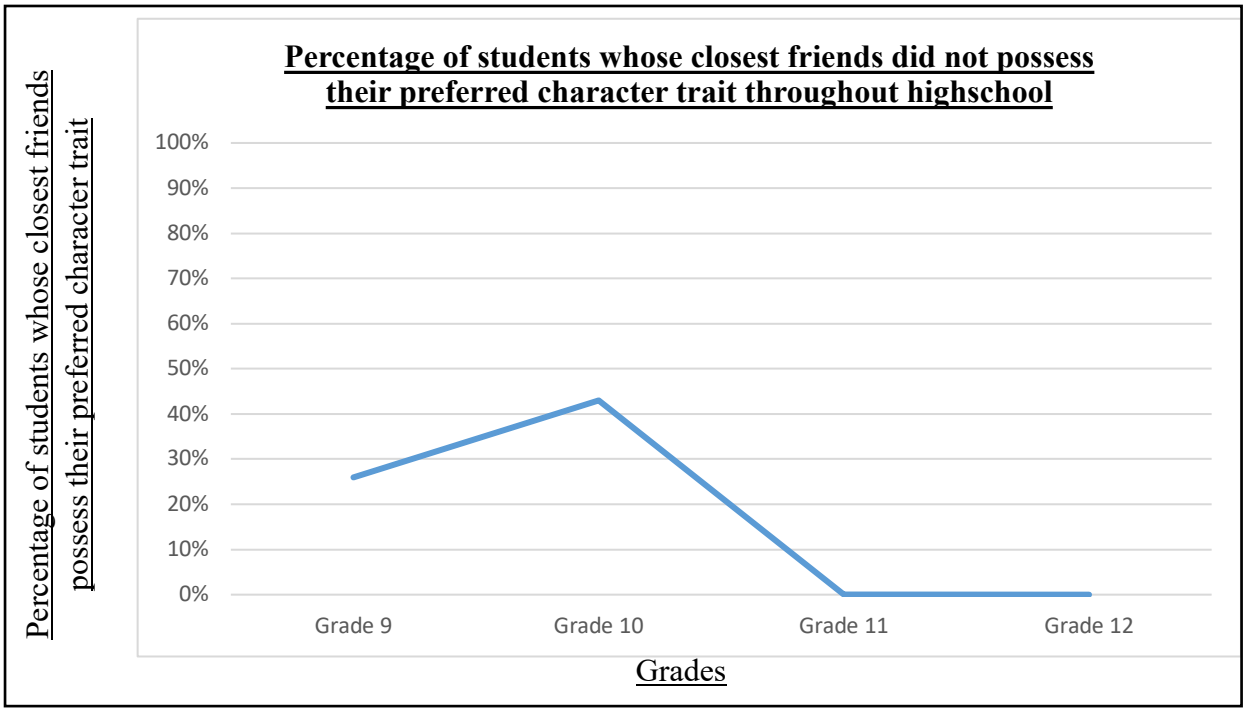


Figure 7 is a linear representation of how the percentage of students whose closest friends do not possess their preferred character trait changed throughout high school:

Figure 7



IV. RESULTS

Although all four grades appreciated traits of integrity greatly (*over forty percent in grade nine, ten and eleven, and nearly thirty percent in grade twelve*), the individually specified traits were more unique to each grade, and demonstrated the changes throughout the grades more clearly. They also answered the main question "How does the preferred character trait in a best friend change throughout high school?" more effectively.

The outstanding trait preferred by the grade nines was popularity (*one hundred percent of the specified answers),* which demonstrated their interest in a more outgoing and generally liked person. For the grade tens, the majority of the additional "other" traits were common interests *(fifty percent of the specified answers),* which showed that they look for friends who shared their own ideas. There was a clear change when looking at the specified answers from grade elevens and twelves. They preferred characteristics such as, communication *(sixty percent),* maturity *(twenty percent),* and reciprocity *(twenty percent)* – all traits that reflect more down to earth, reliable friends.

This outcome proved the hypothesis to be correct, although it is important to explore why the study generated these results.

Referring back to the scientific background information, "Ten Things Your Kids Should Look for in a Friend," is an article which is clearly targeted towards younger children. The first trait that is listed is, in fact, *common values*, which is in line with the preferred traits of the younger grades. The trait directly following that is *character*, which is defined as "the ability to stand out from a crowd," (All Pro Dad, para. 4). This is closely related to popularity – another preferred trait of the younger participants.

In contrast, "The 13 Essential Traits of Good Friends," an article targeted towards older audiences, lists *traits of integrity* first, which is reflected in the favoured traits by the older grades – communication and maturity. Both communication skills and maturity are required in a morally upright friend who is honest and takes responsibility for their actions. Most of all, common interests is not represented anywhere in any of the grade elevens' nor grade twelves' responses, just as it was nowhere in the article meant for a more mature audience.

Even though no other report of a similar study to which these outcomes could be compared was discovered, the clear relationships between popular friendship articles and this investigation provide a reasonable explanation for the results.

Unfortunately, errors often find a way into every investigation. One that may be a part of this study is the lack of supervision, which leads to several other problems.

It was previously mentioned that responses were submitted electronically to protect the student's identity and to ensure the sincerity of the answers. This is assuming that all people are truthful, which is unrealistic.

It is nearly certain that a student would reply as a joke or submit multiple answers, both of which would skew results. The former, if performed too often, would create a drastically inaccurate reflection of the grade, producing false relationships and results. This is because characteristics chosen just for fun tend to be outlandish, which if entered multiple times, could be taken seriously since it would appear to be generally agreed upon.

The latter would lead to a similar problem, though possibly less disastrous. If the trait that was given multiple times is already genuinely agreed upon among the grade, it would just cause the percentage of agreements to be amplified, which is less damaging than the former. However, if the characteristic that was entered multiple times was ridiculous, it would reflect the grade incorrectly and lead to the same problem as the former.

The survey was still completed anonymously because, after comparing the possibility of error and the benefits of the method, the probability of more genuine answers as a result of this method was significantly more likely. This is proven by the abundance of reasonable responses which seem to accurately reflect every grade, leading to a successful investigation.

V. APPLICATION

Several questions raised from these results, one of which is 'If the preferred trait in a best friend can change so much within four years, how could it develop throughout a lifetime?'

With the results from this study, it is possible that specialists in psychology could answer that question by following the pattern of development beyond grade twelve.

The information from this investigation could be useful to the general public as well – a high school student can take the information and determine how to attract or discover a new best friend, while a parent could better comprehend their own child based on the friends they choose

to associate with. Some parents may even find solace in these results, because it is possible that their child currently spends time with very immature students that they don't approve of, and these results show that it is likely the child will develop new preferences over time, and associate with a more comfortable group of people.

Overall, this study answers a fascinating question, and will prove to be quite useful in the future.

VI. REFERENCES

- All Pro Dad. (2017). Ten Things Your Kids Should Look for in a Friend. Retrieved on March 11, 2019 from https://www.allprodad.com/10-things-your-kids-should-look-for-in-a-friend/
- Author, S. (2017, September 23). Why Friendship is Important. Retrieved on March 5, 2019 from https://www.liveabout.com/why-friendship-is-important-1385655
- Degges-White, S. (2015, March 23). The 13 Essential Traits of Good Friends. Retrieved on March 5, 2019 from https://www.psychologytoday.com/ca/blog/lifetime-connections/201503/the-13-essential-traits-good-friends
- Whitbourne, S.K. (2013, March 26). Fifteen Reasons We Need Friends. Retrieved on March 7, 2019 from https://www.psychologytoday.com/ca/blog/fulfillment-any-age/201303/fifteen-reasons-we-need-friends

Impacts of Different Learning Methods on Programming Abilities

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Abstract

As programming becomes an integral tool for performing many tasks in today's workforce, fast and efficient learning methods to improve one's programming skills are essential. This study investigated the impacts of different learning methods (doing questions, reading a book, or hiring a tutor) on a subject's programming abilities over a 3-week period. Participants' programming skills were measured at the beginning of the study by writing a Canadian Computing Contest and were then assigned a learning method to use over the course of 3 weeks. After that period, participants wrote another Canadian Computing Contest to measure any changes in their programming abilities. An increase in a participant's CCC score of approximately 72% was observed with those that were assigned a teacher, compared to a 22% and 23% increase when using doing questions or reading a book, respectively. However, participants who were able to answer at least one question on the first CCC, meaning that they had intermediate programming abilities, benefited more from doing questions (+29% questions, +15% teacher). This indicates that it is important to offer different learning methods to computer science students to ensure that each student learns the most that they can.

I. INTRODUCTION

The world today is becoming more and more reliant on computers and electronics. As a result of this increased demand for technology, software engineers are in extremely large demand (O'Brien, 2019). In fact, in the next decade, around 3/4 of jobs will require some sort of technology/programming skills (US Bureau of Labor Statistics, 2013). Thus, it is crucial to know the most effective way to teach computer programming so that there is no shortage of workers.

Is learning by trial-and-error, through a teacher, or through resources the most effective way to improve one's skills in a computer programming language?

If a programming language is learned through a teacher, it would be the most effective way to improve one's skills in a programming language because teachers can provide lots of insights through experience and can adapt easily to the needs of the student (Young, 2010). Teachers can also give immediate feedback and motivation when students are discouraged (The Slaney Language Centre, n.d.), leading to a more thorough understanding of a language.

II. METHODS

Thirty participants were selected over a range of grade levels and course streams. The following survey was administered to gather information about participants:

1. What hobbies do you enjoy doing?
2. What is your current mark in mathematics and computer science?
3. What is your highest score on the CCC Junior?

4. How many programming languages do you know?
5. On a scale of one to ten, how much do you enjoy computer science (one being not at all and ten being extremely)?
6. At what level would you rate your computer programming skills (beginner, intermediate, advanced)?
7. What is your general attitude towards school and academics?
8. On a scale of one to ten, how would you rate your problem-solving abilities (one being terrible and ten being extremely good)?

Participants were instructed to sleep for 9 hours. The next day, a CCC Junior contest was administered over the course of two hours. If a participant finished before the end of the two hours, their time was recorded. Afterward, each participant was assigned a learning method to interact with for one hour a week for three weeks. At the end of the three-week period, participants were given another survey to measure their perception of any change in their programming abilities:

1. Do you think your programming abilities have improved during the three-week period?
2. Do you think your problem-solving abilities have improved during the three-week period?
3. At what level would you rate your computer programming skills (beginner, intermediate, advanced)?
4. On a scale of one to ten, how would you rate your problem-solving abilities (one being terrible and ten being extremely good)?

Participants were then instructed to sleep for 9 hours and a different CCC Junior contest was administered over the course of two hours to measure any change in their programming abilities. The contest was administered in the same environment as the first contest. If a participant finished before the end of the two hours, their time was recorded.

The independent variable in this experiment was the method of learning programming. The dependent variables were the participant's score on the programming language and their time taken, if they finished the contest. The control variables were the contest problem set, the time allotted for the contest, the amount of sleep acquired the night before, the time spent with the method learning, and the environment in which the contest was written.

The contest problem set was a control variable as different contests focus on different aspects of programming, so participants must write the same contest, otherwise, the resource used may inadvertently prepare one set of participants better than the other due to differences in what the resource covers. The amount of time a participant was allotted to solve a set of problems was controlled as it could have directly affected the number of problems they were able to attempt. The amount of sleep a subject received was controlled as sleep could have affected their concentration and productivity, which would

have skewed the benefits gained through the resource used. The amount of time spent with a resource was controlled as it could have affected how much material was covered, and how much practice was gained, which could have affected the amount of improvement of a programming language. The contest writing environment was controlled as different environments contain different distractions, lighting setups, and furniture, which could have affected a participant's level of comfort and concentration during the contest

III. RESULTS

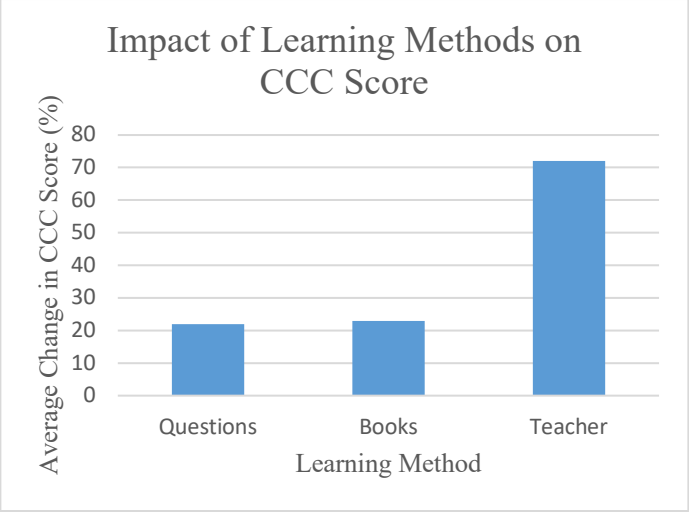

Figure 1: Percent change in CCC score based on learning method

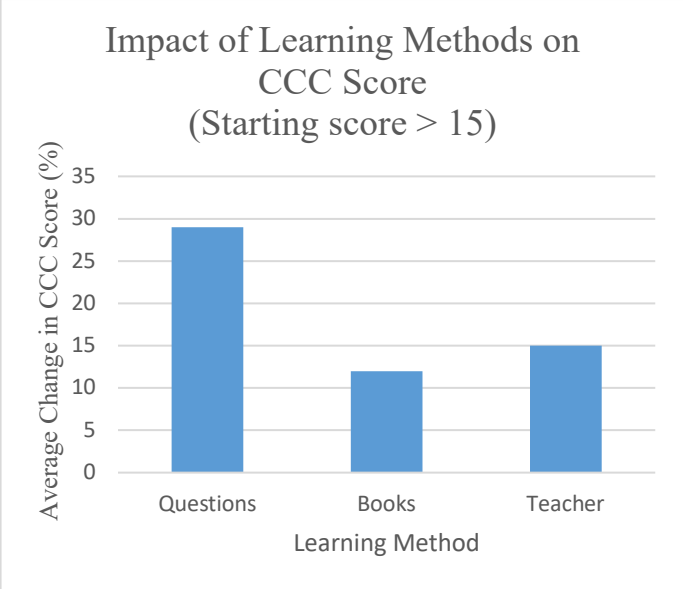

Figure 2: Percent change in CCC score based on learning method (1st score > 15)

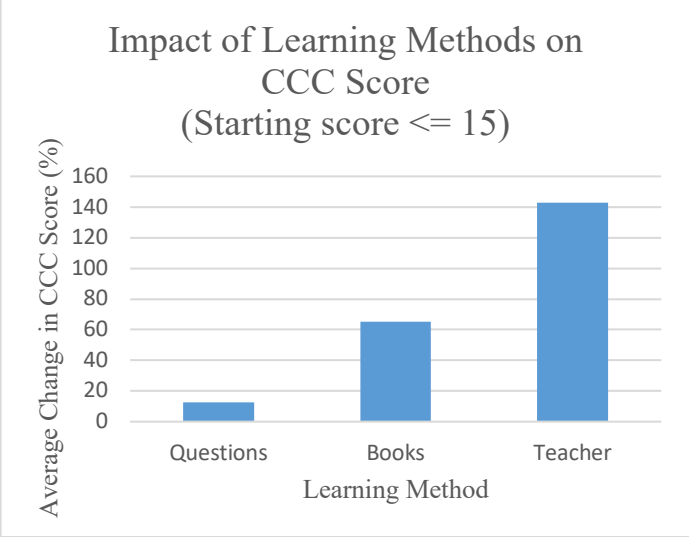

Figure 3: Percent change in CCC score based on learning method (1st score <= 15)

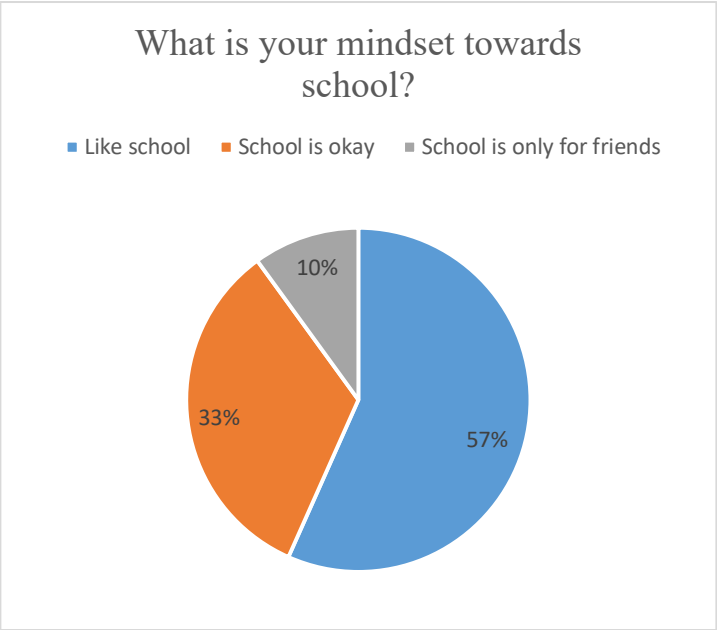

Figure 4: Mindset of students towards school

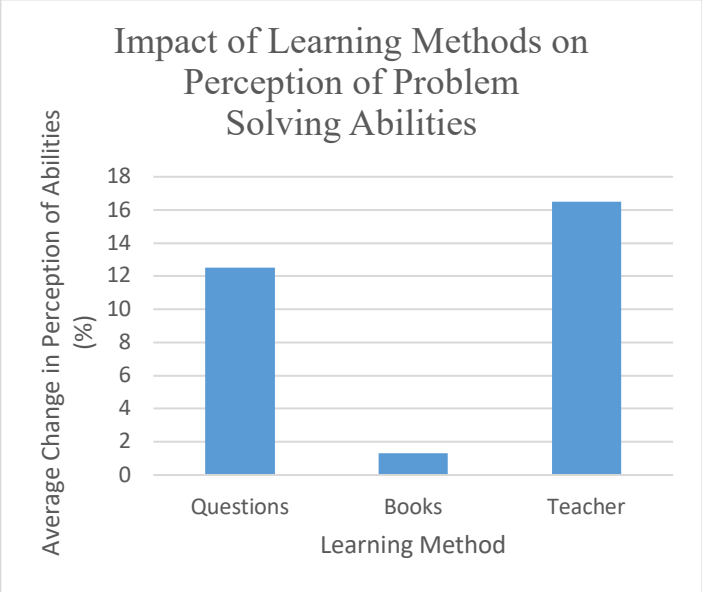

Figure 5: Impact of learning methods of a subject's perception of their problem-solving abilities

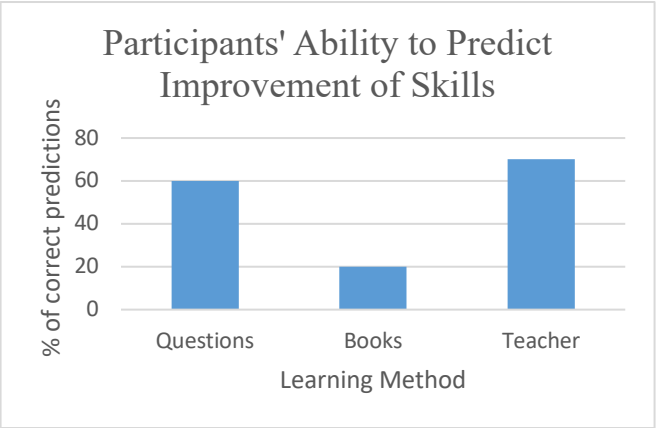

Figure 6: Percentage of correct predictions by a subject of whether there was improvement after using a learning method

Table 1: Results of the experiment

Name	Method	CCC Before	CCC After	pt. change	% change	Hobbies	Mark	CCC Highest	Rate Skill	Rate Problem	Rate Enjoy	School Attitude	Abilities Improve	Rate Skill 2	Rate Problem 2	% change problem
Subject 1	questions	30	34	4	13.33	Fortnite, watching youtube, swimming	98	34	Adv	8	8	meh	Y	Adv	8	0
Subject 2	questions	23	30	7	30.43	Reading, watching TV	98	30	Inter	7	8	love	Y	Inter	8	14.29
Subject 3	questions	15	30	15	100	Reading, watching TV	99	30	Adv	9	8	Love	Y	Adv	10	11.11
Subject 4	questions	30	34	4	13.33	Computer science, League	99	37	Inter	9	9	meh	Ni	Inter	9	0
Subject 5	questions	21	30	9	42.86	Robotics, reading	97	28	Inter	7	8	love	Y	Inter	7	0
Subject 6	questions	30	45	15	50	Photography, Piano	99	30	inter	9	9	love	y	adv	9	0
Subject 7	questions	26	32	6	23.08	Reading, Drawing	95	16	inter	7	7	love	n	inter	7	0
Subject 8	questions	10	7	-3	-30	Basketball, Piano	92	N/A	beg	3	5	meh	y	inter	5	66.67
Subject 9	questions	10	13	3	30	Golf, basketball	85	5	beg	7	2	love	y	beg	7	0
Subject 10	questions	10	5	-5	-50	tennis, badminton	97	10	inter	6	8	love	y	inter	8	33.33
Subject 11	book	30	34	4	13.33	singing, running	94	23	beg	10	10	love	n	inter	10	0
Subject 12	book	25	30	5	20	basketball, swimming	95	20	beg	8	9	meh	n	beg	8	0
Subject 13	book	30	30	0	0	netflix	94	30	inter	5	10	meh	n	adv	5	0
Subject 14	book	24	30	6	25	acting, dancing	98	20	inter	7	7	friends	n	inter	7	0
Subject 15	book	24	35	11	45.83	singing, basketball	93	16	beg	8	9	friends	n	beg	8	0
Subject 16	book	30	24	-6	-20	reading, violin	99	30	adv	9	5	meh	y	adv	9	0
Subject 17	book	10	10	0	0	soccer, basketball	83	N/A	beg	9	5	love	y	beg	9	0
Subject 18	book	10	23	13	130	singing, soccer	95	0	beg	5	5	love	y	beg	5	0
Subject 19	book	27	28	1	3.7	basketball, piano	96	15	inter	8	9	meh	n	inter	9	12.5
Subject 20	book	16	18	2	12.5	saxophone, drawing	82	10	beg	8	8	friends	n	beg	8	0
Subject 21	teacher	15	30	15	100	drawing, singing	72	0	beg	9	4	meh	y	inter	7	-22.22
Subject 22	teacher	32	34	2	6.25	basketball, badminton	98	30	inter	8	8	love	n	inter	8	0
Subject 23	teacher	0	23	23	Infinite	swimming, fishing	95	N/A	beg	8	4	love	y	inter	9	12.5
Subject 24	teacher	10	25	15	150	piano, swimming	99	N/A	beg	4	7	love	y	beg	8	100
Subject 25	teacher	27	30	3	11.11	powerlifting, running	86	5	inter	7	7	meh	n	inter	8	14.29
Subject 26	teacher	30	45	15	50	swimming, programming	82	30	adv	8	10	meh	y	adv	9	12.5
Subject 27	teacher	30	30	0	0	golf, swimming	93	23	inter	7	9	love	n	inter	8	14.29
Subject 28	teacher	10	25	15	150	cooking, piano	98	0	beg	6	6	love	y	inter	8	33.33
Subject 29	teacher	11	30	19	172.73	skiing, cross-country running	88	N/A	beg	7	5	love	y	inter	7	0
Subject 30	teacher	23	25	2	8.7	swimming, skiing	96	10	inter	8	8	love	n	inter	8	0

IV. DISCUSSION & CONCLUSION

The hypothesis that teaching is the most effective method to learn a programming language was proven correct. Through figure one, an average improvement of 72% was seen when using a teacher, while there was only an average improvement of

23% with a book and 22% with questions. However, when a subject achieved a score of greater than 15 points in the first contest, there was an average improvement of only 15% using a teacher, compared to an improvement of 29% doing questions (figure 2). This indicated that a teacher was extremely useful during the beginning stages of learning a language, but that intermediate to advanced programmers benefited more from self-learning.

According to "Ten Quick Tips for Teaching Programming", peer instruction is extremely useful during the course of learning a programming language. This explains why the average improvement seen through using a teacher is more than 3 times that of the next method, reading a book. One possible error that may have contributed to the dramatic decline in improvement using a teacher with more advanced developers was that the knowledge was artificially limited. Teachers were instructed to only teach certain topics which advanced developers most likely already knew, decreasing the amount of new material that could have been learned. Another possible error in collecting the data was that skill levels were not evenly distributed among the learning methods. This resulted in an extremely high improvement average for books with people who scored less than 15 in the first CCC, even though only one subject improved, which the others' skills remained the same.

V. APPLICATION

The results from this study can be used to inform the development of the educational curriculum of Ontario and other provinces. As programming becomes more and more essential in the workplace, it is crucial that students are given the best education possible. Policymakers can use the results of this study to design a learning environment that benefits students of all levels. Current students can also use the results of this study to further their own learning to ensure that they are making the most of their limited time to learn programming. Further research can explore the relationships between perceived improvement and the learning methods used so that students can accurately gauge their abilities, or how learning methods can be combined to produce even better results. The results of this study can also be applied to education in other subjects, namely that students at different levels may learn differently and that many types of learning methods should be presented to students.

VI. REFERENCES

O'Brien, S. (2019, January 26). Here are the most in-demand jobs for 2019. Retrieved on March 16, 2019 from https://www.cnbc.com/2019/01/24/here-are-the-most-in-demand-jobs-for-2019.html

U.S. Bureau of Labor Statistics. (2013, January 12). OOG Winter 2013-14. Retrieved on March 16, 2019 from https://www.legis.iowa.gov/docs/publications/SD/21103.pdf

Yang, S. (n.d.). 7 reasons to study in class rather than study alone. Retrieved on March 16, 2019 from http://www.slaneylanguage.com/7-reasons-to-study-in-class-rather-than-study-alone/

Young, S. (2018, April 04). Why Self-Educated Learners Often Come Up Short. Retrieved on March 16, 2019 from https://www.scotthyoung.com/blog/2010/02/24/self-education-failings/

The Effects of R&B Music on Academic Test Writing Ability

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Abstract

When students listening to music when studying, does it even have an effect on them? R&B music today is very popular. So, how does R&B music affect academic performance when under stress? In this experiment, five subjects the same grade and academic ability wrote two test. The tests consisted of five questions of all different school subjects. One was written with music and one without, in the span of seven minute for each test. The results showed that 3 out of 5 of the subjects improved their test score on the second test (with music). Scores were improved around 10% on average. The subjects also felt more clam, and confident while writing the test with music. The results showed that the subjects were more productive writing the second test. On average, there was a one minute difference in the time it took the subjects to finish the tests (test 2 was more productive). 4 out of 5 improved their neatness of work, or it stayed the same, and subjects showed calm body positions while writing the second test (ex. uncrossed legs, no fidgeting). There were two subjects who were outliers but, participants may not like working with music therefore it didn't show the same results. In conclusion, R&B does help improve academic test writing ability; however everyone has different ways of learning that has to be taken into consideration.

I. INTRODUCTION

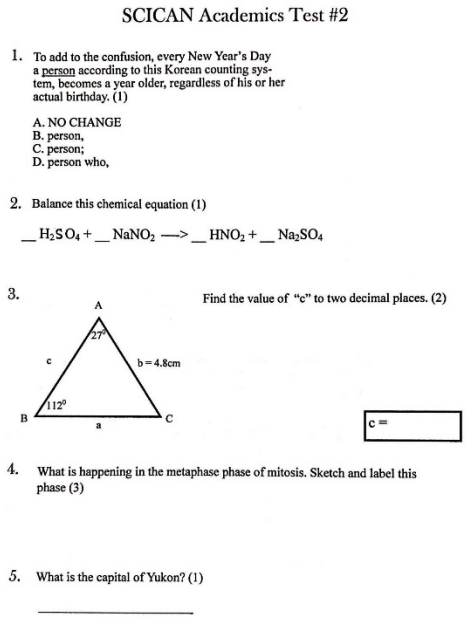
Music is a huge part of our everyday life. Most students listen to music when doing school work to help them stay focused or to be more productive. Does this impact or benefit them in any way? It is important to figure this out because it can help affect the way people study, or how to calm people down during a stressful situation if music does impact performance positively (I.e. A test) (Kazilek, 2014). Another reason why this topic is relevant is because it can help many people who suffer from anxiety and stress by knowing what works best for them (listening to music or not listening to music) (Collingwood, 2018). Answering this question will impact many people in a positive way.

The question relating to this topic is, how does R&B music affect people's performance when under stress?

If people listen to music when under a stressful situation, then, their performance will improve compared to when they are not listening to music. This is because those who listen to music have higher productivity than those who don't. Also, students who are struggling listen to music to stay on task and complete their work without feeling stressed or overwhelmed (Thompson 2017). Also, what happens when music enters brains is it kick starts our pleasure centers. This releases dopamine in your brain which makes you feel happy. Feeling happy when doing something can positively change the way one approaches an activity. This will improve performance since people are approaching the activity with a positive mindset (Ashford 2017).

II. METHODS

This experiment was conducted on 5 grade 10 participants that had the around same academic ability. The participants wrote 2 very similar academic tests that consisted of 5 questions that included school subjects like math, science, geography and English. The 5 subjects sat at five different desks far from each other. The first test was handed out, and a pencil, eraser and calculator was also given. The subjects wrote this test in a quiet room and had 7 minutes to complete the test. When 7 minutes was up, the subjects stopped writing, and time took to finish the test, mood, body movement, neatness and test score were recorded. After the first test, a new set of questions (same format, similar types of questions) was handed out to the subjects. This time, the subjects listened to the R&B artist, "Khalid" through earbuds. The whole test writing process stated before, was repeated and once again, the results were recorded after 7 minutes. The two tests that the subjects wrote:



SCICAN Academics Test #2

1. To add to the confusion, every New Year's Day a person according to this Korean counting system, becomes a year older, regardless of his or her actual birthday. (1)

   A. NO CHANGE
   B. person,
   C. person;
   D. person who,

2. Balance this chemical equation (1)

   $\_\_ H_2SO_4 + \_\_ NaNO_2 \longrightarrow \_\_ HNO_2 + \_\_ Na_2SO_4$

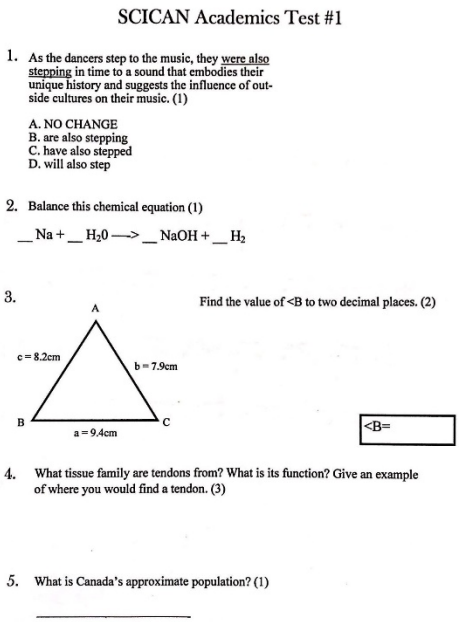
3. Find the value of "c" to two decimal places. (2)

   c =

4. What is happening in the metaphase phase of mitosis. Sketch and label this phase (3)

5. What is the capital of Yukon? (1)

   _____



SCICAN Academics Test #1

1. As the dancers step to the music, they were also stepping in time to a sound that embodies their unique history and suggests the influence of outside cultures on their music. (1)

   A. NO CHANGE
   B. are also stepping
   C. have also stepped
   D. will also step

2. Balance this chemical equation (1)

   $\_\_ Na + \_\_ H_20 \longrightarrow \_\_ NaOH + \_\_ H_2$

3. Find the value of <B to two decimal places. (2)

   <B=

4. What tissue family are tendons from? What is its function? Give an example of where you would find a tendon. (3)

5. What is Canada's approximate population? (1)

   _____

The independent variable was the environment of the test writing room. One test was written with music and one was written without. The dependent variables were the test scores, body movement, time to finish test, mood of subjects, and neatness of work. The controlled variables were the same tests (different tests each round but same test for both people), same environment, same people, same # of people, same age, same academic ability, same song, same pencil and eraser, same volume of music, same time (7 mins), and same seat/desk. These controlled variables were chosen because if these components weren't the same, then the result would not be accurate. For same tests, each subject

needed to be writing the same test and have the same academic ability to get results as authentic and precise as possible. The environment also had to be the same so the subjects can stay concentrated both rounds. Same music was also a factor too. The same song had to be listened because different types of music can affect the test scores. If these controlled variables weren't in place, the results of this experiment would be modified a large amount producing inaccurate results.

III. RESULTS

Table 1: *Academic test results while subjects listen to music compared to when subjects are not listening to music, and the effects it has.*

	TEST #1 SCORES (no music)	TEST #2 (with music)	BODY MOVEMENTS TEST #1	BODY MOVEMENTS TEST #2	TIME LEFT OVER (if any) TEST #1	TIME LEFT OVER (if any) TEST #2	MOOD TEST #1	MOOD TEST #2	NEATNESS OF WORK TEST #1	NEATNESS OF WORK TEST #2
PERSON 1	5/8	7/8	- looks calm - fidgeting - crossed legs	- looks calm - uncrossed legs	N/A	N/A	"Calm"	"Calm and Concentrated"	Very Neat	Very Neat
PERSON 2	7/8	5/8	- looks calm - bouncing leg	- looks more calm - uncrossed legs	N/A	N/A	"Calm"	"Very concentrated"	Very Neat	Very Neat
PERSON 3	4/8	6/8	- normally working (looks calm) - bouncing leg	- looks calm - bobbing to music - uncrossed legs	N/A	2 mins	"Stressed. Especially when answering the math question"	"Felt pretty confident"	Okay Neatness	Very Neat

PERSON 4	6/8	6/8	- crossed legs under chair - panicking close to finish time - bouncing leg	- looks focused - looks calm - legs still crossed	N/A	N/A	"Excited"	"Happy, felt Excellent"	Neat	A bit messy
PERSON 5	6/8	8/8	- looks calm - looks distracted	- looks calm - bobbing to music	2.16 mins	3.5 mins	"felt a bit under pressure"	"felt confident with the music"	Neat	Neat

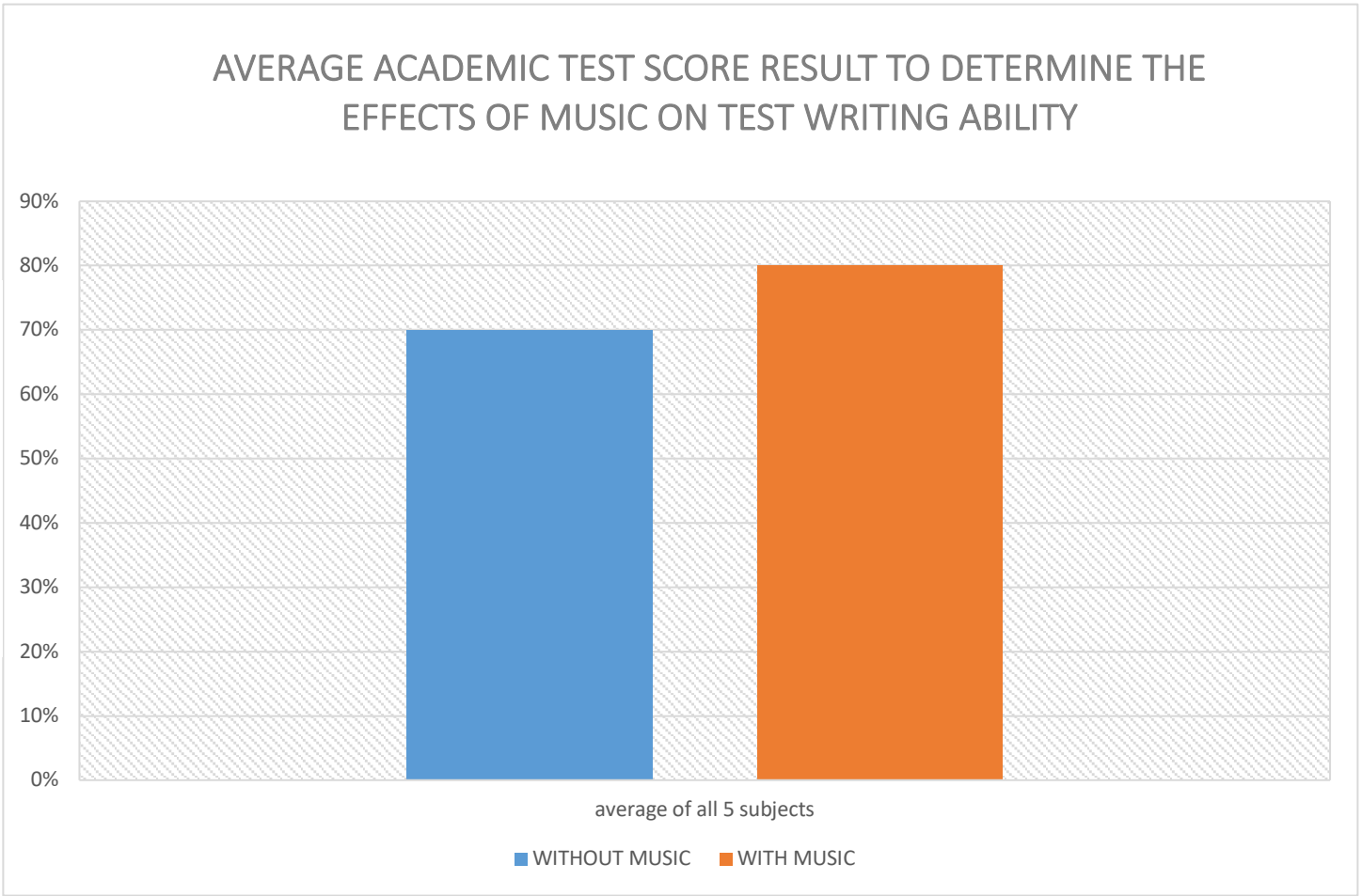


Figure 1: *A graph showing the average test scores of all 5 subjects who wrote two academic tests. One with music and one without.*

IV. DICUSSION & CONCLUSION

In conclusion, the hypothesis was correct. Three out of five of the people who wrote both academic test (one with music and one without), showed better test scores while listening to music compared to no music. When under a stressful situation, like taking an academic test, listening to music improved performance. Not only does it improve performance but listening to music while under a stressful situation was very effective. As shown in the chart (see results section), every single person who wrote the test had a better mood while writing test #2 (with music). This chart also shows that music helped with staying productive. For subjects who finished early, it showed that more time was left over after doing test #2. Body movement and neatness of work was also a factor of consideration. Although one person out of the five did not improve during test 2, and one person had the same test score for both of them, everyone's body movement improved while writing test #2, and 4/5 either improved their neatness of their work or it stayed the same. In conclusion, while under a stressful situation, performance improved in these ways:

- test scores
- mood
- productivity
- neatness
- body movement

Test scores improves for 3/5 of the people because of all of the other factors are affected by music. For example, mood, productivity, neatness, and body movement. Everyone has a better mood while writing test #2 because when music enters our brains is it kickstarts our pleasure centers. This releases dopamine in the brain which causes happiness. Feeling happy when doing something positively changes the way people approach an activity. This is why the subjects feel more confident while writing the test which helps with performing better. For those who finished significantly earlier on test #2, it is because workers who listen to music, come up with better ideas and complete tasks more quickly than those who don't. Also, when surgeons listen to music when operating, they work faster, more accurately, and they are also less stressed (as many articles researched says). Since people who listen to music have a higher productivity level than those who don't, this is how music improves performance. Also, the neatness and body movement for everyone is better for test #2 because of their happy/calm mood, and their productivity which then all relates back to the question… how does music affect performance when under stress? In conclusion, when listening to music, performance improves, as well as mood, body movements, productivity, and neatness.

V. APPLICATION

Music is a very broad concept in the world we live in today; the uses of music are endless, but the enjoyment of music is what is most important. With all the research and the results, music can be useful

in classrooms, while studying or when doing something that calls for a positive mindset/mood. In the future if this is tested again, the effects of different types of music can also be useful information. This information can be applied to many different occupations in the real world; for example, fitness coaches can use music to help clients stay focused or motivated. In a totally different field, music can be used by surgeons when performing a surgery, like said in many articles; listening to music helps with staying focused, working more faster & accurately, and reducing the stress of surgeons.

VI. REFERENCES

Ashford. (2017, June 07). How Does Music Affect Your Brain? Retrieved on March 5th, 2019 from https://www.ashford.edu/online-degrees/student-lifestyle/how-does-music-affect-your-brain

Collingwood, J. (2018, October 08). The Power of Music to Reduce Stress. Retrieved on March 5th, 2019 from https://psychcentral.com/lib/the-power-of-music-to-reduce-stress/

Dewi, C. F., Margawati, A., & Mu'in, M. (December 31st, 2018). Effects of Progressive Muscle Relaxation with Music and Aromatherapy on Decreasing Stress Levels among Teachers. Retrieved on March 26th, 2019, from https://ejournal.undip.ac.id/index.php/medianers/article/view/20681

Eun-Young, Seo, Hyung-Eun, Choi, Chang, Bo-Kyung, . . . Miyoung. (March 30th, 2018). Effects of Group Art and Music Therapy in Newly Hired Nurses: A Mixed Method Study. Retrieved on March 26th, 2019 from https://synapse.koreamed.org/search.php?where=aview&id=10.11111/jkana.2018.24.2.118&code=0163JKANA&vmode=FULL

Kazilek. (2014, June 13). Does Playing Music Reduce Stress? Retrieved on March 5th, 2019 from https://askabiologist.asu.edu/plosable/does-playing-music-reduce-stress

Thompson, V. (2017, November 21). Does Listening to Music While Doing Homework Affect Your Grade in School? Retrieved on March 5th, 2019 from https://education.seattlepi.com/listening-music-doing-homework-affect-grade-school-1365.html

Optimum Combination of the 5 Flavors for Best Tasting Dish

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Abstract:

One of the foundations of economy is food, trillions of dollars each year are spent growing, harvesting, combining and tasting food. Which all try to solve a simple question, what combination of the 5 main flavors will produce a great tasting finished product? The experiment tested combinations by altering amounts of saltiness, sweetness, bitterness, umami and sourness. The process involved a group of subjects rating 5 variations of a bitter and a savory food item; kale and fish, with different seasoning amounts. Each putting a focus on a different flavor per portion. The results showed 2 main trends. The sourness of lemons when paired with savory fish produced the highest rating out of ten. Bitter kale and sweet sugar were also rated very high when compared to the other kale ratings. The findings proved that opposing flavors that oppose each other, which ever flavor is more present in the overall dish will dictate the overall rating; in this case the sweetness overpowered the bitterness resulting a good taste. Some implications that the results could be used for are mass produced foods. None of the results were high enough to satisfy palates of 5-star restaurant customers, so the findings can reduce experimentation time for those who are looking for a quick fix for flavor combinations like fast food industries.

I. INTRODUCTION

The food industry is without a doubt the largest part of the world economy. Every living thing needs it, but many aren't satisfied with simply meeting those needs. If nutrition was the most important factor, then many people around the world would be out of a job. Billions are spent just to taste something extraordinary or unique. Many ingredients are prized for their chemical properties and combining them can produce a favorable reaction. However, it can just as easily produce something grotesque. The key to good food is a great balance of the 5 universally recognized flavors, bitterness, sweetness, saltiness, umami and sourness. [Newly Weds Foods, 2017] For example, an Indian plant known as gymnema sylvestre can take away one's ability to taste sweet, the effects are inspiring, with descriptions like it makes fruit taste like an acid bomb and chocolate cake like baking soda. [Arnold, 2015] The importance of sweetness is obvious enormous; however, it is not the only one.

Another flavor that is seen to have great impact on overall taste is saltiness. The human brain is designed to ensure the body consumes only a certain amount of salt. A small quantity tastes good but too much is supposed to trigger the natural response of bad taste, since human biology is designed to only function on a good balance of salt. [McQuaid, 2015] A greater understanding of these

properties can help give a greater starting block for anyone who begins experiments with ingredients.

The main problem that this project is attempting to answer is: what combination of the 5 flavors can produce an exquisite result? It is hypothesized that if 2 very different flavors are combined, then the result will taste better than other combinations because the difference will either mellow a distasteful flavor or enhance a tasty base flavor.

II. METHODS

Split 3 leaves of kale into 5 equal portions. Seasoned 3 with 2g of salt, 2g of sugar and 2g of lemon juice. Seasoned next 3 with 6g of salt, 6g of sugar and 6g of lemon juice. Seasoned next 3 with 2g of salt, 2g of sugar and 7g of lemon juice. Seasoned next 3 with 7g of salt, 2g of sugar and 2g of lemon juice. Seasoned final 3 with 2g of salt, 7g of sugar and 2g of lemon juice. Took 5 from each variation and pan fried for 7 minutes. Immediately had 5 subjects taste each portion and rate on scale from 1-10. Took another 5 of each variation and boiled for 5 minutes. Immediately had 5 subjects taste each portion and rate on scale from 1-10. Took another 5 of each variation and toasted for 7 minutes. Immediately had 5 subjects taste each portion and rate on scale from 1-10. To keep portion flavors from conflicting had subjects slosh water in mouths before trying each.

Then began cooking the fish. Split it into 5 different portions and seasoned likewise. Boiled 5 variations for 20 minutes and then had subjects taste and rate. Pan fried 5 others for 8 minutes total then had subjects' taste. Finally toasted final portions for 10 minutes.

The independent variables of the experiment were the amounts of salt, sugar and acids. And the dependent variables were the taste ratings that the subjects provided. There were many controls such as the pots and pans which remained consistently clean, the utensils which also remained clean. The source of water because there can be changes in minerals depending on filtration system. Portion size had to remain consistent, so cooking time and absorption of seasoning didn't change. The type of oil was a light cooking oil because if another type it could have interfered with results. The cooking time and rest time remained consistent to ensure no deviation in results.

III. RESULTS

Base Ingredient + Version	Salt (g)	Sugar (g)	Acids (g)	Technique	Taste Score avg. 1-10
Fish 1.1	2	2	2	Boil	6
Fish 1.2	6	6	6	Boil	4.6
Fish 1.3	2	2	**7**	Boil	6
Fish 1.4	**7**	2	2	Boil	4.6
Fish 1.5	2	**7**	2	Boil	2.3
Fish 2.1	2	2	2	Pan-Fry	6.2
Fish 2.2	6	6	6	Pan-Fry	3.7
Fish 2.3	2	2	**7**	Pan-Fry	5.7
Fish 2.4	**7**	2	2	Pan-Fry	2
Fish 2.5	2	**7**	2	Pan-Fry	2.3

Fish 3.1	2	2	2	Toasted	4.8
Fish 3.2	6	6	6	Toasted	2.2
Fish 3.3	2	2	**7**	Toasted	5.8
Fish 3.4	**7**	2	2	Toasted	1.8
Fish 3.5	2	**7**	2	Toasted	2.8

Table 1: Amount of seasoning used, avg rating and technique for each portion of fish

Figure 1: Average ratings of 5 variations of fish cooked 3 different ways tasted by 5 different subjects

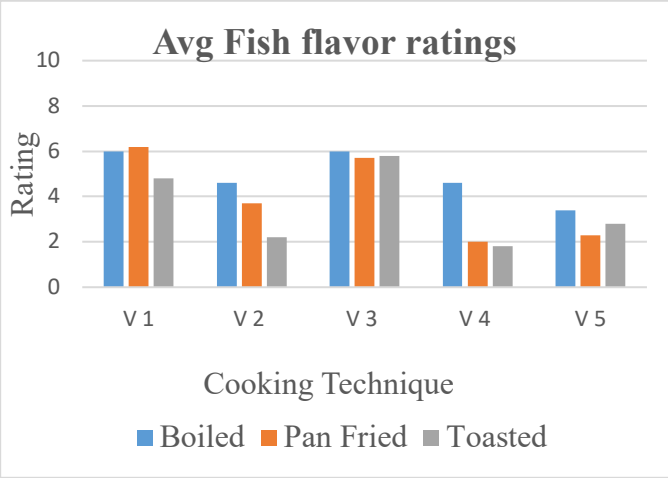

Figure 1:

V1: 2g of every seasoning

V2: 6g of every seasoning

V3: Elevated amounts of sourness

V4: Elevated amounts of saltiness

V5: Elevated amounts of sweetness

Base Ingredient + Version	Salt (g)	Sugar (g)	Acids (g)	Technique	Taste Score avg. 1-10
Kale 1.1	2	2	2	Boil	4.9
Kale 1.2	6	6	6	Boil	5.8
Kale 1.3	2	2	**7**	Boil	2.5
Kale 1.4	**7**	2	2	Boil	4.3
Kale 1.5	2	**7**	2	Boil	5
Kale 2.1	2	2	2	Pan-Fry	5.1
Kale 2.2	6	6	6	Pan-Fry	6.3
Kale 2.3	2	2	**7**	Pan-Fry	3
Kale 2.4	**7**	2	2	Pan-Fry	3.8
Kale 2.5	2	**7**	2	Pan-Fry	6.8
Kale 3.1	2	2	2	Toasted	5.2
Kale 3.2	6	6	6	Toasted	4.8
Kale 3.3	2	2	**7**	Toasted	2.7
Kale 3.4	**7**	2	2	Toasted	3.4
Kale 3.5	2	**7**	2	Toasted	4.5

Table 1: Amount of seasoning used, avg rating and technique for each portion of kale

Figure 2: Average ratings of 5 variations of kale cooked 3 different ways tasted by 5 different subjects

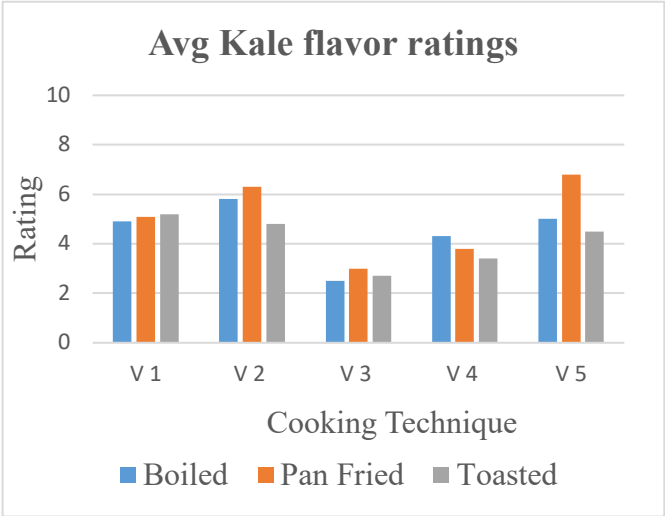

Figure 2:

V1: 2g of every seasoning

V2: 6g of every seasoning

V3: Elevated amounts of sourness

V4: Elevated amounts of saltiness

V5: Elevated amounts of sweetness

IV. DISCUSSION & CONCLUSION

Hypothesis was correct. The 2 opposing flavors did enhance flavors. The experiment proved that bitter tastes can be made better with sweetness since it produced the highest rating and savoury taste is best accompanied by acids because it produced some of the highest as well. Vice versa also occurred the similar tastes such as sour and bitter, which on there own both produce a cringe reaction, once combined performed the lowest in the kale tasting.

The reasoning behind the various outcomes can be supported by chemistry. The way sugar can counteract the bitterness of kale can be explained by the fact they both are sensed by G-Protein coupled receptors. Therefore, if one is stronger then the other, it can easily mask the other's taste. Which can lead to a positive rating since the direct source of sugar greatly outpowered the bitterness that is in kale. Moving on to the fish, citric acid can affect the savoury fish in a positive way because its hydrogen bonds can break in a process called protein acid denaturation. The result is cured meat, explaining the amplification in flavor as well as the high rating since all the subjects enjoy fish on its own. These results relate to the original problem because it reveals there is a set pattern which can be followed to unlock good flavors. The atrocious combination of bitterness and sourness is explained by a bioscience professor named Tim Jacob. He states that bitterness and sourness are aversive and are the body's natural sense to avoid it. With 2 at the same time it is normal for the body to detest the product even more.

Some problems that could have affected the results were the quality of each ingredient. How ever there are techniques to sort a good batch from a poor one, there is no guarantee they will taste exactly alike.

V. APPLICATION

The data collected can assist in fields like cooking. Providing a better understanding of each flavor and its interactions can help with the reliable production of tasteful dishes. A person in processed foods industry could use the information to create a recipe that follows the guidelines that the experiment revealed. The amount of time experimenting can be reduced because of the ability to rule out certain combinations. Questions that are raised by the experiment like what else is needed for a 5-star food can be answered through more intense study. Researching the other chemicals that create other pseudo flavors will become the next step. Further experimentation those chemicals can hopefully provide an even larger base for chefs and foodies to work upon.

VI. REFERENCES

Arnold, D. (2009, November 9). Cooking Issues. Retrieved June 13, 2019, from http://www.cookingissues.com/2009/11/12/how-to-make-everything-taste-bad-in-a-very-instructive-way-and-how-to-eat-20-limes/index.html

Foods, N. W. (2017, June 05). The Five Basic Tastes. Retrieved June 13, 2019, from https://newlywedsfoods.com/five-basic-tastes/

Giancoli, Andrea N. (2018 Sept). *Alternative Food preservatives.* Retrieved from http://go.galegroup.com/ps/retrieve.do?tabID=Magazines&resultListType=RESULT_LIST&searchResultsType=MultiTab&searchType=BasicSearchForm&currentPosition=1&docId=GALE%7CA551496629&docType=Brief+article&sort=Relevance&contentSegment=ZXBE-MOD1&prodId=SCIC&contentSet=GALE%7CA551496629&searchId=R2&userGroupName=ko_k12hs_d27&inPS=true

Harvard Publishing. (2015). *Should you get your nutrients from food or from supplements?* Retrieved on 16 Mar 2019 from https://www.health.harvard.edu/staying-healthy/should-you-get-your-nutrients-from-food-or-from-supplements

Jacob, T. (n.d.). Why do two great tastes sometimes not taste great together? Retrieved June 13, 2019, from https://www.scientificamerican.com/article/two-great-tastes-not-great-together/

Kielmas, M. (2019). *What Chemical Compounds are Thought to be Responsible for the Tastes of Bitter, Sour, Salty, and Sweet.* Retrieved from https://education.seattlepi.com/chemical-compounds-thought-responsible-tastes-bitter-sour-salty-sweet-4749.html

Palin, M., Gariépy, C., Blouin, R., Cliche, S., Sullivan, B., Fortin, F., & D'Astous-Pagé, J. (2017, February 12). Carnosine content in the porcine longissimus thoracis muscle and its association with meat quality attributes and carnosine-related gene expression. Retrieved April 25, 2019, from https://www.ncbi.nlm.nih.gov/pubmed/27842245

Rana, S. (2019). *Have You Been Eating Bananas with Milk?* Retrieved on 16 Mar 2019 from https://food.ndtv.com/food-drinks/have-you-been-eating-bananas-with-milk-you-must-read-this-1694129

Supraja, S. (2018). *10 Dangerous Food Combinations to Avoid.* Retrieved on 16 March 2019 from https://www.stylecraze.com/articles/dangerous-food-combinations-to-avoid/#gref

Thandapilly, S. J., Wang, Y., Harding, S. V., Tosh, S. M., Jones, P. J., & Ames, N. P. (2017, November 8). Barley β-glucan reduces blood cholesterol levels via interrupting bile acid metabolism. Retrieved April 25, 2019, from https://www.ncbi.nlm.nih.gov/pubmed/29115200

The effect of Nintendo's Brain Age on Math and Memory

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Abstract

The popular video game "Brain Age, Train Your Brain in Minutes a Day" has been used by many people in the world, but does the video game actually help leave a positive effect on the Brain specifically for math and memory? The community has already associated itself with the advancements of technology and the need for new engaging methods of helping those who are struggling is greatly needed for a tech advanced future. Results were generated by the use of test written before the influence of Brain Age and after the use of the game. Overall, the use of Brain Age has made a benefit on the Brain by raising test scores from the test results without the use of Brain Age. This has shown to be an engaging, valid method to help those who are in need of assistance with their education or just to better one's self.

I. INTRODUCTION

As the brain continues to age in the human body, the brain starts to deteriorate and become less effective as you get older. Examples of changes that progressively get worse is memory capacity, names of people, numbers and the ability to multitask, according to medicalnewstoday. This calls for a need for various methods to help keep the brain at its peak and with the rise of the use of technology in today's society, technology is needed to be used with new methods, so they can be effective in the future. One method can be able to get people to keep their brains healthy is to use popular gaming devices to get many people, specifically kids to play brain trainer games, so there brains could get exercise every day. A popular game that concentrated on the brain was on the Nintendo DS called Brain Age: Train your brain in minutes a day. Its sole purpose is to promote the human brain to exercise a little every day by doing various tasks, like math, literacy, and memory exercises. Nouchi and his colleagues (2012) stated that the game Brain Age: Train your brain in minutes a day! is able to improve executive functions and speed up processing speeds on a short term basis for the elderly (Nouchi R, Taki Y, Takeuchi H, Hashizume H, Akitsuki Y, et al, 2012). Due to its success in the early 2000's, more games were produced with the same purpose to promote that the health of the human brain is extremely important for everyone in the whole world.

II. Methods

This experiment involved four grade 10 students of academic level or above and were 15 or above. These four test subjects were given a two minute preliminary test to see how well their math skills are. The test should consist of basic math problems involving BEDMAS. A question on the test could be: 2x3+8-6/1. Afterwards, the subjects were given a maximum of 10 minutes a day to use the Brain Age for two days. Then the subjects would be given a new two minute test to see how much improvement was there with the influence of the Brain Age game. The same experiment would be done for the memory session, with the test being two pictures and questions based on the pictures given. An example of a question that could be: what colour was the man in the left corner. The Brain Age game would be used again to see if any improvement would be seen in the final test. The independent variable in this experiment would be the time spent for everything because if I let the subjects take as long as they want, then the results wouldn't be as accurate, so giving a time limit to all subjects will make the experiment fair and would produce more accurate results. Accuracy on the test and time spent every day using the game are dependant variables because the results on the final test are determined by how much time was dedicated to using the Brain Age. For the first test, it was based on initial skill on what the test on. Controlled variables would include loudness of environment, type of writing utensil used, test everyone writes, etc. because if I placed everyone in a distracting environment, then people can't focus and results would be skewed. Also, different writing utensils will give a different grip to the hand and if everyone has written different tests, then this will not give accurate results than everyone under the same circumstances and producing accurate results.

III. Results

Graph 1: Results from the first and final test (Math)

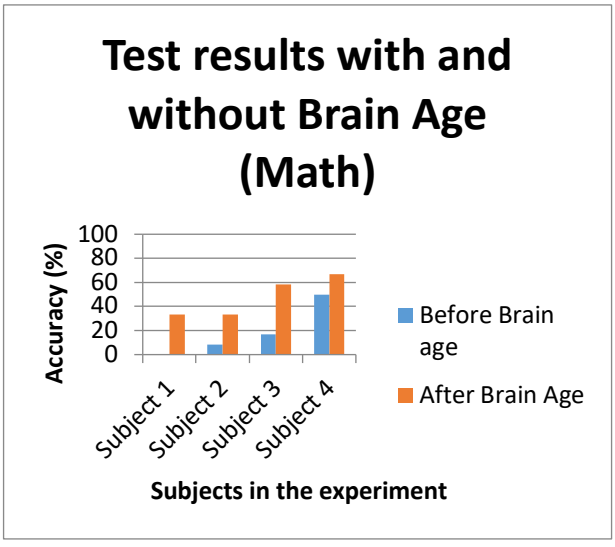

Table 1: Time used for Brain Age Game Day 1

Subject number	Time Taken (Minutes)
1	5:00
2	7:00
3	5:30
4	4:30

Table 2: Time used for Brain Age Game Day 2

Subject number	Time Taken (Minutes)
1	6:00
2	8:00
3	5:00
4	3:00

Graph 2: Results from first and last test (memory)

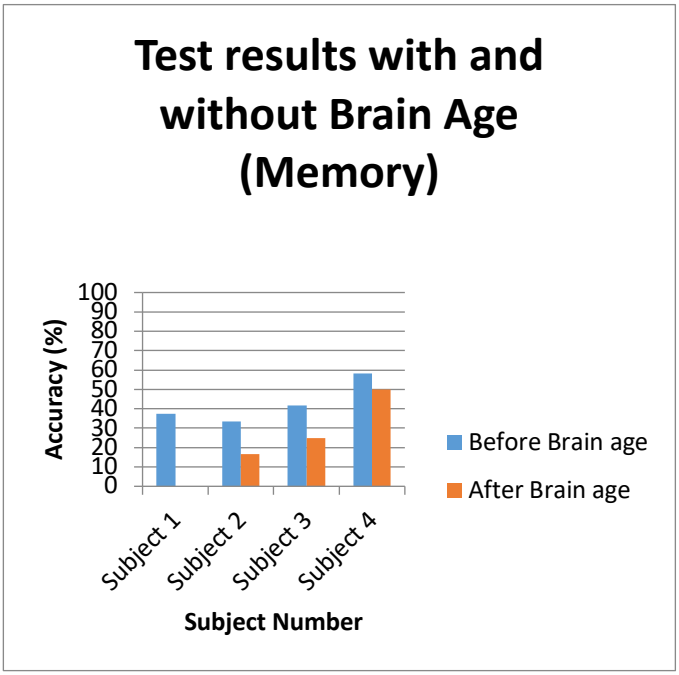

Table 3: Time used for Brain Age Game Day 1

Subject number	Time Taken (Minutes)
1	NA
2	4:00
3	2:55
4	3:20

Table 4: Time used for Brain Age Game Day 2

Subject number	Time Taken (Minutes)
1	NA
2	3:00
3	3:15
4	2:50

IV. DISCUSSION/CONCLUSION

Overall, the hypothesis is correct because as shown in the graphs for the results on the test, the results on the final test went up. For the math session, the average went up from 18.75% to 47.9%. Also, the time spent using the Brain Age decreased by about a minute, which shows that the brain is able to do the questions in less time than the first time. This has proven to be a good way to motivate everyone to train their brain because improvement occurred even when Brain Age was used for only two days, so imagine what the effect could be if it is used for a long period of time. The game's purpose is to stimulate/exercise the brain by giving it questions that involved math, memory and literacy and this will strengthen the brain to have a better memory capacity

and be able to do simple task easily if the game is used every day. The results I got are similar to what other studies have shown because the results saw significant improvement, leaving a positive effect on the brain. Even though the final results for the memory went from 42.6% to 22.9%, this occurred due to other test the subjects had and the stress implemented on them and that affected their performance. If they didn't have that influence, then the results could have went up by 20% - 30% better.

V. ANALYSIS

Teachers can use these results to help engage their students strive to get better because doing everything on pencil and paper isn't very inviting and that the effect on the brain is slowly becoming less effective. With the use of this game in the classroom, not only will the student's results will improve, but the students will also like the use of video games in the classroom and its lasting effect on the students will last longer due to engagement to the method used. Also, further studies can figure out how to make video games like Brain Age even better, so the impact on the brain would be even more significant and better for people in the future. Overall, this topic is important for society in the future as technology is constantly being improved and is being used in everyday life to benefit society for the future.

VI. REFERENCES

Nouchi R, Taki Y, Takeuchi H, Hashizume H, Akitsuki Y, et al. (2012) Brain Training Game Improves Executive Functions and Processing Speed in the Elderly: A Randomized Controlled Trial. PLOS ONE 7(1): e29676. https://doi.org/10.1371/journal.pone.0029676

Hannah Nichols, August 2017, What happens to the brain as we age?, retrieved from

https://www.medicalnewstoday.com/articles/319185.php

The Effects Of Caffeine On Test Scores

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Abstract

The relevance of this project lies under the factor that many of today's youth use caffeine without knowing if it is an obstructive behavior that negatively affects their test scores, or whether it is behavior that benefits them instead. The question investigated in the experiment is : How does having caffeine while studying affect performance on a test? To answer this question 3 students of 10th grade reading level completed 3 Grade 10 level comprehension tests. A different test was written each day within a 3 day period, the first days test was written after ingesting 0 caffeine, the second days test was written after ingesting 150 mg of caffeine, and the third days test was written after ingesting 300 mg of caffeine. The results depicted that students performed better after ingesting 150 mg of caffeine and worse when ingesting 300 mg of caffeine when compared to their first day test scores which were written with 0 caffeine. Based on the results found it was concluded that the initial hypothesis was partially correct. Based on the collected data it was found that the performance of students on tests is enhanced when coffee is ingested in servings of 150 mg prior to test writing, in comparison to ingesting either none or 300 mg of caffeine. This data goes to show that too much of anything is deteriorating to our body especially caffeine, but in contrast to this if caffeine is used in it's intended serving size it can have positive effects on your performance on a test.

I. Introduction

Many students drink caffeine to study, do homework, and even just to feel energized. Due to the fact that schools require such outstanding academic performance, it is crucial for students to know if their daily "Caffeine" is benefiting their grades, or if it's bringing them down. Therefore, students will know what will suit them better for them to succeed in their academic performance. This project is relevant due to the high use of caffeine within students to perform better on tests/exams. There have been many debates on whether caffeine was beneficial or detrimental effects on grades but many agree that the effects are beneficial. One of the most recent experiments was done at John Hopkins University by "Michael Yassa, an assistance professor of psychological and brain sciences… and his team of scientists" which investigated the effects of caffeine on long-term memory. (Gatlin 2014) They found that more members from the caffeine group compared to the placebo group were able to correctly differentiate between the old and new images and realize they were similar, instead of saying they were the same. This is called pattern

separation, which showcased a deeper level of memory retention.

The question intended to be answered in this project was "How does having caffeine while studying affect performance on a test?". After reading over many google articles on this subject, the conclusion was made that If people drink caffeinated drinks while studying then they will focus better and perform better on a test because caffeine helps you stay alert. Caffeine elevates a person's heart which results in the brain being able to comprehend and focus on information easier. (McWilliams 2014)

II. Methods

3 Students of Grade 10 level education (Aged 15-16) participated in this study. This experiment was done over a 3-day period. In a closed environment, the subjects were asked to complete one reading test each day 45 minutes after drinking either "Mug 1" (No caffeine), "Mug 2" (150 mg of Caffeine), or "Mug 3" (300 mg of caffeine). All three tests were similar in length and difficulty and were followed by 10 - 12 multiple choice questions. The first test, Kevlar| Nonfiction Reading Test 1", was to be completed on the first day after participants ingested "Mug 1" (No caffeine). The second test, "Tigers" | Nonfiction Reading Test 1", was to be completed on the second day after participants ingested "Mug 2" (150 mg of Caffeine). The third test, "Castles" | Nonfiction Reading Test 1", was to be completed on the third day after participants ingested "Mug 3" (300 mg of Caffeine). Using a stopwatch, each subject was timed for how long it took to complete each test. After completing all three tests, they were graded using an answer bank provided with the assements, but not given to the participants. The results regarding how many of the participants' answers were correct and how much time it took to complete the tasks were recorded in three tables: *Table 1* for the results of the Kevlar Reading Test, *Table 2* for the results of the Tigers Reading Test, and *Table 3* for the results of the Castles Reading Test.

In this experiment, the independent variable was the amount of caffeine the participants took prior to test writing; 0 mg of Caffeine, 150 mg of Caffeine, or 300 mg of Caffeine. The dependent variables were the number of correct answers given by the participants and the time it took the participants to complete the task. To ensure the experiment was accurate, several variables were controlled. The age of the students (15-16) was controlled to ensure that each participant writing the test had an equal chance. The environment they would write the test in was maintained the same to ensure that all internal and external factors remained the same for each test writer, The amount of caffeine each participant took prior to test writing was controlled to ensure the results were accurate. All three Reading Tests (Kevlar, Tigers, and Castles) were also controlled variable in the experiment because ensuring that

tests were controlled ensured that the experiment was fair and wiped out any bias that could have been present in using other tests. The last controlled variable was the stop watch, it was a a controlled variable and started when each participant began test writing and was stopped once the participant finished test writing. This controlled variable ensured that the data was accurate and free from human error

Kevlar | Nonfiction Reading Test 1 & Answer Key:

Name: _____

Nonfiction Reading Comprehension Test 7
Kevlar

Directions: Read the following passage and answer the questions that follow. Refer to the text to check your answers when appropriate.

Did you know that there is a fiber that is as flexible and lightweight as nylon yet five times stronger than steel? Did you know that this fabric is resistant to temperatures higher than 500 degrees Fahrenheit? Did you know that a woman invented this fiber? This miraculous fabric is called Kevlar and it is used to make everything from body armor to musical instruments.

The year was 1964. There were gasoline shortages due to conflict in the Middle East. A Polish-American chemist named Stephanie Louise Kwolek was working for DuPont, an American chemical company. She and her group were trying to make a lightweight, yet durable fiber to be used in tires. Lighter tires would allow vehicles to get better gas mileage, but the tires had to be strong enough to resist the wear and tear of the road. They had been working on the problem for some time and had little success, until Kwolek had a breakthrough.

Kwolek and her group were synthesizing or creating fibers to test. During one of the steps in the process Kwolek created a milky white solution by mixing two chemicals that were often used in the process. This solution was usually thrown away, but Kwolek convinced one of the technicians to help her test it. They were amazed to discover that the fabric that Kwolek had created was not only more durable than nylon, it was more durable than steel. Kwolek had invented Kevlar.

Kevlar is a remarkable fabric known for its strength and durability. Since its invention it has found its way into a wide variety of products. Kevlar is used in sporting equipment like bike tires, bowstrings, and tennis racquets. It is used in musical instruments like drum heads, reeds, and speaker cones. And it is used in protective gear like motorcycle safety jackets, gloves, and shoes. However, Kevlar is best known for its ability to stop bullets.

Richard Armellino created the first Kevlar bulletproof vest in 1975. It contained 15 layers of Kevlar, which could stop handgun and shotgun bullets. The vest also had a steel plate over the heart, which made the vest strong enough to stop rifle rounds. Vests like Armellino's were quickly picked up by police forces and it is estimated that by 1990, half of all police officers in America wore bulletproof vests daily. By 2006 there were over 2,000 documented police vest "saves," or instances where officers were protected from deadly wounds by wearing bulletproof vests.

Kevlar is an amazing fabric not only for its hardness and durability, but also for its heat resistance. Because of this it has been used to replace asbestos. Asbestos is a naturally occurring material that is known for its ability to resist fire. Asbestos can resist temperatures over 1000 degrees Fahrenheit. For this reason it was used in roofs, electrical cables, and brake pads, until people discovered that it causes cancer and other serious health problems. Kevlar poses no such risks. It is lightweight, flexible, and resistant to fire. Therefore, it has proven to be a good replacement for asbestos in many cases.

Since its invention in 1964, Kevlar has won its way into our lives. From musical instruments and brake pads to protective equipment and sporting gear, Kevlar is everywhere. Every day of your life you are exposed to something that was made better by Kevlar. Who'd have known?

1. Which of the following is **not** a product that has been made with Kevlar?

a. Tennis racquets
b. Bungee jumping cords
c. Brake pads
d. Body armor

2. When was the first bulletproof vest invented?

a. 1964
b. 1975
c. 1990
d. 2006

3. For which of the following characteristics is Kevlar known?

a. Heat resistance
b. Strength
c. Durability
d. All of the above

4. Who is credited with inventing Kevlar?

a. Robert Kevlar
b. Richard Armellino
c. Stephanie Kwolek
d. None of the above

5. Which of the following caused the search for a fabric like Kevlar?

a. A shortage in the gasoline supply
b. A desire to protect police officers
c. The need to replace asbestos
d. The want of better musical instruments

6. A vest made of 15 layers of Kevlar with **no** steel plates could stop **all but which** of the following rounds?

a. Handgun rounds
b. Shotgun pellets
c. Rifle rounds
d. It could stop all of the above

7. Why did people begin using asbestos in buildings?

a. It was extremely durable
b. It was very heavy
c. It was poisonous to insects
d. It was resistant to fire

8. According to the article, how many American police officers are estimated to wear bulletproof vests daily?

a. 1,000
b. 2,000
c. Over half
d. Almost all of them

9. How much stronger is Kevlar than steel?

a. Half as strong
b. As strong
c. Five times as strong
d. 200 times as strong

10. What product was Kwolek trying to improve when she invented Kevlar?

a. Tires
b. Milk
c. Brake pads
d. Armor

Kevlar
Answer Key

1. B
2. B
3. D
4. C
5. A
6. C
7. D
8. C
9. C
10. A

Tigers| Nonfiction Reading Test 2 & Answer Key:

Name: _____

Tigers | Nonfiction Reading Test 2

Who would win in a fight, a lion or a tiger? Well, if size has anything to do with the matter, the tiger would win. That's because tigers are the largest of all cat species. They grow up to eleven feet long and weigh as much as 670 lbs. This makes tigers the third largest land carnivore. The only larger land carnivores are polar bears and brown bears. Tigers are not only large, they are also fast. They can sprint as fast as 40 miles per hour for short distances and leap as far as 30 feet horizontally. This makes for an extremely dangerous pounce. You might not think that such large, fast, and ferocious creatures need help to survive, but they do. The tiger is an endangered species.

Despite all of the tiger's strengths, the future of the species is uncertain. Tigers face a very high risk of extinction. It is estimated that at the start of the 20th century, there were over 100,000 tigers living in the wild. By the turn of the century, the number of tigers outside of captivity dwindled to just over 3,000. Interestingly, the most serious threats that tigers face come from a much smaller species, one with an average weight of around 140 lbs. That species is Homo sapiens, better known as humans. Humans threaten tigers in primarily two ways: hunting and destroying habitat.

Tigers are hunted for many reasons. People have long valued the famous striped skins. Though trading tiger skins is now illegal in most parts of the world, tiger pelts are worth around $10,000 on the black-market. Though the fur would be incentive enough for most poachers, other parts of the tiger can also fetch a pretty penny. Some people in China and other Asian cultures believe that various tiger parts have healing properties. Traditional Chinese medicine calls for the use of tiger bones, amongst other parts, in some prescriptions.

Tigers have also been hunted as game. In other words people hunted tigers solely for the thrill and achievement of killing them. Such killings took place in large scale during the 19th and early 20th centuries, when a single maharaja or English hunter might claim to kill over a hundred tigers in their hunting career. Though this practice is much less popular today than it was in the past, it has not ceased entirely.

Humans have done considerable damage to the world's tiger population through hunting, but perhaps more damage has been caused through the destruction of habitat. Tigers once ranged widely across Asia, all the way from Turkey to the eastern coast of Russia. But over the past 100 years, tigers have lost 93% of their historic range. Instead of spanning all the way across Asia, the tiger population is now isolated in small pockets in south and southeastern Asia. This is because humans have drastically changed the environments. Humans have built towns and cities. Road and transit systems were created to connect these towns and cities. To feed the people living in these areas, forests and fields have been cleared to create farmland. Large tracts of land have been strip-mined to yield metals and other materials used in manufacturing. All of these activities have consumed habitats that at one time supported tigers.

A major obstacle to preserving tigers is the enormous amount of territory that each tiger requires. Each wild tiger demands between 200 and 300 square miles. Tigers are also both territorial and solitary animals. This means that they are protective of the areas that they claim and they generally do not share with other tigers. Because tigers need so much territory, it is difficult for conservationists to acquire land enough to support a large population of tigers. Even when such these considerable spaces are allocated, it is even more difficult to patrol such large areas to prevent poaching. There is no easy way to preserve the wild tiger population without making large sacrifices.

Though tiger population faces many threats and obstacles to recovery, there have been some successes in conservation and preservation efforts. For example, Save China's Tigers, an organization working to restore the wild tiger population, successfully rewilded a small number of South China tigers. These tigers were born into concrete cages from parents who were also captive and unable to sustain in the wild. This organization brought these tigers to South Africa and helped them learn the necessary skills for a predator to survive in the wild. Current evidence indicates that the project was been successful. While this is just a small step, it shows that restoring the world's tiger population is possible.

Directions: Read each question carefully and choose the best answer. Refer to the text if necessary. Write your answer on the provided space.

1. Which of the following is **not** a reason in the article explaining why tigers are hunted? _____
a. Because tiger skins are worth a lot of money
b. Because tiger parts are used as medicines in some cultures
c. Because some tigers attack local villages
d. Because tigers are hunted for enjoyment by some people

2. Which animal does **not** grow larger than the tiger? _____
a. Brown bear b. Lion
c. Polar bear d. All of these animals grow larger than a tiger

3. Which number is *closest* to the estimation of the wild Tiger population in 2003? _____
a. 3,000 b. 100,000
c. 140 d. 30,000

4. Which of the following best describes the author's main purpose in writing this article? _____
a. To provide readers with interesting information about the lifestyles of tigers
b. To persuade readers to help the world's tiger population and to offer ways to help
c. To entertain readers with stories about how tigers hunt and are hunted
d. To explain to readers why the world's tiger population is endangered

5. Information in the third paragraph is *mainly* organized using which text structure? _____
a. Cause and effect b. Compare and contrast
c. Chronological order d. Spatial order

6. Which *best* explains why tigers have lost so much of their habitat according to the text? _____
a. Because humans are afraid of tigers
b. Because tiger skins are extremely valuable
c. Because humans have changed the land
d. Because tigers need so much space to survive

7. Based on information in the text, which *best* explains why tigers are poached? _____
a. Poachers hunt tigers to protect their families from dangerous animals.
b. Poachers hunt tigers for medicine to cure sick family members.
c. Poachers hunt tigers because they enjoy killing dangerous animals.
d. Poachers hunt tigers to earn large amounts money.

8. Which *best* explains why it is so difficult to preserve the wild tiger population? _____
a. Tigers do not get along with most other animals.
b. Tigers must make their homes close to rivers and the world's rivers are evaporating.
c. Tigers require a lot of space.
d. Tigers hunt in large packs and there are too few tigers left to make these packs.

9. Which of the following is an opinion? _____
a. Tigers can grow up to eleven feet long.
b. Saving the wild tiger population is important.
c. South China tigers were brought to live in South Africa.
d. Humans have endangered the world's wild tiger population.

10. Based on context, which *best* defines the term "rewilded" as used in the last paragraph? _____
a. To preserve animals by keeping them in zoos
b. To teach animals to coexist with humans
c. To teach humans to coexist with animals
d. To bring animals born in zoos back to nature

11. What does this idiom mean: "*other parts of the tiger can also fetch a pretty penny*"? _____
a. The fur is the only valuable part of the tiger.
b. Other parts of the tiger are worth a lot of money.
c. The tiger is a very beautiful animal.
d. Tigers can be trained to do tricks like in the circus.

12. Which of the following could be best supported by information from the text? _____
a. Efforts to save tigers have had some success, but there are many obstacles to recovery.
b. Efforts to save tigers have failed in the past, but there is reason to continue trying.
c. Efforts to save tigers have been so successful that they saved tigers from endangerment.
d. Efforts to save tigers have failed completely.

Castles Nonfiction Reading Test 3 & Answer Key:

Name: _____

Castles | Nonfiction Reading Test 3

Palaces are known for their beauty and splendor, but they offer little protection against attacks. It is easy to defend a fortress, but fortresses are not designed with the comfort of a king or queen in mind. When it comes to structures that are both majestic and well-fortified, the classic European castle is the pinnacle of design. Across the ages castles changed, developed, and eventually fell out of use, but they still command the fascination of our culture.

Castles were originally built in England by Norman invaders in 1066. As William the Conqueror advanced through England, he fortified key positions to secure the land he had taken. The castles he built allowed the Norman lords to retreat to safety when threatened by English rebellion. Castles also served as bases of operation for offensive attacks. Troops were summoned to, organized around, and deployed from castles. In this way castles served both offensive and defensive roles in military operations.

Not limited to military purposes, castles also served as offices from which the lord would administer control over his fiefdom. That is to say, the lord of the land would hold court in his castle. Those that were socially beneath the lord would come to report the affairs of the lands that they governed and pay tribute to the lord. They would address disputes, handle business, feast, and enjoy festivities. In this way castles served as important social centers in medieval England. Castles also served as symbols of power. Built on prominent sites overlooking the surrounding areas, castles constantly loomed in the background of many peasants' lives and served as a daily reminder of the lord's strength.

The first castles constructed in England were made from earth and timber. Those who constructed them took advantage of natural features, such as hills and rivers, to increase defenses. Since these castles were constructed from wood, they were highly susceptible to attacks by fire. Wooden castles were gradually replaced by stone, which greatly increased the strength of these fortifications; however, being made from stone did not make these castles entirely fireproof. Attackers could hurl flaming objects into the castle through the windows or ignite the wooden doors. This led to moving the windows and entrances off of the ground floor and up to the first floor to make them more difficult to access.

Castles served many purposes during the Middle Ages.

As the nobility accumulated wealth, England became increasingly attractive to those who sought to plunder. Raids by Vikings and other marauders increased in regularity. In response to these attacks, castle defenses were updated and improved. Arrow-slits were added. These were small holes in the castle, large enough for an arrow to fit through, which allowed defenders to fire from nearly invulnerable positions. Towers were built from which defenders could provide flanking fire. These towers were connected to the castle by wooden bridges, so that if one tower fell, the rest of the castle was still easy to defend. Multiple rings of castle walls were constructed, so that even if attackers made it past one wall, they would be caught on a killing ground between inner and outer walls. Advances such as these greatly increased the defense of castles.

The demise of castles can ultimately be attributed to gunpowder. Gunpowder was first introduced to Europe during the 14th century, but the first gunpowder weapons were unreliable, inaccurate, and weak by later standards. During the 15th century, artillery became powerful enough to break through stone walls. This greatly undermined the military role of castles. Castles were then replaced by artillery forts that had no role in civil administration, and country houses that were indefensible. Though castles no longer serve their original purposes, remaining castles receive millions of visitors each year from those who wish to experience these majestic vestiges of a time long passed.

Directions: Read each question carefully and choose the best answer. Refer to the text if necessary. Write your answer on the provided space.

1. Which of the following is **not** a function of castles as expressed in the text? _____
a. Castles served both offensive and defensive purposes militarily.
b. Castles served as symbols of power.
c. Castles were important social centers in medieval England.
d. Castles were places where knights would keep their best horses.

2. Which of the following *best* describes the main idea in paragraph 2? _____
a. It describes how and why William the Conqueror took control of England.
b. It explains why castles were first built in England and the military purposes they served.
c. It shows how Norman lords were often scared and frequently retreated.
d. It details all of the purposes that English castles served.

3. Which *best* explains why the original castles were first made from earth and timber? _____
a. It takes a lot more time and energy to build a stone castle.
b. It did not occur to people to build castles out of stone.
c. People did not realize how weak wooden castles would be against fire.
d. Wooden castles were prettier than dirty stone castles.

4. Which of the following is **not** a true statement according to the text? _____
a. Palaces are designed for luxury, not fortification.
b. Fortresses are designed for fortification, not luxury.
c. Castles are designed for luxury and fortification.
d. Palaces are designed for luxury and fortification.

5. Which best explains why wooden castles were converted to stone castles. _____
a. Wooden castles take a long time to build.
b. Wooden castles are uncomfortable.
c. Stone castles offer better defense.
d. Stone castles stay cooler in the summer.

6. Which of the following best describes the structure of the text in the fifth paragraph? _____
a. Compare and contrast
b. Order of importance
c. Cause and effect
d. Chronological order

7. Which is **not** described in the text as an improvement in castle defenses? _____
a. Towers attached to the main castle by wooden bridges
b. Deep ditches dug around the castle walls and filled with water
c. Multiple castle walls providing layers of defenses
d. Windows and entrances raised off of the ground floor

8. Which *best* explains how gunpowder ended the role of traditional castles? _____
a. Wars were fought with guns and hiding in castles was no longer necessary.
b. Artillery forts with large cannons became more stylish than traditional castles.
c. Defending castles grew difficult, since attackers could just shoot castle defenders.
d. Cannons were able to knock down stone walls, so castles offered little protection.

9. Which of the following titles would *best* describe the content of this passage? _____
a. *William the Conqueror: Bringing Castles to England*
b. *Defending the Castle: Technologies Used to Defend Medieval Castles*
c. *A Short History of Castles: The Rise and Fall of Castles in England*
d. *Fancy Living: Learning about Castles, Palaces, and Fortresses*

10. Which of the following is an opinion? _____
a. Stone is more resistant to fire than wood.
b. William the Conqueror built the first castles in England.
c. It is unfortunate that castles no longer serve their original purposes.
d. Castles were used as offices of administration during the Middle Ages.

Castles
Answer Key

1. D
2. B
3. A
4. D
5. C
6. C
7. B
8. D
9. C
10. C

III. RESULTS

Table 1- Kevlar | Nonfiction Reading Test 1:

Table 1 portrays the data collected from the first trial where participants were asked to complete the Kevlar Reading Test after ingesting 0 Caffeine. The results portray that the average time it took for participants to complete the Kevlar Reading Test (7.57 Minutes) was quicker than the time it took participants to complete both the Tigers Reading Test (7.72 Minutes) and the Castles Reading Test (7.71 Minutes)

Participant	*Number of Correct Answers (/10)*	*Time taken to Complete Test (Min)*
1	9/10	8:56 Minutes
2	7/10	8:03 Minutes
3	7/10	5:44 Minutes

Table 2- Tigers | Nonfiction Reading Test 2:

Table 2 portrays the data collected from the second trial of the experiment where the subject were asked to complete Tigers Reading Test after ingesting 150 mg of Caffeine. The results depict that the average percentage of correct answers from Tigers Reading test (83%) exceeds the average percentage of correct answers from both the Kevlar Reading test (76%) and the Castles Reading Test (76%)

Participant	*Number of Correct Answers (/12)*	*Time taken to Complete Test (Min)*
1	10/12	7:41 minutes
2	11/12	9.23 Minutes
3	9/12	6.03 Minutes

Table 3- Castles| Nonfiction Reading Test 3:

Table 3 portrays the data collected from the third trial of the experiment where the subjects were asked to complete Castles after ingesting 300 mg of Caffeine. The results depict that the average time it took to complete the Castles Reading test (7.71 Minutes) was quicker than the average time it took to complete the Tigers Reading test (7.72) , but longer than the average time it took to complete the Kevlar Reading Test (7.57 Minutes)

Participant	*Number of Correct Answers (/10)*	*Time taken to Complete Test (Min)*
1	9/10	9:35 minutes
2	6/10	8:02 Minutes
3	8/10	5:38 Minutes

Figure 1:

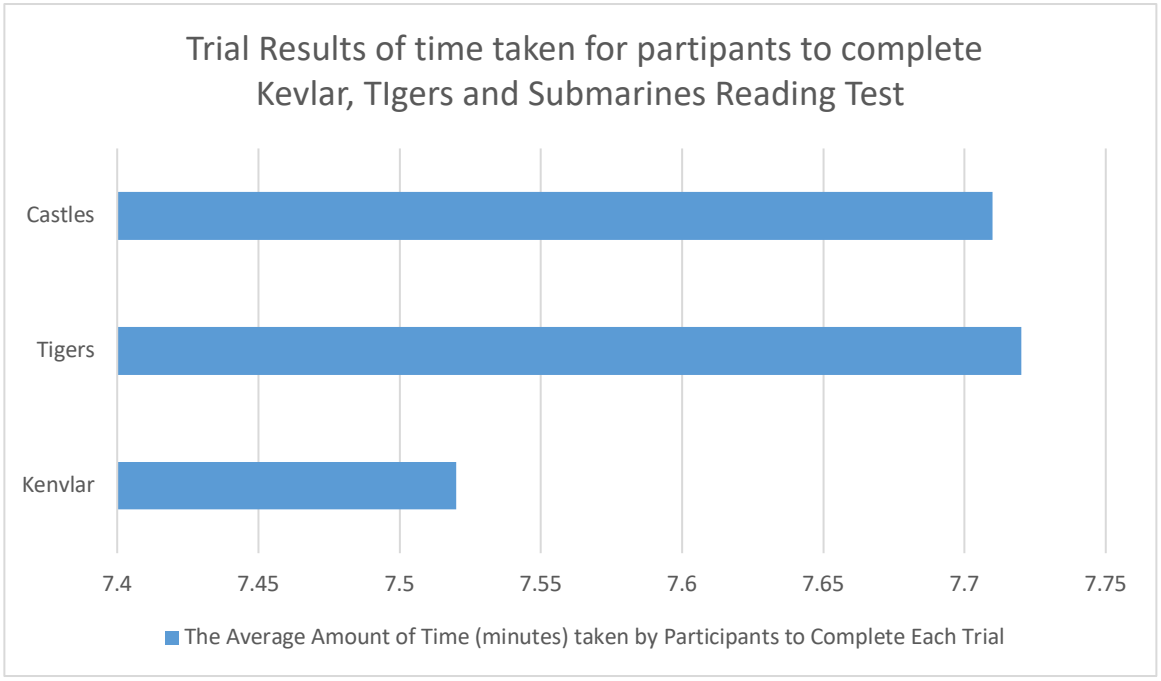

Figure 1 displays the averages of the data collected across the three trials for the amount of time it took to complete each test. The blue bar represents the Average Time Taken to Complete Each test in Minutes.

Figure 2:

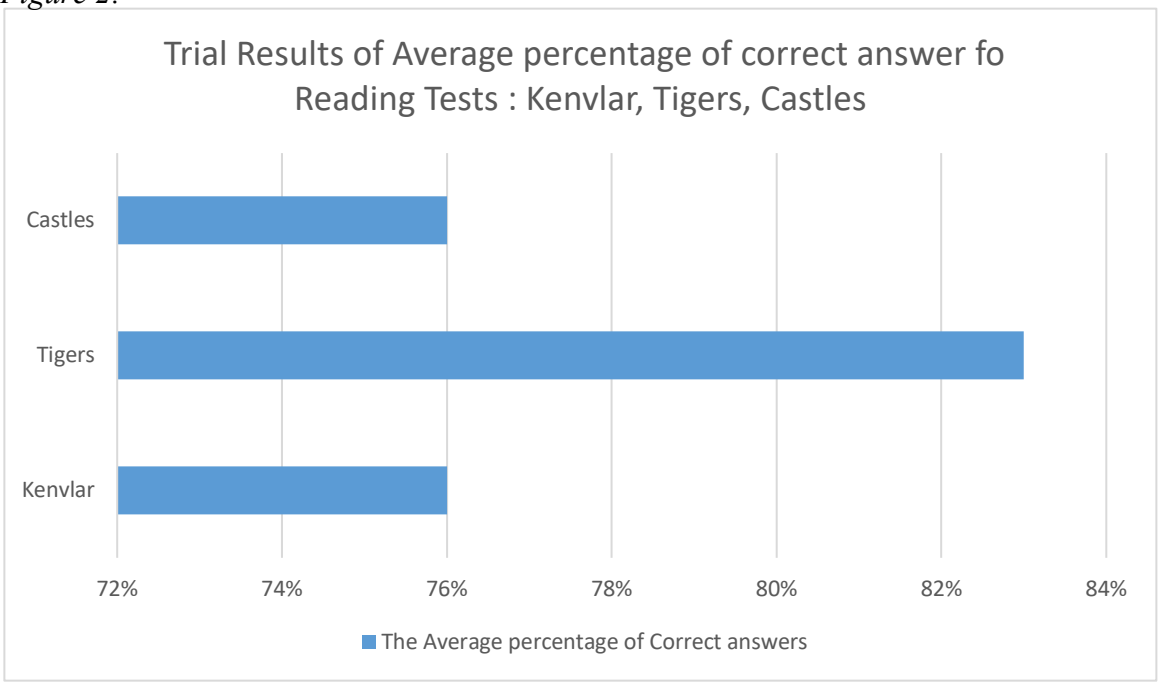

Figure 2 displays the averages of the data collected across the three trials for the amount of correct answers. The Blue bar represent the Average Correct Answer percentage for each test.

IV. DISCUSSION & CONCLUSION

In completing the experiment, the data suggest that the hypothesis was half correct. The hypothesis states that if the ability to score better on a test is related to caffeine intake while studying, then students who intake caffeine prior to studying will have an increase in the level of focus maintained and an increase in level of preciseness and efficiency. The data of the experiment shows that the overall average percentage of number of corrects answer from the Reading Tests' Tigers' (83%) completed after participants ingested 150 mg of caffeine (Mug #2) outweighed the overall average percentage of number of correct answers from both 'Kevlar' (77%) and 'Castles (77%). Kevlar being written after participants ingested 0 mg of caffeine (Mug #1) and Castles being written after participants ingested 300 mg of caffeine (Mug #3). These results showed a limitation in concentration as the average percentage of correct answers dropped when the participants had either no caffeine in their system or when they had 300 mg of caffeine. Therefore, in answering the initial question (How does having caffeine while studying affect performance on a test?), the data represented that the performance of students is enhanced when ingesting 150 mg of caffeine prior to test writing, in comparison to ingesting either none or 300 mg of caffeine.

The experiments results can be justified by using past scientific studies. A study conducted by Scientist at John Hopkins University support these results. The study examined the performance of 2000 participants on a test this test included the scientist showing each participant a series of image and then asking them to examine then. After doing this they gave each participant either a placebo or 200 mg of caffeine in order to ensure the results were accurate. The following day the same participants were asked to come back and look at a new group of images which included the ones presented to them the day before. The results showed that the group of participants that had consumed the 200 mg of Caffeine were able to differentiate between the images easier and were able to recognize small details that were altered, which resulted in better performance on the test. (The Hub 2014) This previous done experiment would explain why the participants did better after intaking 150 mg of caffeine but it does explain why the participants performed poorly after intaking 300 mg of caffeine in comparison to 150 mg. The reason the participants performed poorly after ingesting 300 mg of caffeine is because according to the scientists that conducted this experiment at John Hopkins University "there's an optimal dose to be able to get this enhancement, it is around 200 mg. Above that dose people start to report unfortunate side affects like headaches and nausea", this would explain the drop in efficiency and accurateness when the participants ingested 300 mg of caffeine. (The Hub 2014)

V. APPLICATION

Results from the experiment can be applied to other fields of study such as Neuropsychology. The finding in this experiment could lead to the investigation of what is component is in caffeine that makes you either become focused or distracted, and specifically what part of the brains actually get turned on when intaking caffeine.

The data in this study could also be used by the general public to help them decide what manner they feel most comfortable and confident studying in. In being informed on these findings, the general public may choose to start drinking that optimal dose of 200mg (The Hub 2014) or

continue to not drink coffee at all. The results of these experimental efforts could also spark future studies on whether students should drink coffee, or if it negatively affects their body over time.

VI. *REFERENCES*

Gatlin, Latarsha. “Caffeine Has Positive Effect on Memory, Johns Hopkins Researchers Say.” *The Hub*, 12 Jan. 2014, hub.jhu.edu/2014/01/12/caffeine-enhances-memory/.

Franke, A. G., Christmann, M., Bonertz, C., Fellgiebel, A., Huss, M., & Lieb, K. (2011, November). Use of coffee, caffeinated drinks and caffeine tablets for cognitive enhancement in pupils and students in Germany. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21993866/

Prep, M. T. (n.d.). Is Caffeine Good or Bad for Studying? Retrieved from https://info.methodtestprep.com/blog/bid/107111/Is-Caffeine-Good-or-Bad-for-Studying

Types of Motivation on Athletic Performance

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Abstract

Motivation affects our lives tremendously. In fact, the reason we do anything or even live is because of an effort to reward ratio. If we think that something yields rewards greater than the perceived effort needed to complete the action, then we do it. I knew that motivation increases our perceived reward of an action and motivates us to want to do it more. However, I wanted to know which type worked the best. The purpose of the experiment(s) was to determine which type of motivation works the best in order to push athletes beyond their normal capabilities. Four types of motivation were given. Money, food, encouragement, and fear. In the first of the two experiments tested, 12 subjects were all told to run a 400m lap as fast as they could. Upon crossing the finish line, 3 of them were offered each type of motivation to run another 400m lap and beat their time that they just ran. For encouragement, they were given helpful words telling them that the extra lap is making them stronger in the long run. For food, they were offered a meal at their favourite restaurant. For money they were offered $20 and for fear, they were told that if they lap was not completed faster, their phones would be smashed. The second experiment involved getting all 12 people to run a 800m lap as fast as they could and getting their time. Then, they were all told to run the 800m again on a different day being offered motivation as an incentive if they completed the race in the top 20% of participants. This was repeated for all the types of motivation and the one that made them run the fastest was observed and concluded to be the best type of motivation for pushing athletes past their normal capabilities. This type was fear as everybody ran faster than their original run when threatened that their phone would be smashed.

I. INTRODUCTION

This experiment is important because it helps athletes establish and find the perfect type of motivation that works for them in order to increase their athletic performance capabilities. Many athletes value things more than others and may be motivated by different things. This experiment will help athletes determine which motivational factors work the best for most/all people and in which amounts in order to achieve peak performance without injuring the body for future competitions. How do different types and amounts of motivation affect fatigue during athletic performance? If **all types of motivation decrease fatigue during athletic performance, <u>then</u> a higher amount of any type will make athletes perform better than if a lesser amount was given <u>because</u> the reward:effort ratio will become greater.**

II. METHODS

Experiment 1:

Tell 1st person to run 1 lap around the track (400m) as fast as they can and time their first lap. Tell them their first lap time and tell them that if they run another lap immediately and beat their first lap time, they will get $10. Get their time and compare 1st and 2nd lap results. Repeat steps 1-3 with the 2 more people (total 3). Repeat steps 1-4 but instead of offering them money, offer them pizza. Take the phone of the next 3 people before repeating steps 1-4 but threaten to smash their phone instead of offering them money or pizza. Repeat steps 1-4 without offering them any incentive to run faster on the 2nd lap other than telling them that it will improve themselves.

Experiment 2 (on different days):

Tell all people to run 2 laps (800m) around the track as fast as possible and get their time. On another day, repeat step 1 with all the people but tell them that if they finish in the top 20% of finishers, that they will get $10. Repeat step 2 on different days but using food as motivation or threaten to smash their phone if they do NOT finish in the top 20%. The independent variable used was the motivation given. The dependant variable was the time taken to run the laps. The controlled variables were same track, same people, distance ran, day ran on, instructions and amounts of motivation given. These variables were selected as controls in order to allow the same running conditions for everybody. The amount of food and money given are the same to provide people with theoretically equal motivation. The same track and people are used to ensure that the runs are all fair and nobody has an advantage over others (experiment 2). The weather while running is the same for experiment 2 in order to also make the running conditions fair for everybody. For both experiments, while each runner's running capabilities may be stronger than the others', the test is only to see how each runner performs proportionally to his own performance without motivation or with other types of motivation in order to see which type works best for which types of people.

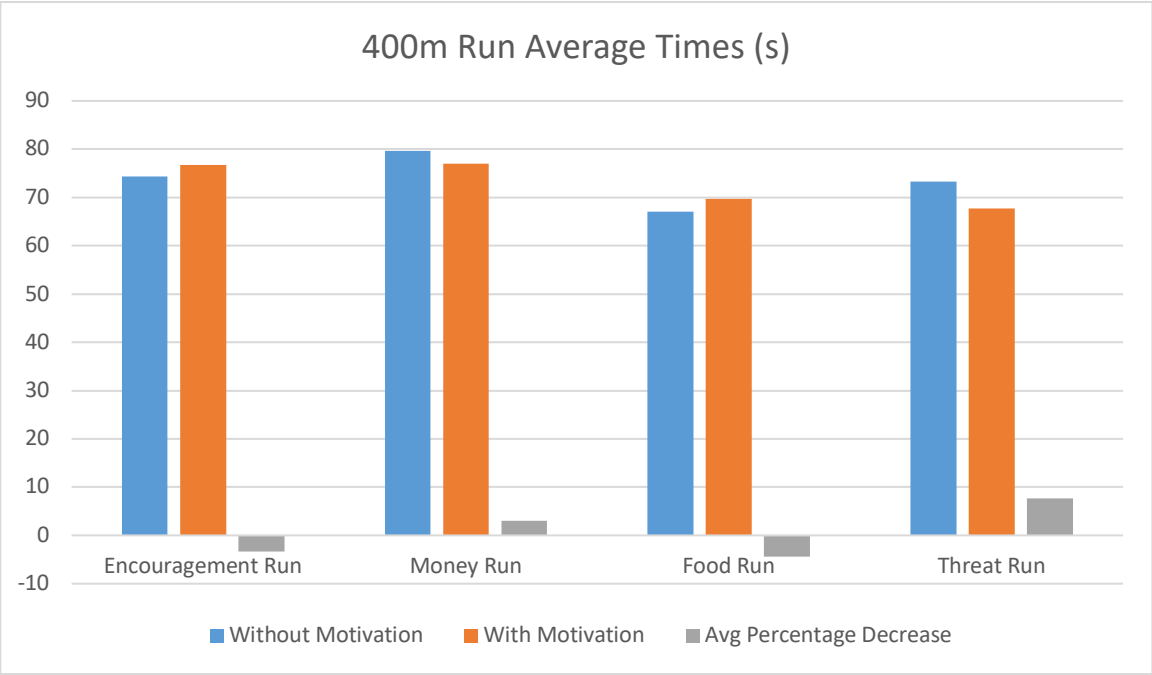
III. RESULTS

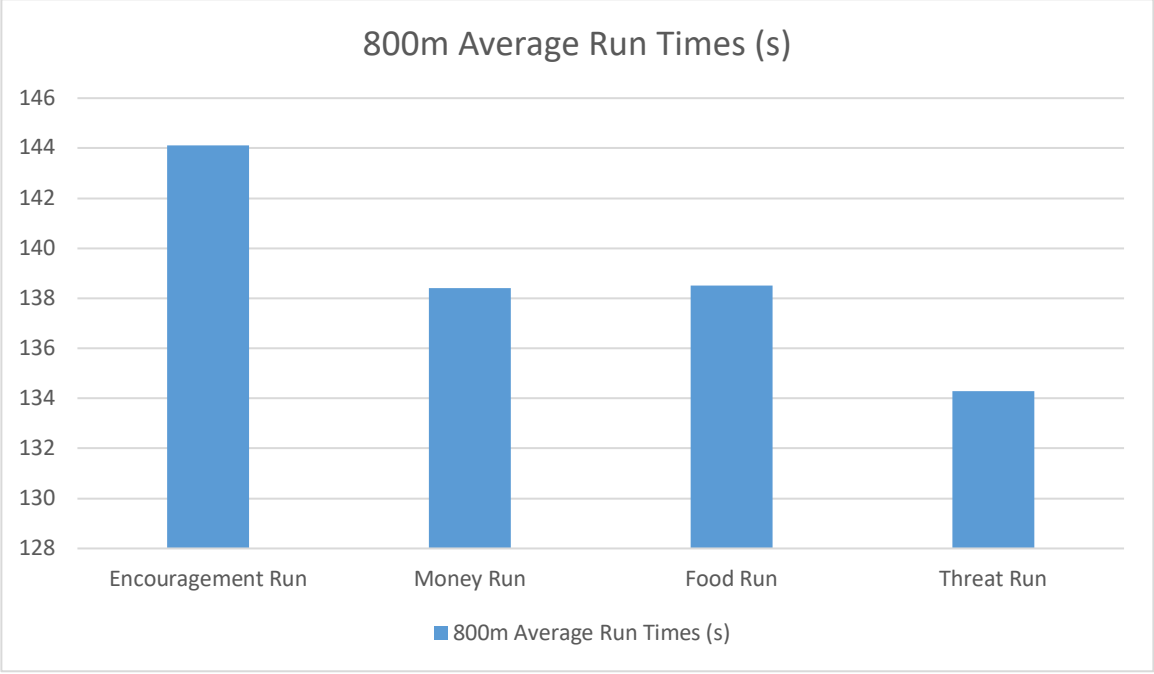
Experiment 1 data table:

Person #	First Run time	Motivation used for second run	Second run time	Did they beat their time?	Seconds between first and second run (+/-)	Percentage increase or decrease in time (+/-)
1	1:07	Encouragement	1:09	No	+2	+2.985%
2	1:21	Encouragement	1:19	Yes	-2	-2.469%
3	1:15	Encouragement	1:22	No	+7	+9.333%
4	1:42	Money	1:35	Yes	-7	-6.863%
5	1:03	Money	0:59	Yes	-4	-6.349%
6	1:14	Money	1:17	No	+3	+4.054%
7	1:00	Food	1:04	No	+4	+6.667%
8	1:18	Food	1:17	Yes	-1	-1.283%
9	1:03	Food	1:08	No	+5	+7.936%
10	1:13	Threat	1:07	Yes	-6	-8.219%
11	1:09	Threat	1:05	Yes	-4	-5.797%
12	1:18	Threat	1:11	Yes	-7	-8.974%

Experiment 2 data table:

Person #	First Run Time	Money motivation run time	Food motivation run time	Threat motivation run time	Which type of motivation worked best?
1	2:23	2:19	2:21	2:16	Threat
2	2:08	2:04	2:07	2:02	Threat
3	2:17	2:16	2:14	2:12	Threat
4	2:29	2:25	2:26	2:19	Threat
5	2:11	2:09	2:08	2:06	Threat
6	2:17	2:15	2:14	2:12	Threat
7	2:32	2:25	2:23	2:19	Threat
8	2:28	2:20	2:24	2:17	Threat
9	2:24	2:18	2:16	2:14	Threat
10	2:18	2:13	2:15	2:11	Threat
11	2:42	2:34	2:30	2:24	Threat
12	2:40	2:23	2:24	2:20	Threat





IV. DISCUSSION & CONCLUSION

The hypothesis was correct as the threat was the highest amount of motivation which also made people run faster as their phones were worth a lot of money and meant the most therefore they ran the fastest when it was threatened. Higher amounts of motivation to each individual person increase speed and results. Threats seemed to be a global best source of motivation as long as you target something people value a lot. Higher amounts of motivation decrease people's perception of the effort needed to accomplish a task and create a seemingly more desirable reward : effort ratio creating higher amounts of motivation and desire to achieve a certain goal or complete a certain task. Fear made sense as the best form of motivation as you don't know what will happen if something you have is lost. However, a reward is different because you already know how your life is without the reward and getting it will only make it better, However, with a threat or blackmail, if the task isn't completed, you could enter unknown territory not knowing what would happen if you lost something that you have at the moment.

V. APPLICATION

This experiment was useful as it allows people to know which type of motivation works the best to get somebody to do something that you want. This way, of threat/fear motivation works the best such as comparing blackmail and threats or just finding out which type of threat works the best. Fear motivation should only be used in most extreme absolute cases as a last resort as most of the time, it is illegal.

if there is something that must *absolutely* happen, you will know which type of motivation to use. Further experiments that could be conducted to further study my results could be testing which type

VI. REFERENCES

How does strength training relate to sports performance? | Strength Training & Exercise. (n.d.). Retrieved from https://www.sharecare.com/health/strength-training/strength-training-relate-sports-performance

Lieke, Bart, Hettinga, & J., F. (2018, July 17). Drive in Sports: How Mental Fatigue Affects Endurance Performance. Retrieved from https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01383/full

Massar, A., S. A., Linden, V. D., & Dimitri. (2018, May 11). Quantifying the Motivational Effects of Cognitive Fatigue Through Effort-Based Decision

Making. Retrieved from https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00843/full

Sport Fatigue And Performance. (n.d.). Retrieved from http://nssmc.com.au/conditions-we-treat/fatigue-and-performance/

Tucker, R. (2013, October 27). Fatigue Series: Introduction. Retrieved from. https://sportsscientists.com/2008/04/fatigue-series-introduction/

The Relationship between Movie Genres and 16Personalities' Personalities of Analyst, Diplomats, Sentinels, and Explorers

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Abstract

This experiment tested the correlation between 16Personalities' personalities to movie genres. This allowed to see if certain preferences, are due to part of your personality. Eight test subjects had to complete a personality test, then they were put into four personality categories. After, they had to watch movies of a certain genre, and rated the movies out of ten. For this experiment, the 75% of the categories liked a certain type of genre. 50% also disliked a certain type of genre more than another. In conclusion, a personality is in relationship to a certain type of movie genre and indicates a relationship to related media genres. The results of this experiment had helped in terms of understanding the human's mindset, and their relationships between external factors.

I. INTRODUCTION

This experiment provides significance in the field of movies, as it shows correlations between four personalities to six specific type of genre by the personalities rating movies out of ten. Their rating of the movies allows to see correlations between someone's certain personality and their likes and dislikes towards a specific movie genre.

Does a certain personality relate to certain genres? The hypothesis is that certain personalities do relate to certain genres, because people with similar likes tend to have the same type of personality.

II. METHODS

First, two test subjects of different sexes, were found per age group according to 3-10, 11-18, 18-25, 25+ and numbered between 1-8. They then had to complete 16Personalities' quiz (NERIS Analytics Limited, 2011), with their results, they were put into one of the categories: Analyst, Diplomat, Sentinel, or Explorer.

Secondly, all eight subjects had to watch PG movies based off the genres of Comedy, Horror, Action, Sci-fi, Romance and Fantasy, and rated each of the movies out of ten. The movies in this experiment were *Rush Hour*, *ParaNorman*, *The Incredibles*, *Men in Black*, *Flipped* and *Harry Potter and the Goblet of Fire*.

Independent variables were the movies, as the movies will be changing so that subjects can rate them out of ten. The subjects' rating and their favourite movie are differing based off the movies they watched. The controlled variables were the amount of people per age group, as it would be unfair if there were more children or more adults, as that's when personalities are developed or developing, and preferences in the media

differentiate between age groups. The consistency of movies and people were also controlled, as if anything were to change, the data would be inaccurate as the specific measures were not met.

III. RESULTS

Figure 1. depicts the quantity of people each of the category. Explorers had the largest quantity, with 3/8 people, and Sentinels being the lowest, with only 1/8 of people.

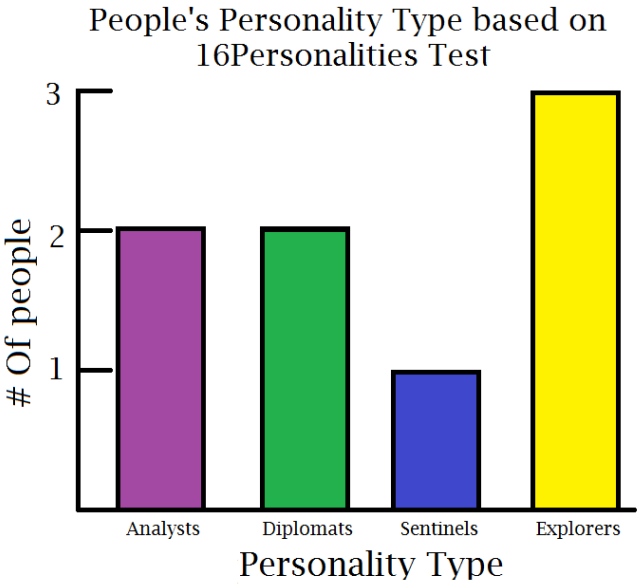

Figure 1: Subject's results taking the 16Personalities quiz.

Between the personality groups, their favourite movie was recorded (Figure 2), and the results show that 100% of the Diplomats like the same movie, 100% of the Analysts like the same movie and 100% of the Sentinels like the same movie.

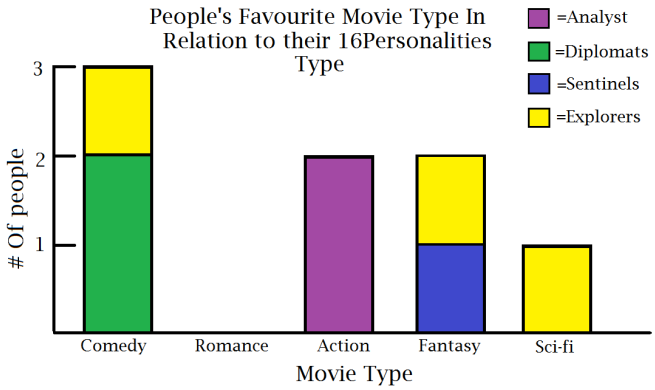

Figure 2: Subjects divided amongst their personality

Table 1: Subject's rating of each movie out of ten, as well as their favourite movie.

Person #	COMEDY	ROMANCE	ACTION	FANTASY	SCI-FI	HORRO R	Fav. Movie
1	8/10	7/10	8/10	9/10	7/10	9/10	Comedy
2	9/10	6/10	7/10	8/10	9/10	3.5/10	Comedy
3	6/10	6/10	8.5/10	7.5/10	7/10	5/10	Action
4	10/10	8/10	8/10	8.5/10	5/10	4.5/10	Comedy
5	7/10	8.5/10	9/10	8.5/10	5.5/10	5/10	Fantasy
6	7.5/10	6/10	7/10	5/10	8/10	4.5/10	Sci-Fi
7	6/10	6.5/10	8/10	7.5/10	9/10	2/10	Fantasy
8	8/10	6/10	10/10	9/10	7/10	8/10	Action

Table 1 represents correlations between each subject's rating. Another example would be how most of their rankings are similar, like Person #3 and Person #8 had similar ratings, despite the Horror movie rating.

IV. DISCUSSION AND CONCLUSION

The hypothesis was correct. It was correct, as the information aligned with the inferences. A certain personality does relate to certain genres. In Figure 2, it specifically shows that 50% of the groups had the same favourite movie. A lot of the subjects with the same personality, had similar ratings in movies, as seen in Table 1.

An explanation leads towards the evidence, like in Figure 2, 100% of all the Diplomat-type personalities claim to like the Comedy movie better than the others, as well as 100% of the analysts claim to agree upon action being their favourite movie. Other evidence is researched from Sarah Miller-Shreve (Miller-Shreve, Sarah, 2018) who researches on correlations between how a person's anxiety level, that could be correlated with personality, is related towards horror movies. She found that there are personal characteristics that relate to her subjects liking horror movies, for example higher trait anxiety levels.

V. APPLICATION

This data is relevant to the movie industry and the field of psychology. For the movie industry, the data could prove useful to movie directors and movie analysts, to see which genre of movie would be more useful for them to depict or analyze, allowing them to narrow their target audience. As for the psychology field, it could be used in research, and help study the mind more and comprehend its decisions. The public could also see and figure out which movies or type of media they can discover, based off this article. The public can also use this research, to test out if this this experiment's hypothesis was correct in their terms.

VI. REFERENCES

NERIS Analytics Limited. (2011). Free Personality Test. Retrieved on April 2019 from https://www.16personalities.com/free-personality-test

Miller-Shreve, Sarah, (2018), *The Relationship Between Personal Characteristics and Entertainment Preferences*, Retrieved on April 25th 2019 from https://ir.lib.uwo.ca/brescia_psych_uht/16

Miller-Shreve, Sarah, (2018), *The Relationship Between Personal Characteristics and Entertainment Preferences*, Retrieved on April 24th 2019 from https://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=1012&c ontext=brescia_psych_uht

Benefits of Lavender Oil on Stress

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Abstract

Can essential oils help relieve feelings of stress and anxiety? The purpose of this experiment was to determine if the use of lavender essential oil, by inhalation, could help reduce anxiety and nervousness in students in times of increased stress.

Results of this experiment demonstrated that inhaling lavender oil was beneficial to students by reducing their resting heart rate and their perceived stress level. Results of the experiment were important because the use of oil offered a quick, inexpensive treatment to alleviate nerves and anxiety before the subjects' competition.

I. INTRODUCTION

Aromatherapy is a natural healing practice that uses plant extracts to increase well-being when inhaling the essential oil scent. One theory of how they work is that by stimulating the smell receptors in your nose, they can send messages to your nervous system and affect the body's chemical and energy systems. Because of this, aromatherapy is often used as a natural remedy to relieve anxiety and stress.

The inhalation method is chosen because the "olfactory nerve gives us our sense of smell and starts from our nose and enters the skull through tiny holes to connect directly to the brain. This nerve sends signals almost instantaneously to many parts of the brain, including the limbic system and amygdala, which are in charge of emotions, mood, and memory. These systems are also in charge of regulating our autonomic nervous system or can soothe us through turning on the parasympathetic nervous system, which relaxing our bodies." (Wei, 2016

It is hypothesized that if test subjects inhale lavender essential oil prior to their band competition, this would help to reduce the stress and anxiety felt by the test subjects because the oil would promote a sense of calm and positive feelings.

The use of essential oil to reduce anxiety, stress, tension etc. could be very beneficial to students. It is an, inexpensive and accessible product and provides a safe alternative for coping with stress instead of turning to prescription medication, legal and non-legal drugs.

II. METHODS

Test Subjects:

This experimental study included 20 subjects, ranging in ages from 13-17 years of age. The group consisted of 9 females and 11 males from the Competition Band members of the Royal Canadian Sea Cadets Agamemnon Windsor.

Questionnaire:

Subjects in the group were administered a survey prior to testing. The majority of the survey measures were rated on a 0-10 scale, with 0 being the lowest and 10 being the highest level of stress.

Experiment Methodology

Lavender essential oil was applied by the inhalation method to the subjects in the experimental group.

Plain white paper napkins with 3 drops of lavender oil were placed in front of each test subject, at a distance of 15-20cm from the noses of the subjects. Lavender oil was used because of its apparent relaxing, anti-anxiety effects. After the placement process, 3 minutes were allowed for subjects to inhale and experience the lavender oil. After inhalation, subjects were asked to rate their perceived level of stress and to retake and record their resting heart rates on the questionnaire forms.

Independent Variable: The variable that is changed or controlled is the lavender essential oil.

Dependent Variable: The variable being tested and measured are the student's level of perceived stress/anxiety.

Control Variable: In order for the experiment to be fair, variables need to remain constant. In this experiment control variables included: plain white paper napkins, number of essential oil drops added to each napkin (3) and the length of time participants are asked to inhale scent (3 minutes).

Data collection

Survey results were compiled, computed and tables and graphs were created in Microsoft Excel.

III. RESULTS

Table 1 – Daily Stress Level

Of those surveyed, males felt more stressed than the females on a daily basis.

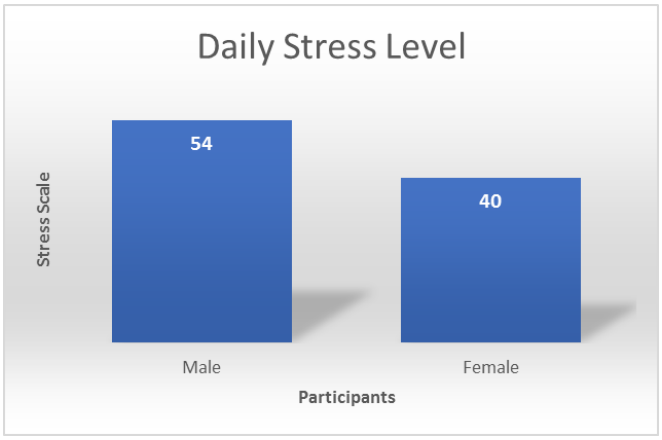


Table 2 - Perceived Stress Levels (Pre and Post Inhalation)

Both males and females experienced a reduction in stress by three points from pre to post inhalation.

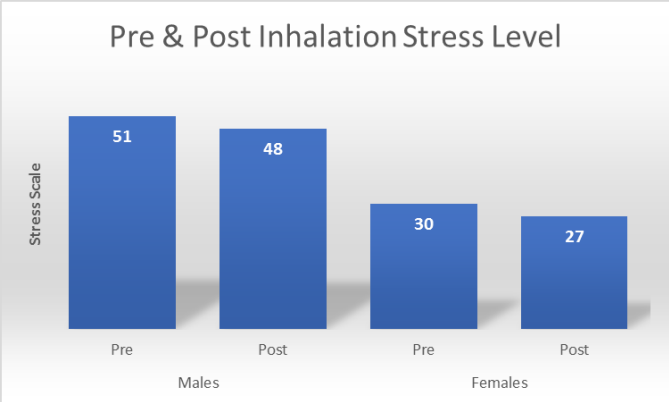
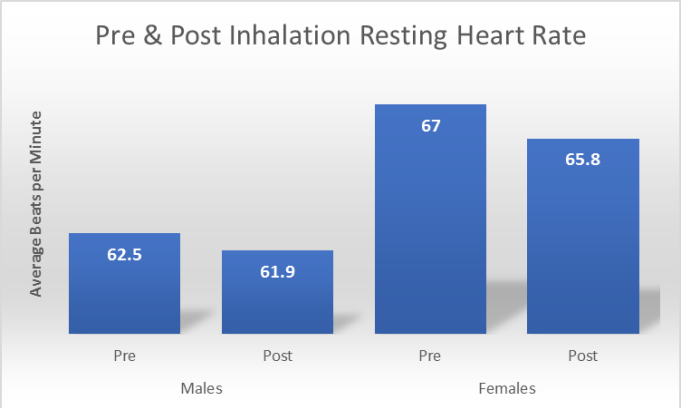


Table 3 – Pre and Post Inhalation Resting Heart Rate

Heart Rates in both male and female participants decreased after inhaling the lavender oil. Males saw an overall average heart rate reduction of 0.6 beats per minute while females experienced an average reduction of 1.2 beats per minute.



IV. DISCUSSION AND CONCLUSION

The hypothesis was correct – the inhalation of lavender essential oil did provide a decrease in the test subjects perceived stress level and also reduced their resting heart rates. According to the data collected there was no overall change in male stress levels from pre to post inhalation. However, females did experience an overall drop in stress by three points. Heart Rates in both male and female participants (11 out of 20 participants) dropped after inhaling the lavender oil. Males and females saw an overall heart rate reduction of 4 beats per minute.

In case studies, lavender was shown to be a useful remedy for symptoms of depression and anxiety (Appelton, 2012). According to a 2006 study on nurses, inhaling a lavender lowered stress and anxiety levels, blood pressure, heart rate, and serum cortisol (Hwang, 2006). Positive emotions including the feeling of well-being and alertness were reported by test subjects after inhaling essential oil (Sayowan, Winai et al., 2013). It can be concluded that lavender essential oil promotes the sense of calm and provides positive benefits to reduce stress and anxiety.

V. APPLICATION

The results of this experiment show that there is a benefit to using essential oils as a remedy to manage and reduce stress and anxiety. Further study should be done on lavender essential oil and its effects on those seeking alternative treatment to deal with stress. All people, not just students can find benefit in its use, as the oil is affordable, safe and very accessible. Scientists may want to explore if the use of oil, due to its calming effect, has positive outcomes on test scores, presentation performance and athletic competitive performance.

VI. REFERENCES

Appleton, J., ND. Lavender Oil for Anxiety and Depression. Natural Medicine Journal. 2012 February; volume 4, Issue 2. Retrieved on March 6, 2019 from https://www.naturalmedicinejournal.com/journal/2012-02/lavender-oil-anxiety-and-depression-0

Hwang JH. The Effects of the Inhalation Method Using Essential Oils on Blood Pressure and Stress Responses of Clients with Essential Hypertension. J Korean Acad Nurs. 2006 Dec;36(7):1123-1134. Retrieved on March 6, 2019 from https://doi.org/10.4040/jkan.2006.36.7.1123

Sayowan, Winai & Siripornpanich, Vorasith & Hongratanaworakit, Tapanee & Kotchabhakdi, Naiphinich & Ruangrungsi, Nijsiri. The Effects of Jasmine Oil Inhalation on Brain Wave Activities and Emotions. Journal of Health Research. 2013 April; volume 27. 73-77. Retrieved on March 6, 2019 from https://www.researchgate.net/publication/236235613_The_effects_of_jasmine_Oil_inhalation_on_brain_wave_activies_and_emotions

Wei, M. (2017, April 30). 6 Aromatherapy Essential Oils for Stress Relief and Sleep. Retrieved from https://www.huffpost.com/entry/6-aromatherapy-essential_b_9805630

Figure Skating - Testing Best Position to Generate the Most Revolutions in a Spin

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ABSTRACT

The experiment focused on finding the best position for arms and hands in a camel spin to generate the greatest number of revolutions. This would improve the skater's chance at gaining bonus points towards their score during competition. To test this, the subject would complete a camel spin in one of the two varied hand positions. When a timer reaches five seconds, observer would record the amount of revolutions completed. Subject then repeats the camel spin with the second arm and hand position. The observer will record the results. The results showed that the position with hands to the sides of the body in a "V" shape is the best position for arms in a camel spin. Although some subjects found position two was better, it all depends on the skater. The findings displayed that the best position may vary depending on experience, ability, and practice with the element and each position.

I. INTRODUCTION

Answering this question is important because it can affect the skater's overall performance in many ways. According to the International Skating Union, which is used throughout all competitions worldwide, the criteria for a positive grade of execution (GOE) include, "good speed and acceleration throughout the spin," (The New Range of Grade of Execution, no date). In finding the best position for arms and hands in the spin for such speed and acceleration, it will help the skater create an advantage for themselves and hopefully improve their overall skating skills.

If having hands and arms pulled back towards sides (1) and having arms pulled back with hands interlaced (2) are being compared, then option 2 will produce a higher number of revolutions in ten seconds because the mass of the skater is distributed on a smaller space than option 1 due to the arms and hands being pulled far behind the back. With arms drawn back and hands interlaced, the distribution of mass is reduced and therefore the speed must increase to compensate for the difference and maintain the continuous momentum of the skater. Similar to jumps, the closer the skater is to the axis of rotation, the faster your rate of spin will be. This, once again, would lean towards option 2 creating more revolutions in a ten second span.

Which way of holding hands and arms in a camel spin will produce the highest number of revolutions in five seconds?

II. METHODS

Hypothesis was tested by instructing subjects to complete two separate camel spins, one with position one arm and hand positions, and the second with position two arm and hand positions. Subjects completed the spin, and an observer counted revolutions, while another observer worked the timer, which was stopped at five seconds. The number of revolutions in the five seconds was recorded for each of the positions in a labeled table.

Position One

Position Two

The independent variable was the two different arm positions in the camel spin. The dependent variable was the number of revolutions. The controlled variables were the skates, the timer and the ice. These were listed these as the controlled variables because if any of them were changed or altered, there would be a significant difference in test results. For example, if the test was done once on one pad, and then tried again on a different pad, the surface may be bumpier and affect the total number of revolutions. As for the timer, if a manual one is used and then switch to one on a phone, there may be a delay and therefore a difference in the number of revolutions due to a time change. Lastly, if the subject were to wear different skates on different testing dates as an example, the different blade may change the way the skater spins and, in turn, affect the accuracy of the experiment.

III. RESULTS

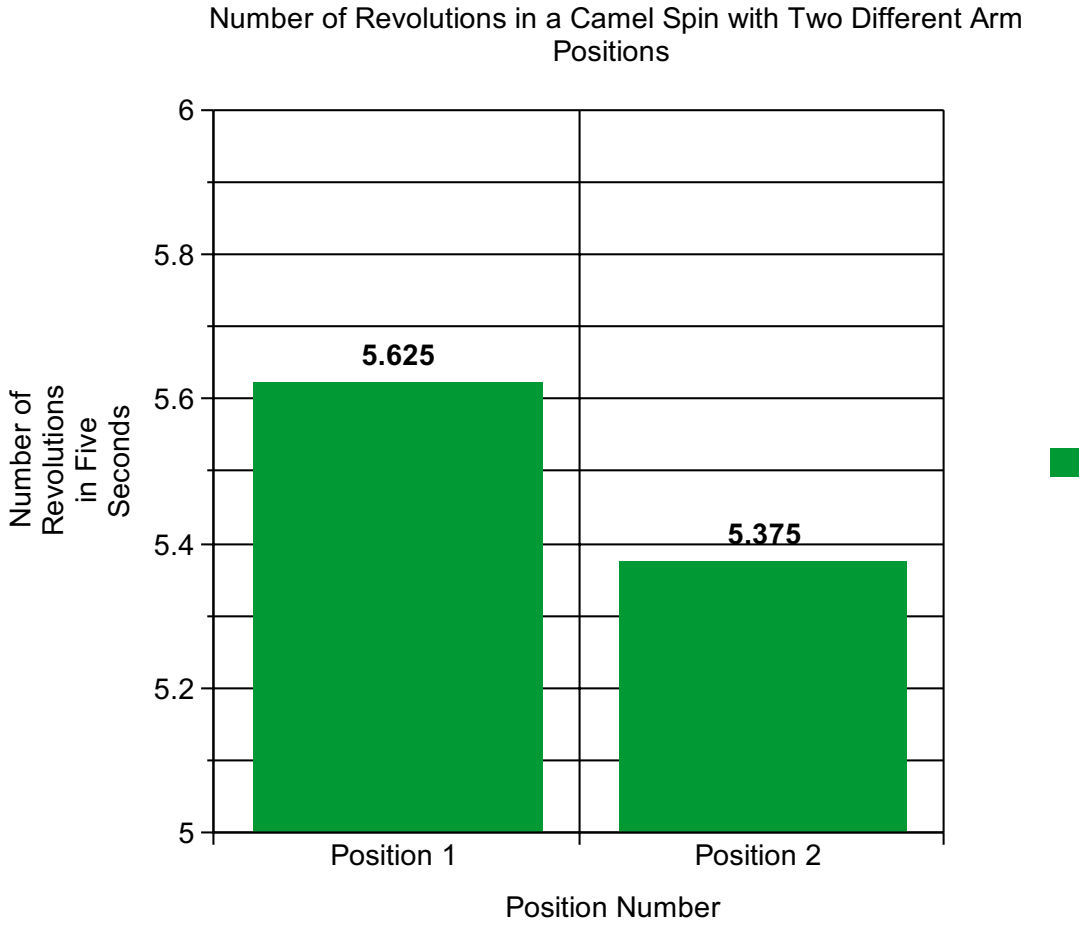
Subject #	Position 1	Position 2
1	5	4
2	7	6
3	6	6

4	5	4.5

Table 1

This table shows the results of the subject's number of revolutions for each position in a five second span.

Figure 1



This graph displays the average number of revolutions per position with the combined four subjects.

IV. DISCUSSION AND CONCLUSION

In conclusion the hypothesis was proved false. Instead, position one was found to produce a higher number of revolutions per five seconds. This means the ideal arm position for a skater doing a camel spin, is having hands pulled to the sides of the body, not interlaced behind the back. The average number of revolutions for position one and two were 5.625 and 5.375 respectively.

The experiment could have shown opposite results for a few reasons. One being the choice of clothing some subjects were wearing. This possibility references the article "a review of aerodynamics in sports" found in Energy Procedia. This article mentions how the aerodynamic efficiency of an athlete can significantly be altered by the clothing

the athlete is wearing. Looser-fitting clothing or a hood could have slowed down the speed at which the skater was spinning, and therefore effected the overall number of revolutions completed.

V. APPLICATION

More extensive and high-tech research could be done to improve the accuracy of the experiment. This may include using the same equipment used during competitions to keep the accuracy done to a quarter revolution in the five seconds. Using this equipment would also allow a further look into the effects of wearing different clothing on sports performance. This information could later be used in other sports like speed skating and cycling. The current information can also be useful for all of those in the competitive figures skating community in helping competitors learn how to better the ability to perform in the best way possible. For the general public, people would gain information on

VI. REFERENCES

Yıldız, A., & Dandıl, B. (2018). Investigation of effect of vehicle grilles on aerodynamic energy loss and drag coefficient. *Journal of Energy Systems,* 190-203. doi:10.30521/jes.461133

Alam, F., Chowdhury, H., & Moria, H. (2019). A review on aerodynamics and hydrodynamics in sports. *Energy Procedia, 160*, 798-805. doi:10.1016/j.egypro.2019.02.158

Effect of Sugar on Memory

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Abstract

Many studies have shown a link between memory loss and sugar consumption, this means that sugar may be the cause of many memory related diseases such as Alzheimer's disease. This assumption leads to this question: what is the effect of sugar on memory? To find the answer, an experiment has been conducted. The experiment was to get 10 subjects to match 6 pairs of flipped cards together before and after drinking water mixed with sugar. Each subject was timed, and the results were recorded. The results of the experiment were that when drinking water mixed with sugar, the subjects took 3.9 seconds longer to match the cards than before drinking water mixed with sugar. These results proved that the memory of a person works slower when the person consumes sugar than when they do not consume sugar. This is another reason out of many reasons why people should consume less sugar.

I. INTRODUCTION

Canadians consume a lot of food that contains sugar, 1 in every 5 calories consumed comes from sugar (Kellie and Didier, 2015). Sugar related health issues are increasing each year as the amount of sugar consumed by people is increasing. These health-related issues are physical and mental issues, but people seem to take notice only on the physical issues and not much notice is taken on the mental issues. The mental issues caused by the consumption of sugar are just as important as the physical issues, since they cause the same or more amount of harm to the body. One of the mental issues caused by sugar is memory loss. A rat study conducted by the University of California in Los Angeles shows that a diet high in sugar slows down the memory (Elaine, 2012). It is important to know more about the link between sugar and memory because if the ability of sugar to worsen memory continues to be overlooked, then this issue will become a bigger problem that will be hard to solve or may never be solve.

The question that will be discussed to go deeper in this issue is: what is the effect of memory on sugar? If more than seven and a half teaspoons of sugar is consumed, which is the average maximum amount of added sugar that should be consumed by a person according the American Heart Association, then it could decrease a persons' ability to memorize simple things for a certain amount of time depending on how much excess sugar is consumed. That is because consuming too much sugar can cause problems in

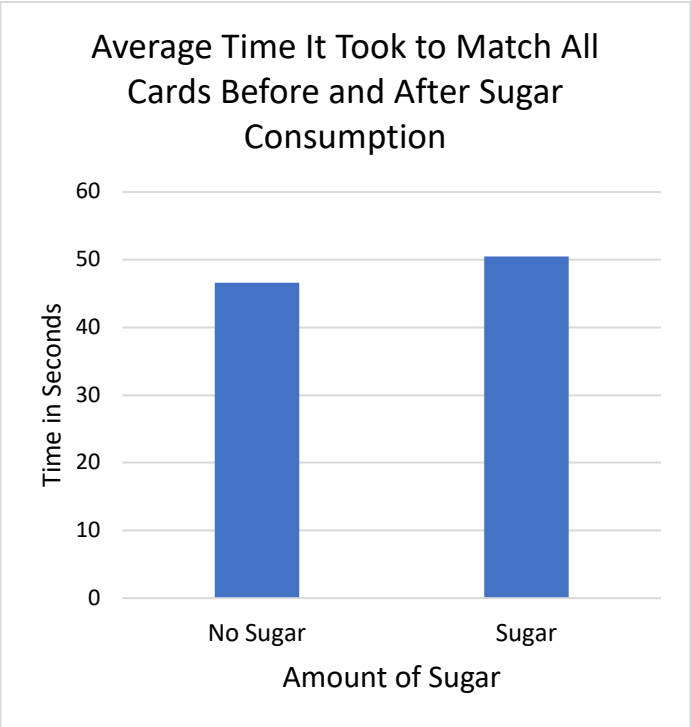
insulin's ability to control how cells store and use sugar, which is important for processing thoughts and emotions in the brain (Daniel, 2018).

II. Methods

10 16-year-old students were chosen as the subjects for this experiment. 6 pairs of 2.5”x2.5” cards that had the words “dog”, “cat”, “mouse”, “horse”, “bird”, or “panda” written on them were used to conduct this experiment. Each pair of cards had the same word written for both cards in the pair so that the cards could be matched together. Each subject did the experiment individually. The cards were placed randomly in columns of three, the words were showing. Subjects were given 10 seconds to look at the cards and then the cards were flipped so the words were not showing. A timer was started, the subjects were given instructions to match the pairs of cards based on their memory. If a pair of cards was mismatched, the pair of cards would be flipped back. This continued until all the cards were matched. The timer was stopped, the results were recorded in a table with 10 columns for each subject and 3 rows named “no sugar”, “sugar”, and “Time Difference”. After the results were recorded, subjects were told to drink a cup of water mixed with a quarter teaspoon of sugar. The same procedures were done a second time after the subjects drank the sugar water, but the results were recorded in the row named “Sugar” instead of the row named “No Sugar”. The time difference was then found out by subtracted the time with sugar from the time without sugar. The independent variable was the amount of sugar put in water. The dependent variable was the time it took each student to match all the cards. The controlled variables were the age of people, the amount of water, the pieces of paper used, organization of cards, and type of sugar. If the ages of the subjects were different ages, it would make the experiment be about the effects of sugar on different ages and memory. If the amount of water was different for each person, it would cause the results to be different because it wouldn’t just be the sugar that is changing, but also the amount of water, which would make it hard to discover how different amounts of sugar effect the human body. The controlled variables could have changed the whole experiment if they were changed.

III. Results

The results showed that the average time it took the subjects to match the cards when consuming sugar took 3.9 seconds longer than the average time it took them to match the cards without consuming sugar.


Average Time It Took to Match All Cards Before and After Sugar Consumption
60
50
40
30
20
10
0
Time in Seconds
No Sugar
Sugar
Amount of Sugar

The Effects of Competition on Academic Performance

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Abstract

This project was conducted to discover how adding competition effects one's short-term performance when writing a test. By analyzing the results of the experiment, students could see to adding competition to their studying arsenal, or make sure they avoid at all costs. The experiment was conducted with 21 high school students, ranging from grade 9 to 12. They first wrote a 30-question multiplication test alone, then the same test again with 2 other subjects a week later. Their completed time and score were recorded, as well as any behavior that the subjects demonstrated. The results displayed and an increase in scores, as well and shorter completion times when the subjects were in groups. So, when the students wrote the test with competition, their overall performance improved. This information could be used by students of all ages as a way to challenge themselves and improve their performance in school.

I. INTRODUCTION

In academics, many students have trouble studying or focusing and are not satisfied by their results at the end of a unit. So, how could students get themselves to perform better? Many studies have been done that link competition to an increased quality of performance. Saleeb (2016) states that competition prompts students to work harder to better their peers and leads them to setting higher standards for themselves. This is important because this could provide students an easy source of motivation that will strengthen study quality, and therefore have more satisfactory results. Firmin, Julius, and Johnson (2009) stated in their experiment that students believed that beating other students was what they considered success, rather than performing well in general, in the classroom setting. Since students would want to strive for their meaning of success, they would strive to do better than their peers. This is an example of how competition could improve a student's performance in academics.

So, how does the added factor of competition effect one's performance? The hypothesis is that if there is the factor of competition during a testing procedure with a winable prize, then the result will be better than compared to a result without competition because the competition will motivate the subject to do better than other people writing as well.

II. METHODS

21 high school students, ranging from grade 9-12, were collected for the experiment. One at a time, each subject was seated in a silent setting (i.e. a library) and given a cut in half blank sheet of paper

and a pen. Before starting the test, the subject was given a 10 question survey.

1. *What is your name?*
2. *What grade are you in? N. N. N. !$! Bu no*
    a. *9*
    b. *10*
    c. *11*
    d. *12*
3. *What is your biological sex?*

. *A. Male*
B. Female

4. *Are you involved in a competitive sport, activity?*
5. *On a scale from 1-10, how competitive are you, with 1 being extremely non-competitive and 10 being extremely competitive?*
6. *On a scale from 1-10, how skilled do you think you are at multiplication, with 1 being extremely not skilled and 10 being extremely skilled?*
7. *In letter format, what is your grade in math, F meaning below 50%, D meaning 50%-69%, C meaning 70%-79%, B meaning 80%-89%, and A meaning 90%-100%?*
8. *Do you expect to end math with an A, or less?*
9. *Are you ready for this quiz?*
    ***** ONLY ASK NEXT QUESTION AFTER GROUP QUIZ IS FINISHED*****
10. *How do you feel after writing that quiz compared to when you wrote the quiz alone?*

The subject was told that they had 5 minutes to complete a 30-question multiplication test, with the questions proceeding from easy to mild difficulty. When they were ready, the subject was given the quiz and the timer was started. While they wrote, observations were recorded about their behavior during the writing period, like facial expressions, sounds they made and if they said anything. When the subject was done the test, or 5 minutes was up, they would hand their answers in and they would be marked. Their score out of 30 and their completion time would be recorded. After a one-week period, test subjects were brought back to the same testing place in groups of three, and each of the subject's score and time would be displayed for all three subjects to see. After a one-minute period, the previous results would be taken away, and each subject was given a cut in half blank sheet of paper and a pen. The subjects were told that whoever got the best score would be given $5, however, the prize would not be given even if they won. The testing procedure from the single subject testing was repeated. After all scores and times were recorded, the group was asked about how writing in groups was different then writing by themselves, and which way they preferred.

THE QUIZ

1)	3x4	11) 12x9	21) 4x40
2)	4x9	12) 4x15	22) 19x10
3)	2x7	13) 11x8	23) 80x4
4)	9x4	14) 9x12	24) 18x15
5)	5x6	15) 7x10	25) 60x12
6)	8x9	16) 13x8	26) 24x30
7)	4x7	17) 12x12	27) 45x20
8)	3x5	18) 11x11	28) 121x12
9)	11x5	19) 21x3	29) 312x13
10)	13x3	20) 18x5	24) 1234x121

In this experiment, the independent variable was the number of people participating in the experiment. The dependent variable were the subjects' scores, completion times, and their behavior when writing. Control variable included the experiment setting, the

writing utensil, the quiz given, and the time provided to complete the quiz. The experiment had to be the same for every subject and subject group because external factors could upset focus in the subjects and affect their performance. The writing utensil had to be controlled because the subjects could get frustrated at a utensil because it does not work, causing them to lose focus, which again affects their performance as well as waste time finding a working utensil. The quiz and time had to be controlled as well to give each subject a fair testing and an equal opportunity to perform. Giving different quizzes would not test the subjects on the same information, and therefore the results would not be comparable. Giving different timing would either relieve or pressure subjects, which would make the results incomparable.

III. RESULTS

Figure 1. Survey

SUBJECT #	**Q.1**	**Q.2**	**Q.3**	**Q.4**	**Q.5**	**Q.6**	**Q.7**	**Q.8**
Subject 1	10	Male	Yes	6/10	8/10	A	Yes	Yes
Subject 2	10	Female	Yes	8/10	6/10	A	Yes	Yes
Subject 3	10	Female	Yes	7/10	7/10	A	Yes	No
Subject 4	10	Male	Yes	7/10	7/10	A	Yes	Yes
Subject 5	10	Male	Yes	9/10	7/10	A	Yes	Yes
Subject 6	10	Female	No	3/10	7/10	B	Yes	Yes
Subject 7	10	Male	Yes	7/10	8/10	C	No	No
Subject 8	10	Male	Yes	8/10	7/10	C	No	No
Subject 9	10	Male	Yes	10/10	7/10	A	Yes	Yes
Subject 10	10	Male	Yes	8/10	9/10	B	Yes	No
Subject 11	10	Female	No	5/10	8/10	A	Yes	Yes
Subject 12	10	Female	Yes	7/10	4/10	A	Yes	Yes
Subject 13	11	Female	No	5/10	6/10	B	No	Yes
Subject 14	11	Male	Yes	7/10	3/10	A	Yes	No
Subject 15	11	Female	Yes	9/10	5/10	B	Yes	No
Subject 16	11	Male	Yes	9/10	10/10	A	Yes	Yes
Subject 17	11	Female	No	2/10	4/10	C	No	Yes
Subject 18	11	Male	No	5/10	5/10	D	No	Yes
Subject 19	12	Female	Yes	8/10	8/10	A	Yes	Yes
Subject 20	12	Male	Yes	8/10	9/10	A	Yes	Yes
Subject 21	12	Male	No	5/10	4/10	B	No	Yes

Figure 2 – Observations (Quantitative)

SUBJECT #	**Score/30-Alone**	**Time Finished (in min)-Alone**	**SUBJECT GROUP #**	**Score/30-G**
Subject 1	28	2:05	*Subject Group 1*	30
Subject 2	30	3:42		30
Subject 3	29	4:35		29
Subject 4	30	3:10	*Subject Group 2*	30
Subject 5	28	3:46		29
Subject 6	30	3:50		28
Subject 7	23	4:57	*Subject Group 3*	26
Subject 8	24	4:44		28
Subject 9	30	2:37		30
Subject 10	28	5:00	*Subject Group 4*	28
Subject 11	30	4:52		30

Subject 12	27	3:20		29
Subject 13	30	3:25	*Subject Group 5*	30
Subject 14	22	3:37		25
Subject 15	30	3:27		30
Subject 16	30	2:28	*Subject Group 6*	30
Subject 17	20	4:23		22
Subject 18	19	5:00		18
Subject 19	30	2:20	*Subject Group 7*	30
Subject 20	29	2:22		30
Subject 21	28	4:00		28

Figure 2.1 – Observations (Qualitative)

SUBJECTS	**ALONE (During Quiz)**	**GROUP (During Quiz)**	**GROUP (After Quiz, Question 10)**
Subject 1	Quiet, talking to self	Loud, talked with group members	"Definitely more fun than on your own."
Subject 2	Quiet, straight-faced	"Shut up I'm trying to think", "Crap, I have to go back", sighs, groans, laughing	-Felt more challenged to beat the other 2 and tried harder
Subject 3	Quiet, talking to self	"[Subject 1], stop talking. It's annoying", laughing	"The competition makes it more fun."
Subject 4	Quiet, tapping pencil on desk	"Ahhhh shoot what's the answer", laughing, did not tap pencil on desk	-liked trying to beat other people for bragging rights "Bragging rights are the best prize"
Subject 5	Quiet, "So easy"	Telling jokes, laughing, a lot of profanity…	-competition added pressure -felt better in some aspects, worse in others
Subject 6	Loud, talked questions out loud, rocking back and forth with chair	Asking other participants to compare answers, asking me for answers	"It was way more fun, getting to see who was better"
Subject 7	Quiet, did not talk once	Quiet most of the time, small smiles	-atmosphere was more fun than alone
Subject 8	Quiet, slowly writing, "I'm stressed", "no, I messed up"	Laughing, asking what question other participants were on, smacked table when done	-felt like competition compelled him to do better
Subject 9	Quiet, biting nails	Talking while writing, asking for answers from other participants, "Dude, if I don't beat [Subject 8]…"	-always likes competing with friends to see who is better
Subject 10	Quiet, "Dude, why did you make this so easy?", no hesitation when writing answers	Mummering under breath, knocking on his head, "what is it, what is it, what is it"	-Likes competition, always wants to compete with people around same level as him
Subject 11	Quiet, no hesitation when writing answers, straight faced	Did not talk out loud to other participants, quiet	-Likes the competition more, "It's more fun to fight with others, I have to

			prove myself as a girl."
Subject 12	Mostly quiet, talked to self sometimes, "No, that's wrong, how did I manage to do that wrong."	Did not talk out loud to other participants, talked to self, "augh, this is stressful."	-Liked the competition more, liked being on edge during writing it
Subject 13	Quiet, talked through questions with self	"[Subject 15] is going to win dude, why am I doing this", laughing, tried to cheat off Subject 14	-"Yeah, adding people made it much more fun and entertaining, and I still did better."
Subject 14	Mostly quiet, wrote slowly "alright, whatever, I don't care.", left 4 questions blank	wrote on paper much faster than when alone, "man, I have to beat their scores. Mine was garbage.", "Yo, you two quiet."	-wanted to improve much more after learning what other 2 participants got when alone, took it more seriously
Subject 15	Mostly quiet, played with pencil and hair	"Hey, [Subject 13], what did you get for 19?", loud, laughing, making "uhhhhhh" sound	-"being put against another person makes you take something more seriously."
Subject 16	Mostly quiet, straight-faced	Laughing, making jokes, "Ok that's probably right."	-doing something with other people makes it more fun, would have liked to compete against a score that wasn't his own
Subject 17	Talking loudly to herself, "Oh my gosh I'm stupid", lots of scribbling out answers, side work	"So, [Subject 18] this is basically a fight for second place.", talked a lot, laughing	-would have felt more rewarding if there was a reachable score to beat compared to own score
Subject 18	Quiet, looked around the room repeatedly	"I don't think I will be able to beat any of you guys.", talked, laughing	-agreed with Subject 17
Subject 19	Quiet, no sound from her	"Yo [Subject 20], what question are you on right now.", mostly quiet, only talked to ask Subject 20 questions, slapped table when done	-a lot of fun to compete against an opponent that is your equal
Subject 20	Quiet, fiddled with pencil around fingers, ear	"[Subject 19] did better than me on the alone portion out of luck", mostly quiet, groaned when Subject 19 finished first	-agreed with Subject 21
Subject 21	Wrote slowly, quiet, played pencil drums, looked around	Quiet, no pencil drums, only looked at page and questions	-thought seeing the other 2 participants "furiously" competing made him want to do better as well

Figure 3

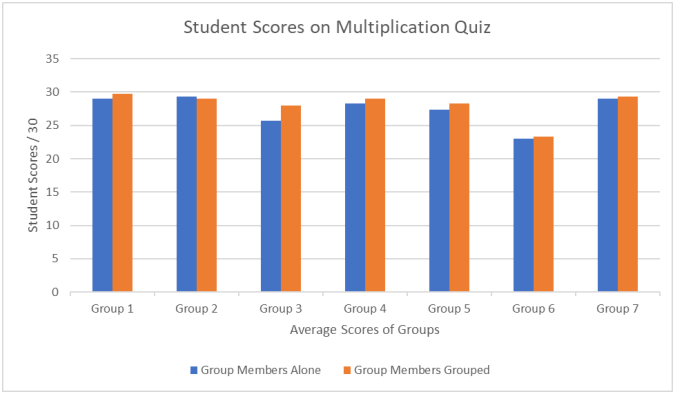
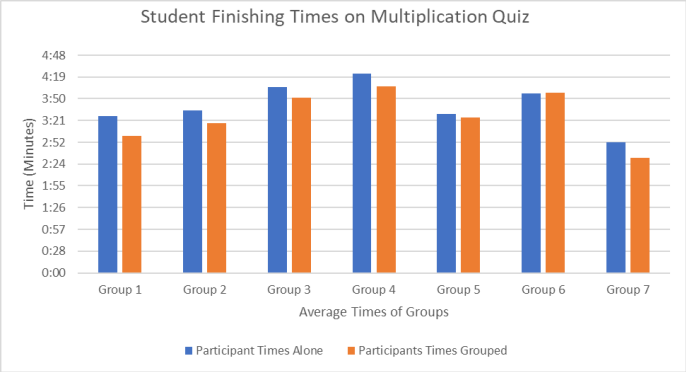


Figure 4



IV. DISCUSSION AND CONCLUSION

The hypothesis was correct. It stated that if there was a factor of competition added to a testing procedure (test, quiz, exam), then the result will be improved compared to a result without competition because the competition will motivate the person to perform better. Figure 3 compares the average scores alone and with others. In almost all cases, the average scores while with others were increased by a range of 0.3-2.7. Figure 4 compared completion times where in all cases, the average time taken to finish the quiz decreased for all groups, ranging from a 4-26 second decrease. In Figure 2.1, many participants said after writing the quiz that writing with a group of people competing against each other pushed them to become better, for example, Subject 2, who explained that she, "felt more challenged to beat the other 2 and tried harder".

Our predisposition on competition comes from the culture and society we are born in, it is not wired into our DNA. In western culture, there is an individualistic and competitive norm, where competing against one another, for the most part, is encouraged. We can see this in big sports events, and even in education, where students compete with one another to get limited spots into a university. This is why many people who were tested all loved and enjoyed trying to beat won another's scores. However, many other cultures look towards collaboration instead of competitiveness, like in Japan and more traditional cultures/societies. Depending on where and how one was raised, competition is something someone would love to have, or try to avoid.

V. APPLICATION

This data could be used by students preparing for an upcoming testing, like a quiz, test or, exam, and help them find motivation to study. Many students don't feel the need to study, so finding a competitor to strive to beat will prompt them to study and perform better. A way that this research could be taken a step further is by doing long term experiments about competition in academics. For example, does having a long-term rival further amplify the effects of competition in academics?

VI. REFERENCES

Firmin, M. W., Lucius, J. E., and Johnson, S. (2009). Student Perspectives of Competition: A Qualitative Analysis. Retrieved from March 6, 2019 from https://digitalcommons.cedarville.edu/psychology_publications/102/

Hennerdal, P., Malmberg, B., and Andersson, E. P. (2018, June 14). Competition and School Performance: Swedish School Leavers from 1991–2012. Retrieved on March 6, 2019 from https://www.tandfonline.com/doi/abs/10.1080/00313831.2018.1490814

Saleeb, M. (2016, April 16). How Competition Influences Students Academic Performance Introduction. Retrieved on March 6, 2019 from http://blogs.ubc.ca/engl112sec13m/files/2016/04/How-Competition-Influences-Students-Perfromance.pdf

Venhorst, A., Micklewright, D. P.,and Noakes, T. D. (2018) The Psychophysiological Determinants of Pacing Behaviour and Performance During Prolonged Endurance Exercise: A Performance Level and Competition Outcome Comparison. Retrieved on March 6, 2019 from https://link.springer.com/article/10.1007/s40279-018-0893-5

Height of a soccer player in response to athletic ability in soccer

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Abstract

The purpose of this project was to find out whether height had an effect on athletic ability in soccer. This is important since many soccer players experience discouragement of their skill level based on their height. To further enquire on this issue the currently best soccer players were compared with their heights using a graph. There were tall as well as small soccer players within the best rated soccer players. This proved that height had no effect in athletic ability in soccer. What makes you the better soccer player is how motivated and determined you are in the game.

I. INTRODUCTION

Height is a very important factor in many sports.

The problem of height is important since there are many talented athletes who get discouraged, based on their height and they blame their height for not succeeding in soccer. If a tall and a short player are compared, then the taller soccer player will not have any advantage in athletic ability because of the extra distance he or she can cover horizontally or vertically.

II. METHODS

Top soccer were taken, based of Business Insider.

The height of the top 100 players were collected.

The top soccer players were on the x-axis label and

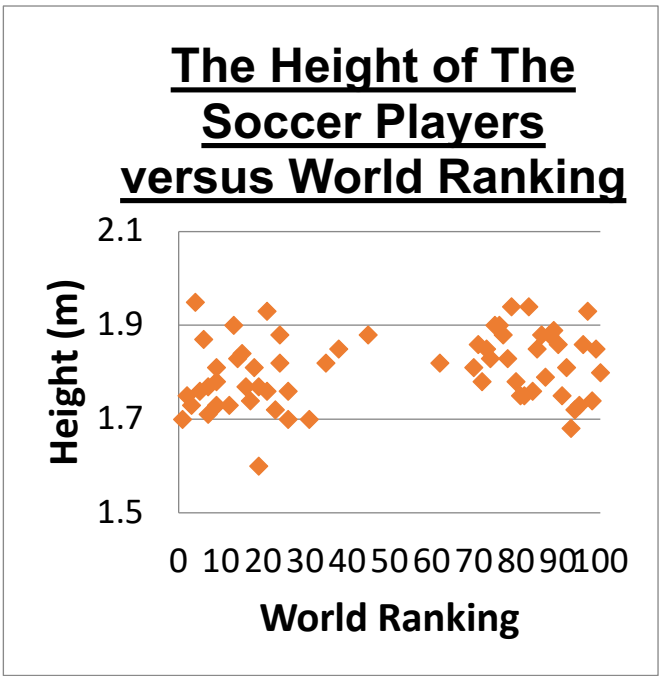
Their heights for the y-axis label. Points were plotted

On the graph. Outliers were indicated. The independent variable was their height. The soccer game was the variable was the player's performance. The dependant

Controlled variable, since it is kept the same.

III. RESULTS

Once the graph was plotted, many observations were made. There was no correlation, meaning that, there were tall players in the top 10 of the 100 players as well as small players in the top 10 of the 100 players. Also there were tall players as well as small players in the last 10 of the 100 players. This proved my thesis of soccer players not having an advantage in the game due to their height.



IV. DISCUSSION AND CONCLUSION

The factor of weight was never included in the experiment. A small but large player could be better than a tall and skinny player In conclusion, height didn't affect athletic ability. However, what made them the better player was how Determined and motivated they were in the game. Just like in many sports, it is the effort you've put that helps you excel.

V. APPLICATION

This information is useful, since it helps boost confidence of tall or small soccer players. If I compared more of the player's statistics like their defending, attacking, and heading ability, it could have helped answer questions raised by my result. This information can be applied to Kinesiology, since they talk about the humans body. The general public could use this information by motivating kids that blame their athletic struggles on their height.

VI. REFERENCES

James, R. (not given). Does Height Affect Ability in Sports. Retrieved on March 27, 2019 from https://www.livestrong.com/article/540491-does-height-affect-ability-in-sports/

Oghale, E. (2019). Does Arch Height Affect Athletic Ability. Retrieved on March 27, 2019 from https://aafoot.com/2014/01/does-arch-height-affect-athletic-ability-podatrist-fort-worth/

Mental Effects of Islamic Prayer with Focus versus Without Focus

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Abstract

Muslims pray 5 times a day, however some of them pray with little focus. The relevance of this project was to compare the effects of Islamic Prayer with focus versus without focus. 4 people were asked to do their noon prayer while trying to remain focused and reflect on their prayer afterwards. The same was asked of another 4 people except while praying with little focus in a noisy area. The people who prayed with focus felt around a 75% difference after the prayer while the ones who prayed with little focus only felt around a 20% difference. This shows the importance of trying to focus during prayer in order to attain as much of the benefits as possible.

I. INTRODUCTION

As a Muslim who prays 5 times a day, it is important to understand not only the spiritual, but also the physical and medical effects of prayer on the body. This project was inspired by a verse in the Holy Quran that says: "Verily, in the remembrance of God, do hearts find peace". (Chapter 13, Verse 26). Ahmad Al Shugairi (2014), an activist and media figure, mostly known for his TV show, Khawater, had an episode where he showed the effects of prayer on the mind by using a before and after brain scan in a hospital. The image of the brain after prayer showed that everything in the brain was lined up in the middle, and the frontal lobe was relaxed, meaning that the man was in a state of submission and peacefulness. The doctor had not seen something like it before. Also, a study has shown how the postures during the prayers are beneficial for the spine, heart, as well as memory and attention. (Abdullah, Badawi, 2012).

What are the physical and mental effects of the Islamic prayer on body and brain?

If a person prays, focuses in their prayer, and takes their time, then they will feel positive physical as well as mental effects on their mind and body, because a study has shown that by praying 5 times a day, blood circulation, digestion, and cardiovascular health are improved, and back pain and joint pain are relieved. (Islamic Finder). The prayer is also beneficial for the body since it makes all of the muscles physically active and induces serenity in the mind. (Misbah Ghous). It has also been proven to be a psychological therapy that calms the soul and relieves tension.

II. METHODS

A group of 8 people were divided into 2 groups of 4. The first group was asked to pray their daily afternoon prayer in a noisy area without being focused. They were asked to rate their focus, how

different they felt, any relieved stress, peacefulness, and mindfulness, all on a scale of 1-10. The second group was asked to pray their daily afternoon prayer in a quiet area, while trying to be as focused as possible. They were asked to rate the same things as those who prayed without focus after they were done praying. The subjects were asked to complete this procedure for the noon prayer for the 3 consecutive days. The prayer of those who were not focused and those who tried to be as focused as they could was compared.

The independent variable was the environment that the subjects prayed in, and the dependent variable was the level of focus. The control variables included age range, to ensure that all of the subjects were adults, the prayer time, because the noon prayer is prayed in the busiest time of the day, so the subjects are all busy, rather than the night prayer which is prayed right before the bed, and the questions asked afterwards were the same as well to ensure the same things were examined.

III. RESULTS

Table 1: Results for Subject 1 after praying without focus.

Name: Subject 1/No Focus	Day 1	Day 2	Day 3
How focused were you?	4	5	1
How different do you feel?	3	2	1
If you had any stress, how relieved do you feel?	1	1	1
How peaceful do you feel?	1	1	1
How mindful do you feel?	1	1	1

Table 2: Results for Subject 2 after praying without focus.

Name: Subject 2/No Focus	Day 1	Da
How focused were you?	2	2
How different do you feel?	3	1
If you had any stress, how relieved do you feel?	2	3
How peaceful do you feel?	1	1
How mindful do you feel?	2	1

Table 3: Results for Subject 3 after praying without focus.

Name: Subject 3/No Focus	Day 1	Da
How focused were you?	3	2

How different do you feel?	3	2	If you had any stress, how relieved do you feel?	3	6		7
If you had any stress, how relieved do you feel?	2	3		1			
			How peaceful do you feel?		8		6
How peaceful do you feel?	1	2	How mindful do you feel?	2	7		9
How mindful do you feel?	2	1		1			

Table 4: Results for Subject 4 after praying without focus.

Name: Subject 4/No Focus	Day 1	Day 2	Day 3
How focused were you?	3	3	
How different do you feel?	3	2	
If you had any stress, how relieved do you feel?	3	2	
How peaceful do you feel?	1	3	
How mindful do you feel?	2	1	

Table 5: Results for Subject 1 after praying with focus.

Name: Subject 1/Focus	Day 1	Day 2	Day 3
How focused were you?	7	8	
How different do you feel?	7	8	

Table 6: Results for Subject 2 after praying with focus.

Name: Subject 2/Focus	Day 1	Da
How focused were you?	8	8
How different do you feel?	8	6
If you had any stress, how relieved do you feel?	9	6
How peaceful do you feel?	8	6
How mindful do you feel?	7	9

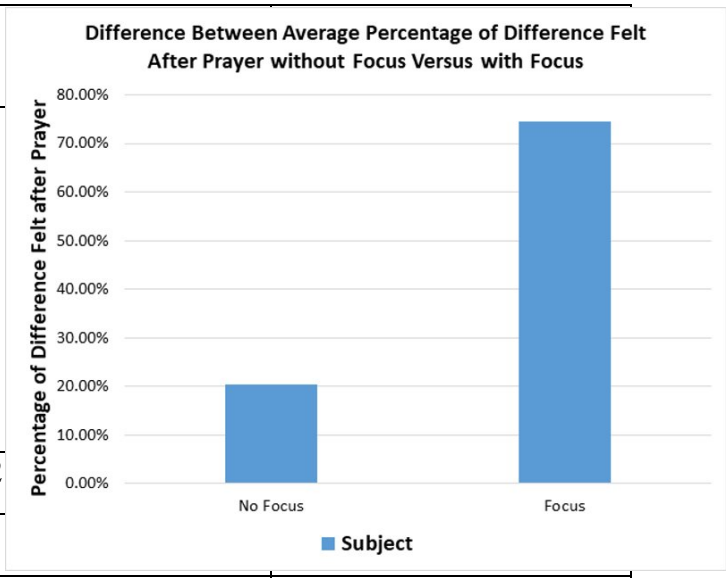
Table 7: Results for Subject 3 after praying with focus.

Name: Subject 3/Focus	Day 1	Da
How focused were you?	6	8
How different do you feel?	4	6
If you had any stress, how relieved do you feel?	N/A	7
How peaceful do you feel?	7	8

How mindful do you feel?	7	8

Table 8: Results for Subject 4 after praying with focus.

Name: Subject 4/Focus	Day 1	Day 2
How focused were you?	7	7
How different do you feel?	8	6
If you had any stress, how relieved do you feel?	6	9
How peaceful do you feel?	9	6
How mindful do you feel?	8	7



Graph 1: The difference between average percentage of difference felt after prayer without focus versus with focus.

Image 1: Image by Ahmad Al-Shugairi, Right: before praying with focus, Left: After praying with focus.

IV. DISCUSSION & CONCLUSION

The hypothesis that if a person focuses in their prayer, they will feel a positive difference afterwards, while if they pray without focus, they

will not feel very different, was correct. This is so because the average of difference after prayer with focus was about 74%, while the average of difference after the prayer for those who did not try to focus was about 21%. This shows that those who prayed with focus felt a difference after their prayer more than 3 times larger than those who simply did the actions and did not take time to try to pray with focus.

A behavior neuroscientist, Misha'a Khan (2018), along with many other scientists in this field confirmed that a person who prays consistently and with focus has a much better mental health state than one who does not. Prayer with focus has been proven to act as a psychological therapy by calming a person's soul and relieving them of any stress or tension. The Islamic Prayer also improves concentration and provides the person with important things for the soul, including: humility, piety, and modesty. Also, Muslims recite the Holy Quran during their prayer which has been proved to release negative feelings, or any fear or guilt, and blood pressure and stress level are decreased.

V. APPLICATION

By having more advanced technology such as a brain scan accessible, testing the difference in the brain before and after the prayer would have been easier to do. Also, physical changes in the body could be measured, including: blood pressure, respiratory rate, and oxygen saturation. This could be related to the effects of yoga, meditation, and the prayers associated with other religions. This information would be beneficial to the public as it raises awareness and educates people on the values and beliefs of Muslims, therefore creating more understanding and love between each other. It would also benefit the Muslim community because it would make those you are unaware, aware of the benefits of the prayer and the changes that are happening in their bodies when they're praying.

VI. REFERENCES

- Abdullah, A.B. (2012). Physical benefits of Salah. Retrieved on March 15, 2019 from https://www.farhathashmi.com/articles-section/worship/physical-benefits-of-salah/

- Amna A. A. (2018). Scientific benefits of Salah. Retrieved on March 15, 2019 from https://www.islamicfinder.org/news/scientific-benefits-of-salah/

- Misbah M.G. (2016). Health Benefits of Salah. Retrieved on March 15, 2019 from https://www.researchgate.net/publication/306124412_HEALTH_BENEFITS_OF_SALAT_PRAYER_Neurological_rehabilitation

- Muslimah, S. (2014, July 08). THE EFFECTS OF SALAH ON OUR BODY. Retrieved from

https://www.youtube.com/watch?v=H6-WkUPxWmw

- N.A. N.D. Benefits of Salah in Every Dimension. Retrieved March 15, 2019 from https://scienceprovesprayer.weebly.com/mental-benefits.html

The Effects of Cool Colours and Warm Colours on Mood in an Art Piece

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Abstract

The effects of cool and warm colours can drastically change a work of art in terms of mood. Mood plays a key role in an art piece thus, it was important to investigate the question, "What are the effects of cool and warm colours on mood in art piece?" To conduct the experiment, watercolour supplies were required. The first painting consisted of cool colours while the second consisted of warm colours. A survey was then put out to gather results from several individuals to see how they felt about each painting. The results from the survey answered the question stated above and supported that cool colours tend to evoke negative emotions whilst warm colours tend to evoke happiness. A total of 23 people, which is majority, answered with less stimulating emotions for the painting with cool colours whilst a total of 20 people felt content whilst looking at the piece with warm colours. There was one outlier for the piece with warm colours where 3 people stated they felt sad after viewing the painting. This is important to keep in mind since it does show that your feelings towards a certain colour can be subjective, but the majority of the results show that colours have a universal meaning connected to them.

I. INTRODUCTION

Determining what colours go best with a certain mood is very important because mood plays a key role in an art piece as well as how people perceive a painting. Colour can help harmonize or compose the work (Kent, D. No date) while mood is used to create emotion and atmosphere which also makes a piece more visually appealing. (Przybylek, S. No date). Therefore, without knowing what colours compliment mood, the piece altogether can be less appealing. Perceptions of a certain colour can be subjective but there are some colour effects that have a Universal meaning (Cherry, K. 2019). More often than not, cool colours such as blue, purple and green tend to make the viewer feel calm or sad while warm colours such as red, orange and yellow tend to make the viewer feel warmth or happiness. The reason for this is because certain colours can trigger certain chemicals in your body or brain. These chemicals generally make you feel a certain way, for example seeing the colour yellow tends to make your brain release serotonin which is a chemical that's associated with happiness.

To gain further understanding of the question, "What are the effects of cool and warm colours on mood in art piece?" a hypothesis is formed where "If warm colours and lighter values create a more positive mood then cool colours and darker values create a much more negative mood because of the universal meanings they have to a human being. Though the emotional influence in colour can be rooted from past experiences or culture".

II. METHODS

To test the hypothesis an experiment was conducted. First, two pieces of equally cut watercolour papers were taped down on all four sides onto a table. Papers were taped separately. On both papers, a slightly zig-zagged tree branch with three sections was sketched with a 4H pencil, starting on the middle right of the page and then going down to the bottom right corner. On the second section of the branch, a bunny was sketched, slightly inclined with paws hidden behind the tree branch. Then, a series of leaves were sketched on each corner of each page. Next, a kneadable eraser was used to lightly erase the lines. For the first page, cool colours such as blues, purples and dark greens were used to paint for the leaves and branch. The background was painted first, starting at the bunny with a diluted blue which slowly transitioned into a darker blue as it reached the edges.

Then, for the second page, warm colours such as red, yellow, orange and yellow-green were used to paint the leaves and branch. The background was painted first, starting at the bunny with yellow which then slowly transitioned into orange and red as it reached the edges. The bunny was left white on both art pieces. Once paintings had dried, tape was peeled off slowly.

Then a survey was conducted with both paintings attached. Each painting had the same open response question: “How does this piece make you feel?”. After this question, a multiple-choice question, “Is there a specific reason as to why it made you feel this way?” with the choices “yes” or “no” were put out for both art pieces. Lastly, another open response question was put out asking, “If yes was answered above, please state the specific reason below,” for both paintings.

The independent variable for this experiment was colour while the dependent variable was mood. The control variables were the sketch, watercolour brand, water quality and paper type. The sketch was a control variable because if a different sketch was used, it could alter the effect of mood on a person due to how the subject was positioned and facial expressions in the sketch as well as the objects used around it. Watercolour brand was also a control variable because different watercolour brands have varying levels of quality. If a low-quality brand was used it would have made the painting look chalkier and less smooth which would alter how the viewer perceives the piece. Next, water quality was another control variable since if dirtier water was used instead of clean, it could have made the colours look muddier and less appealing for the viewer. Lastly, paper quality was a control variable because certain papers can cause issues when using watercolours. For example, if printer paper was used it wouldn’t be able to handle the amount of water being used, causing the paper to buckle in certain areas and thus making the piece look less appealing.

III. RESULTS

A total of 29 people took the survey.

Table 1: Responses to painting with warm colours

Feelings People Felt for Painting with Warm Colours	# of People who felt this way
Warm	5
Happy	6

Calm	9
Sad	3
Other	6

Table 2: Responses to painting with cool colours

Feelings People Felt for Painting with Cool Colours	# of People who felt this way
Cold	5
Sad	8
Calm	6
Worried	5
Other	5

Most responses were categorized into a specific group but those that did not fit into one specific category or had more than one specific response were put into "other".

Figure 1: Bar graph comparing results for how people who felt differently about the piece with warm colours

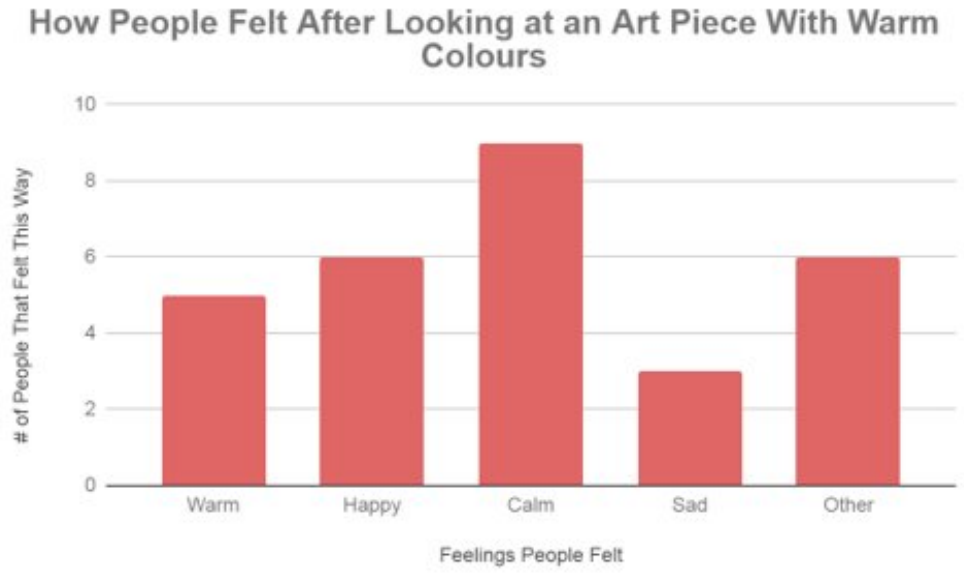
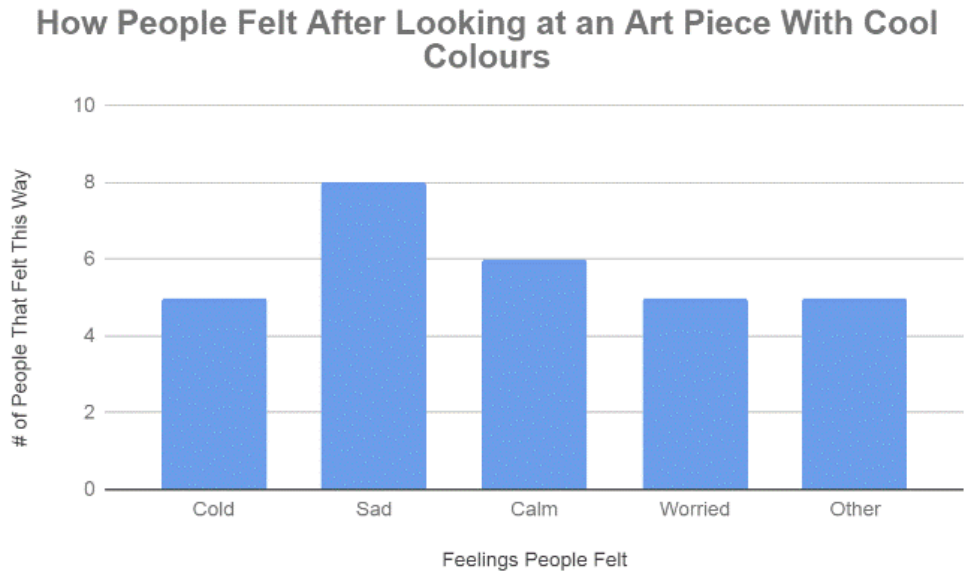


Figure 2: Bar graph comparing results for how people felt differently about the piece with cool colours



IV. DISCUSSION & CONCLUSIONS

As seen in the data, the art piece with cool colours had the majority of people, which is 23, respond with more negative or less stimulating emotions and a total of 20 people responded with the Universal emotions connected to the piece with warm colours. Therefore, these results supported the first portion of my hypothesis where "warm colours and lighter values create a more positive mood while cool colours and darker values create a much more negative mood because of the universal meanings they have to a human being". Although, there were two surprising factors with the responses for both paintings. An unexpected 6 individuals stated that they felt calm instead of sad or distressed when viewing the art piece with cool colours. Though, previous research shows that cool colours can in fact trigger calming chemicals in our brain and body which is an explanation to these unexpected results. The art piece with warm colours also had one outlier. 3 people stated they felt sad after viewing the painting due to the fact that they had different experiences with the colours used. As stated previously, feelings towards a certain colour can be subjective which supports the second portion of my hypothesis as well as proves the reason for the outlier in the graph. A possible error that could have been made whilst doing the experiment was putting a certain painting with either warm or cool colours before the other on the survey. This could have accidentally influenced a certain mood on the viewer, making the results less accurate. Instead, putting both art pieces side by side on the survey would have more accurate responses.

V. APPLICATION

Other than art, knowing which colours evoke a certain mood can be very useful for the advertising

industry as certain colours can be used to an advantage where you want to make audience members feel a certain way. In marketing and branding, it can also help give your audience a general idea of what your product is all about as well as to draw in more attention to your product. This can also be applied in the medical industry to help patients feel a certain way when they most need it. For example, a blue room in a hospital can help patients feel more relaxed if they feel stressed about an upcoming surgery.

VI. REFERENCES

Cherry, K. (2019. March 13) Color Psychology: Does It Affect How You Feel?, Retrieved on March 27, 2019 from https://www.verywellmind.com/color-psychology-2795824

Kent, D. (N.D). How to Create Mood Using Colour and Value, Retrieved on March 9, 2019 from https://snapguide.com/guides/create-mood-using-color-and-value/

Przybylek, S. (N.D). Understanding Visual Art: Identifying Theme, Mood and Tone, Retrieved on March 5, 2019 from https://study.com/academy/lesson/understanding-visual-art-identifying-theme-mood-tone.html

The Benefits of Short-Term and Long-Term Exercise on Stress-Related Performance

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Abstract

Stress and anxiety issues are growing at a rapid rate, while the amount of people exercising is decreasing. A co-relation between stress and physical activity was investigated and it was hypothesized that exercising would improve stress coping efficiency. The short-term effects of physical activity on stress were studied through a stress management testing game completed before and after exercising; while the long-term effects of physical activity on stress were obtained using a survey comparing subjects who exercise to those that do not. The research concluded that exercising has great benefits in both experiments. Both show that exercising improves stress coping efficiency by approximately fifteen per cent. This experiment proves how much of a difference exercising can make in an individual's life.

I. INTRODUCTION

With the new generation's decreasing ability to handle stress, it is important to find out the reason why. It is relevant to answer this problem because it can help prevent the increasing number of anxiety issues in adolescents and young adults. According to the government of Canada, the average Canadian is expected to exercise for approximately thirty minutes a day; however, a 2017 study conducted by *Statistics Canada* found that only 18% of the population aged 12 to 17 meet these requirements, compared to 52% in 1981. Likewise, a 2017 study published in the journal *Psychological Bulletin* found a 33% spike in anxiety issues since 1989. Studies in this subject can end up helping many people handle their daily stress. The problem being answered is the short-term and long-term effects of physical activity on stress coping and management.

It is hypothesized that increased amounts of exercise will increase stress coping capability. Individuals who compete or perform in physical activity are theorized to have a better ability to cope with stress than those who do not. If someone exercises, then they will be able to clear their mind. This occurs because working hard distracts the brain from outside influences and stimulates the amygdala, which is the centre of emotional processing in the brain (Forever Fit Science, 2015). Furthermore, working out would increase an individual's amount of sleep. Since exercising tires a person out, they will be more rested when they go to bed. Sleeping is highly beneficial to cleansing the brain and reducing stress (The Sleep Doctor, 2017). Participating in physical activity can also improve self-esteem, which is highly linked to anxiety, because they will be more pleased with their body (livestrong.com, 2019). If a person practises in an interactive sporting environment, then they will expand their social life, which can be a great way to reduce stress. This is so since a group of individuals with similar problems

can help and support one another (American Psychologist, 2009).

II. METHODS

Short-term experiment: Five subjects were placed in a quite environment where they had a few practice rounds of the stress game, "Time Shock" (see Figure 1), to understand how it works. Once the subject was calm and ready, they were timed completing the first game. The times were recorded in the "Time Before Exercise" column. If they did not complete the game, an additional three seconds were added to every piece not placed in their respective hole. The subjects then completed a twenty-minute moderate run. Directly after, they replayed the game following the same parameters as the first round. The times were recorded in the "Time After Exercise" column. The time of improvement (time before exercise - time after exercise) was recorded in the last column.

Figure 1: Stress management game "Time Shock". All orange blocks must be placed in the correct hole in under 60 seconds.

The independent variables were the completion of the game prior to and after running. The dependent variable was the time it took to complete the game. The first controlled variable was the game since the exact same game was played before and after the run. The second was the position of the shapes. Each block was placed in the exact same order for all the subjects. The third controlled variable was the environment. Both games were played in the same quiet environment to ensure focus. The fourth independent variable was the time of day. Both rounds of the game were played after school.

Long-term experiment: Fifteen subjects willing to participate were obtained; five of whom

compete in exercise (subjects Exp2-A), five who exercise for recreation or fitness (subjects Exp2-B) and five who do not do any exercise (subjects Exp2-C). A survey asking many different stress-related questions rated on a scale of one to ten was created (see Figure 2). The subjects completed the survey in a quiet environment. Stress coping efficiency was then recorded. If they answered 1/10 on a question, they were given 1 point, 2/10, 2 points, et cetera. The total number of points was added up, divided by 140, multiplied by 100 and rounded to two decimal places. This score was then placed in the "Efficiency" column. The average efficiency of all the subjects in each respective category was calculated.

The independent variables were the types of exercise (competitive, recreational, unaffiliated). The dependent variable was the stress coping efficiency score on the survey. The first controlled variable was the survey. All subjects of all categories had to complete the same survey. The second controlled variable was the environment. Each subject completed the survey in a quiet room to prevent distractions. The third controlled variable was the writing utensil. Everyone wrote with a lead-packed fully functioning 0.5 mm lead pencil. This would prevent distractions such as sharpening the pencil and getting new lead. The final controlled variable was the time of day the survey was written. They were all written at lunch since it is when the brain is most lively.

Category:	☐ A – competitive exercise ☐ B – recreational exercise ☐ C – unaffiliated exercise
Daily stress level:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 high low
Stress level during exam season:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 high low
Stress management:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 inferior superior
Average anxiety level:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 high low
Daily average hours of sleep:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ≤1 ≥10
Level of tiredness during the day:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 high low
Average focus level:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 negligent attentive
Average time management:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 low high
Time management during FSE season:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 inferior superior
Average anger emotional zone:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 low high
Average sadness emotional zone:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 high low
Average happiness emotional zone:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 low high
Average energy level:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 low high
Emotional control index:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 low high

Figure 2: This was the survey used for the study. The total number of points were divided by 140 then multiplied by 100.

III. RESULTS

Short-term experiment:

Table 1: Chart comparing subjects' times completing the shape matching game before and after running at an easy aerobic pace for 20 minutes

Subject	Time Before Exercise (sec)	Time After Exercise (sec)	Improvement (sec)
Exp1-A1	81	65	16
Exp1-A2	75	58	17
Exp1-A3	63	52	11
Exp1-A4	83	69	14
Exp1-A5	52	54	-2

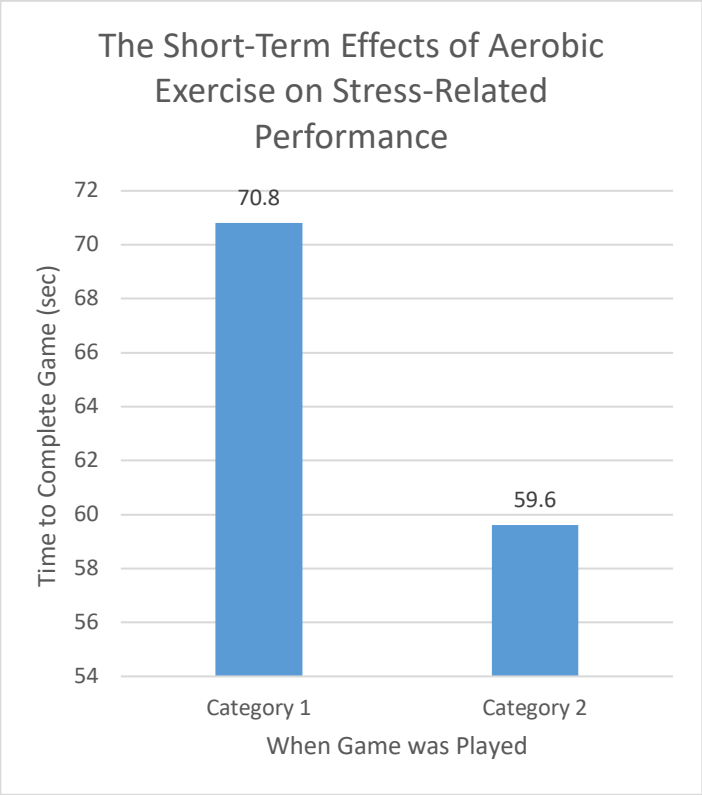

Figure 3: Bar graph displaying the data form Table 1. This graph compares the times side by side.

The subject's times were an average of 11.2 seconds faster the second game. They scored an average of 70.8 seconds (1:10.80) on their first game, prior to exercising; and an average of 59.6 (0:59.60) on their second game, after exercising. The outlier of the test is subject Exp1-A5 who went slower the second game by 2 seconds. Excluding the outlier, the subjects improved by an average of 14.5 seconds.

Long-term experiment:

Table 2: Chart comparing stress coping efficiency survey scores. Subjects labelled Exp2-A compete in exercise; those labelled as Exp3-B exercise for fitness or recreation; those labelled as Exp2-C do not exercise.

Type of Exercise	Subject	Efficiency (%)
Competitive Exercise	Exp2-A1	88.57
	Exp2-A2	94.29
	Exp2-A3	87.14
	Exp2-A4	95.71
	Exp2-A5	82.14
Recreational Exercise	Exp2-B1	80.71
	Exp2-B2	86.43
	Exp2-B3	83.57
	Exp2-B4	93.57
	Exp2-B5	89.29
Unaffiliated	Exp2-C1	77.14
	Exp2-C2	74.29
	Exp2-C3	83.57
	Exp2-C4	79.29
	Exp2-C5	67.86

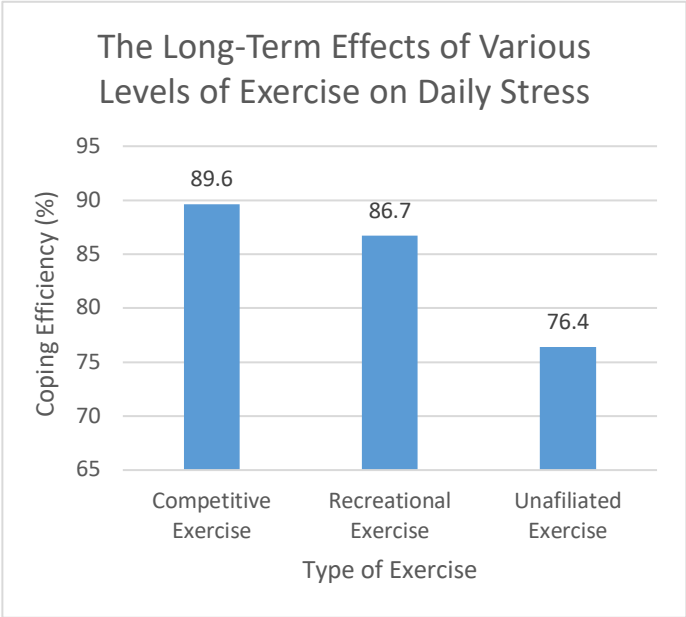

Figure 4: Bar graph displaying the data form Table 2. This graph compares the efficiencies side by side.

The subjects who compete in exercise cope with stress with approximately 89.6% efficiency. Those who exercise for fitness or pleasure cope with stress with about 86.7% efficiency. Subjects who do not

exercise scored an average of around 76.4% efficiency. No noticeable outliers were present.

IV. DISCUSSION AND CONCLUSION

The hypothesis that exercise will decrease a person's stress level and improve overall mental health was proven correct. The short-term effects of exercise on stress are positive. The subjects improved by an average of 11.2 seconds (15.8%/1.16×) on the stress test after participating in 20 minutes of aerobic exercise. Meanwhile, on the long-term effects survey, those who participated in physical activity scored significantly higher than those who did not. Subjects who compete in their respected form of exercise scored the highest at 89.6%, followed closely (3% less) by subjects who participated in non-competitive physical activity, at 86.7%. Subjects who do not do any sort of exercise performed over 10% lower than the other categories at 76.4% (13% lower or 1.15×worse than competitive & 10% lower or 1.12×worse that recreational). In both experiments, people who exercise appear to be about 15% better with handling stress than those who do not.

Improved stress levels and management appear to be a trend in people who participate in physical activity. This could be the case for multiple reasons. First, exercising has been proven to stimulate the amygdala, the brain's centre of emotional processing (Forever Fit Science, 2015). This would both reduce stress and improve its management. Second, since exercising tires a person out, they will sleep longer which will have multiple mental health benefits such as reduced anxiety and an overall better mood (The Sleep Doctor, 2017). Both these factors influence one's stress levels. Third, exercising improves a person's physique which can improve self-esteem and overall happiness and calmness (American Psychologist, 2009). Errors that can occur in the short-term experiment are that a person can just be alert for one of the rounds of the game, thus not reflecting their true capabilities. Certain errors that can occur in the long-term experiment are that since the survey only consists of fifteen people, it is not a one hundred per cent accurate representation of the norm. People who have high or low stress can be chosen by coincidence. In addition, a person can easily answer a survey dishonestly. This would corrupt the data. Adding on to that, subjects may be over-dramatic as to how they feel which will cause more extreme scores.

V. APPLICATIONS

Exercising as a means of coping with stress can be used for a wide variety of reasons. Psychiatrists, psychologists, therapists or other mental health professionals can use physical activity as a treatment for high anxiety patients. Furthermore, educational boards can impose a mandatory weekly or daily fitness session for students to reduce stress levels and issues. Further research into exercise on other branches of mental health issues can provide a wide variety of solutions to decrease outbreaks. More in depth measures to determine the effects of exercise on stress can include blood pressure tests, brain

scans, heart rate monitors and psychological analyses. This research can be used to help many people facing stress and anxiety problems in everyday life.

VI. REFERENCES

Breus, M., PhD (2017, May 17). *The Benefits of Exercise for Sleep*. Retrieved on March 5, 2019 from https://thesleepdoctor.com/2017/05/22/benefits-exercise-sleep/

Crawford, B. (2019). *How Does Exercise Affect Your Self-Esteem?*. Retrieved on March 6, 2019 from https://www.livestrong.com/article/438937-how-does-exercise-affect-your-self-esteem/

Crisp, R. J., & Turner, R. N. (2009). Can imagined interactions produce positive perceptions?: Reducing prejudice through simulated social contact. *American Psychologist, 64*(4), 231-240.

Elsevier (2014). Using Physical Exercises to Improve Mental Health. *Science Direct*, 149 (1), 921-926.

Hill, A. P. (2017). Perfectionism Is Increasing Over Time: A Meta-Analysis of Birth Cohort Differences From 1989 to 2016. *Psychological Bulletin*, 145(4), 410-429.

O'Brien, C. (2015). *4 Areas of The Brain That Benefit from Exercise*. Retrieved from https://foreverfitscience.com/brain-health/4-areas-brain-exercise/

President's Council on Sports, Fitness & Nutrition (2017, January 26). *Facts & Statistics – Physical Activity*. Retrieved on March 5, 2019 from https://www.hhs.gov/fitness/ resource-center/facts-and-statistics/index.html

Statistics Canada (2005). *Physically Active Canadians*. Retrieved on May 31, 2019 from https://www150.statcan.gc.ca/n1/pub/82-003-x/2006008/article/phys/10307-eng.htm

Statistics Canada (2017). *Directly measured physical activity of children and youth*. Retrieved on May 31, 2019 from https://www150.statcan.gc.ca/n1/pub/82-625-x/2015001/article/14136-eng.htm

The Lancet. (2018, August 8). Exercise linked to improved mental health, but more may not always be better. *ScienceDaily*. Retrieved on June 12, 2019 from www.sciencedaily.com/releases/2018/08/180808193656.htmUniversity of Toronto (N/A). *Department of Psychology*. Retrieved from http://home.psych.utoronto.ca

University of Toronto (N/A). *Faculty of Kinesiology and Physical Education*. Retrieved on April 23, 2019 from https://kpe.utoronto.ca/

Wikipedia (N/A). *Jordan Peterson*. Retrieved on April 23, 2019 from https://en.wikipedia.org/wiki/Jordan_Peterson