Overcoming Stereotypes That Hinder Academic Performance Through Psychological Priming

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This study is focused on the effects psychological priming has on low to average performing high school sophomores and juniors, in regards to theirSAT scores. The brain is constantly receiving stimuli and utilizes memories to correctly respond to the situation at hand. Thus, the environment and the information it yields directly or indirectly affects a person’s mindset at a subconscious level. This is known as psychological priming. Prior studies have found that the subconscious can often control not only one’s mood, but also one’s actions and thoughts. This study builds upon a foundation of research focused on both student-impacting stereotypes (Steele, 1999) and studies that focused on motivation (Dweck, 2006). My previous research in this field indicated that there is a significant correlation between presenting students with a fact-based article that iterates the power of the human brain and higher scores on mock passages from the SAT. This study is specifically focused on student group with a high minority percentage, compared to the overall sample school. When the psychological priming was applied to students where race-based stereotypes were activated, they performed significantly better than the control group where the negative stereotypes were not activated. This was shown through a p-value of .07 (when compared to an a = .05), thus there is not significant evidence to conclude that positive, potential-based priming is an effective way to overcome the racial stereotypes hindering impact on student's performance on SAT Reading Test, within the population constraints of the study.

Introduction

The environment that surrounds an individual affects a person’s mindset. The information people receive either at a conscious or subconscious level determines the state of one’s subconscious mind. This is the underlying principle of what is called psychological priming. The Automaticity of Social Life, by Bargh & Williams (2005), discussed the significant relationship between priming and behavior. This study is aimed at finding what priming can be given to help students overcome the stereotypes that are prevalent in our society.

This student study builds on two previous pivotal studies. The first study focuses on how impactful negative stereotypes can be on a student’s performance on scholastic assessments (Aronson and Steele, 1999). The other study focuses on how praise of a student’s effort and potential, rather than their previous performance, yields a both a higher performance and more active brain activity in the face of a challenge (Dweck, 2006). The purpose of the current study is to tie together the two previous studies in hopes that negative stereotypes can be overcome through potential based priming.

A previous study titled “Stereotype Threat and The Intellectual Test Performance of African Americans”, found that implicit implication of racial performance discrepancies had a dramatic effect on test results. The factorial design of the study was a 2 x 3, in which race (black or white) and test description (diagnostic of ability, problem solving indicator, or problem-solving indicator with hard questions) were the tested variables. The researchers then compared the scores the students received on the GRE test to their reported SAT scores yield (using a comparison equivalence table between the two scores).

How the test was described to its participants is incredibly important to the outcome of the scores. The graph above shows the comparative performance of groups when the test was described in different ways. In reference to the graph above, when the test was described as a diagnostic of student ability, the most noticeable difference between the two racial groups occurred (first 2 columns). Compare this to when the test was described as non-diagnostic and merely a test looking at how students take multiple choice tests - the performances of the two groups were relatively the same (the second 2 columns). When the test was described an assessment that focused on the student’s ability (Diagnostic), there was an extremely noticeable difference between the performances specifically in regards to race, compared to the almost negligible difference between the two groups when the test was described as merely a participatory activity (Non-Diagnostic). This gives quantitative data showing that the stereotype threat is activated when performance is judged, and skill is required. Further research elaborates on this idea, stating that “the stereotype threat manipulation may not only have an effect on the emotional reactions but also on the strategies applied in the test situation” (Keller and Dauenheimer, 2003). Meaning that this subconscious hinderance or block on one’s performance when a diminishing stereotype is enforced, the impact goes beyond the emotional state of the person, but also affects how they respond in the situation.

After reviewing this research, it is very logical to then question: “Why do stereotypes play such an impactful role in a student’s performance?” Or “How is it possible that our environment can have such an impact on our actions?” This all can be answered by nature and the structure of the brain. The human brain is constantly receiving and receiving information from its environment. It is not a passive organ, but instead it actively stores memories from previous experiences and utilizes them in response to the events occurring around it. In response to the stimuli, the brain utilizes previous memories to fulfill its expected role in the particular situation. This is the basis of the “Top-down model” (Kveraga, 2014), and it is under this principle that stereotypes have such a resounding impact on both the conscious and subconscious mindset. When the brain acts upon expectations, instead of fact or ability, this is known as the Stereotype Threat (Steele, 1995).

This phenomena occurs not only by happenstance, but also it is a result of the anatomical structure of the brain. The Anterior Cingulate Cortex, which plays crucial role in both cognition and emotion (Hurley, 2011), has a pivotal and unique location. This positioning allows it to have access to both the Limbic system (which controls the experienced emotions and memory formation) and the prefrontal lobe (which is responsible for the brain’s perception, memory, and cognitive processes) (Siddiqui, 2008).

Building upon both the structure of the brain and the top-down method of the brain’s activity, Dweck (1998), in her study “Praise for Intelligence Can Undermine Children’s Motivation and Performance”, found a link between self-belief and its impact on the success of students in the face of a challenge. Given that top-down monitoring and control processes can be linked to particular patterns of neural activity, “we argue that such patterns can be used to reveal how self-beliefs impact learning success in challenging academic tasks” (Dweck, 1998). Her research focuses heavily on the malleability of the human brain and the science behind neuroplasticity. Her study, “Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model” found that students who view knowledge as a fixed entity are more likely to become discouraged at the face of trials and are less likely to grow in their cognitive abilities. But people who view knowledge as a changing and malleable, then they inherently emphasis learning and thus their mental capability increases.
In the graphic shown above, the green shows a limited amount of brain activity, whereas the red show where the brain is visibly active. This graphic comes from a Magnetoencephalography (MEG) scan that was taken when students were confronted with a challenging problem that they needed to overcome. The scan shows that in response to the challenge, when students believed that their knowledge and abilities was a fixed entity, they were less likely to exhibit brain activity. It was observed that these students, instead of approaching the challenge, would withdraw and not put forth effort; believing that they were not able to properly answer the challenge, so they did not even attempt it. But in contrast, students who believed that their ability and performance was always able to grow and change, their brain was very active. This shows the importance of the underlying mindset of a student surrounding their potential directly correlated to their response to a challenge.

This study will use the findings of Aronson and Steele to ensure that the stereotype threat was activated, as well facts from Dweck’s findings to see if coupling the two can overcome the implicit, performance-inhibiting stereotypes. It is hypothesized that students who receive the positive priming before the test, even after receiving a proctoring that stimulates the stereotype threat, will perform better than those who do not receive the positive priming prior to testing. This study is focused on using positive messages that reinforce the student’s potential -and not their performance- to cause them to overcome a hindering stereotypes that may be linked to scholastic performance. The hypothesis is that students belonging to a minority race will demonstrate a greater positive response to factual priming, than their negative response to the activation of the negative stereotype.

Methods

This study will take place in English 3 CP classes - which are comprised mainly of high school sophomores and juniors. This class is chosen in specific for two reasons. Firstly, this grade would be preparing for the SAT, so this study would fit directly into the curriculum. Secondly and more importantly, this grouping provides a moderately uniform population of students taking part of this start. Based on the student’s English class placement, it is assumed that these student’s performance on the SAT Reading test will be relatively comparable.

The overall procedure of the study is as follows: The students first receive a paper on which the instructions of the test are written. Along with the instructions, the students also receive two passages from the SAT Reading section. Each student has 30 minutes to complete the questions. The passages are printed to better simulate the test taking environment that takes place on the actual SAT test day. The questions pertaining to the passages are on a google form that are given to the student via google classroom. (This is an electronic platform used by teachers to post digital assignments to their students. This platform was chosen because it is already used by teachers within the classroom). After the students completed the SAT Reading test, they are then asked to complete a demographics questionnaire (attachment 1) which allowed the ethnic composition of the class to be acquired.

Within the actual class, the students are divided, using systematic sampling (based on seating chart) into three groups: control, activated, and primed.
The first group will be the control group and they will receive the test first. Before receiving the test, they will receive a random passage (attachment 2) that does not focus on anything of importance, and will be given to the students so they do not feel isolated in not receiving a passage. The test will be described as a study of how the students utilize test taking strategies. Following the completion of the assessment, they will receive a questionnaire that will provide the demographic composition of the group tested.

The second group is the activated group. This group will receive the same test as the prior group, but will the test will be described as “dependent upon ability” (attachment 3). Thus activating any race based performance-inhibiting stereotypes (as followed in the outline of the study completed by Aronson and Steele). The student will then receive a random passage to read that will neither boost nor inhibit their performance, but will allow the students to go through the same process as the other groups. After reading this filler passage, the students will then proceed to take the same sample SAT test.

The final group is the Priming Group who will also receive proctoring that states that the testing is “dependent upon ability”. This test description will then activate any race-based, performance-hindering stereotypes (established by Aronson and Steele). The students will then receive a passage that focuses on the malleability of the brain and how knowledge is not a fixed entity, but instead a malleable state that is always growing and changing (attachment 4). This positive priming passages will be using materials proven to enhance performance (Dweck, 1988).

Participants
In order for the confidentiality of these students to be protected, the students will not indicate their name. The test will be given in a secure testing environment. Any personal information will be indicated in an online survey that will be taken after the completion of the actual testing. This is done so that no questions on the survey will impact the test taker’s performance. The people participating in this study will be high school students (ages 14-18) of both genders. No race shall be encouraged or discouraged to be a part of this study. The students selected for this study will be chosen via a random number generator. The students apart of this study will be high school students from Chapin High School. They will be invited to participate and have the option to decline if they do not wish to participate in the study. After the students participated in this study, the proctors read a disclosure (attachment 5) which ensures that the participants understand that this test was for data gathering only, and is not a determiner of their ability to perform or improve.

This study’s test population is comprised of a majority of low to mid-performing high school sophomores and juniors. This is an important thing to note about the test group for two reasons. First, within the particular school participating in this study, there is a higher concentration of minority students enrolled in the grade-level classes. For example, 12.8% of the participants in this study identified as African American, this compared to the overall school’s population that contains only 4% of African American Students. Thus the grade-level class had a higher percentage of the target population. The second reason that is important to specify that the participants in this study are mainly low to mid-performing students, is that often within these classes there is an overall attitude of apathy and disconnect. The “perceptual aspects of the social-psychological environment of learning are consistent in the direction of their relationship to cognitive, affective, and behavioural learning outcomes”. Meaning that the class environment impacts, not only the attitude of the class, but their overall work ethic and expectation of success - specifically in regard to: “Cohesiveness, Satisfaction, Task Difficulty” (Haertel, 1981).

Results and Discussion
This study seeks to address questions such as: “If stereotypes shape mindset, can the mindset be changed?” and “If our thoughts and actions are so malleable as to give way to common expectations, how can those thoughts be altered to yield a positive and encouraging result?”

To compare the three different groups’ performances on the SAT reading test, the ANOVA test was used. During the initial phase of testing (with a sample size of 34 students), the ANOVA test comparing the three groups yielded a p-value of .221, meaning that there were no significant differences found between the three groups.

But, as testing proceeded, and the student sample size was increased (to a sample size of 103 students), when ANOVA test was run, it yielded a p-value of .0918 (see figure below).

To further compare the performance of the groups, several 2 Sample T-Tests were run. The first one compared the control group to the group who received the priming. This test produced a p-value of .0198, which proved to be significant (when compared to an α = .05). But when a 2 Sample T-test compared the activated group and the primed group yielded a p-value of .3833, and thus does not provide convincing evidence to reject the null hypothesis.

Focusing on the ANOVA test, there is insufficient evidence to reject the null hypothesis (at an α =.05), meaning that the priming used in this study was not a highly effective in activating negative stereotypes within the “activated group”. One reason for this could be the uneven distribution of students into groups. The teacher proctors of the tests did not evenly distribute each test, thus the number of students in each group
was disproportionate (for example 25 students were in group 1 and 14 students were randomly placed in group 3). This in turn would decrease the randomness of the sample. Another possible reason that this study did not prove significant, was the student population taking part in the study. (Only 12.8% of the students apart of this study were African American, and 74.4% of the students were Caucasian). Therefore, the inhibiting, race-based stereotypes that this study was targeting to overcome may not have impacted the students the way it would a student population comprised mainly of African Americans.

In order to address the potential flaws in the study, the testing is currently being expanded to other English 3 CP classes, located at other high schools with a more racially diverse student population. Distribution of each group will be managed to be more uniform. The expansion to testing to a larger student population, will also increase the ethnic diversity of the student population. As evidenced by the decrease in the size of p-values from the first ANOVA (.221) and the second ANOVA test (.0918), the increase of population size (as well as the increase of the number of minority students participating in the study) lead to an increase of the significance of the study. It is hypothesized that this occurred due to the increasing number of minority students participating in this study. Due to number constraints, a further breakdown of performance of only the minority students was not possible because there was less than five minority members in some groups (thus not meeting the qualifications for running an ANOVA test).

The findings of this study are meaningful, because they allow for a tangible, simple solution to a problem that impacts a very vast yet uncharted topic of the subconscious mind. Understanding people at their core gives insight into what can be used to motivate them to succeed. It is also important to note that the cognitive neuroscience Top-Down model states that the brain is not a passive entity, waiting to be activated by stimuli, but instead is an active system, that employs memories of past experiences to best respond the situation presented. Thus, when students have a positive association with their ability and a standardized test, they will then later associate the positive priming with the future event. Making this not just a single occurrence, but instead a lasting impact on the student’s subconscious mindset and their performance.

Acknowledgements

I want to thank Dr. Beth Pontari for being an incredible help in this study. She is currently a professor of psychology at Furman University. She has given me insight into the potential impact this study can have on the field. I also want to thank Mrs. Lisa Maylath, my research one teacher. She has mentored me in my second year of this significant research project. I would especially like to thank the students of Chapin High School. Their willing participation in my study has allowed me to gather data that has the potential to allow students to outperform the stereotypes they have had placed on them.

Notes and References

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Supplemental Information: Attachment 1

Class Composition

1. TEST FORM NUMBER
   * Required
   Mark only one oval.
   - 1
   - 2
   - 3

2. Student Number *

3. Current High School *
   * Required
   Mark only one oval.
   - Chapin High School
   - Dutch Fork High School
   - Irmo High School
   - Spring Hill High School
   - Other:

4. What block is your English class? *
   Mark only one oval.
   - 1A
   - 2A
   - 3A
   - 4A
   - 5B
   - 6B
   - 7B
   - 8B

5. Current Grade Level *
   Mark only one oval.
   - 9th
   - 10th
   - 11th
   - 12th

6. Gender *
   Mark only one oval.
   - Male
   - Female
7. Race / Ethnicity (check all that apply) *
   Check all that apply.
   ☐ Hispanic or Latino
   ☐ American Indian or Alaska Native
   ☐ Asian
   ☐ Black or African American
   ☐ Native Hawaiian or Other Pacific Islander
   ☐ White

8. Classes Currently Enrolled In *
   Mark only one oval.
   ☐ Mainly CP
   ☐ Mainly Honors
   ☐ Mainly AP

9. What is your average grade in English (using 10pt grading scale) *
   Mark only one oval.
   ☐ A (100-90)
   ☐ B (89-80)
   ☐ C (79-70)
   ☐ D (69-60)
   ☐ F (59 & below)

10. Current GPA *
    Mark only one oval.
    ☐ 5.0 & above
    ☐ 4.0-4.9
    ☐ 3.9-3.0
    ☐ 2.9-2.0
    ☐ 1.9-1.0
    ☐ 1.0 & below

11. Have You Previously Taken The SAT *
    Mark only one oval.
    ☐ Yes
    ☐ No

12. What was your previous score? (write N/A if you have not previously taken the SAT) *

13. How confident are you in your academic performance? *
    Mark only one oval.
    1 2 3 4 5
    Not very confident ☐ ☐ ☐ ☐ ☐ Very Confident

14. Do you base your academic confidence on your number grade in a class? *
    Mark only one oval.
    ☐ Yes
    ☐ No
    ☐ Maybe
Today you will be taking the SAT Critical Reading Portion. It will consist of 21 questions and you will have 30 minutes to complete it. A physical copy of the passages will be provided to you and the corresponding questions will be in a quiz found on google drive.

This test is a part of a study that looks at student’s test taking strategies. Because of this, be sure to thoroughly consider and answer all questions that time permits.

Before you begin, please read the following passage.

Build A Beautiful Sandwich

On any given day, about 49 percent of Americans eat a sandwich, but many fall apart after a few bites. With just a few, simple engineering tweaks, Pashman says a sloppy one can be recovered.

"Give a lot of thought to the interior layering of your components," he says. In particular, "watch out for slippery components like sliced cucumbers, tomatoes and avocados."

He calls this "the sliced cucumber conundrum." But it can be solved with "the silver lining of greens." Instead of keeping all the slippery ingredients together, Pashman recommends separating them with thin layers of greens in between to create friction.

"The other thing to take into account is the hardness or crustiness of the bread," he says. The harder the bread, the harder the bite required and the more likely the inside ingredients are going to slip out under pressure.

NPR Staff. "Friction Can Save Your Sandwich," NPR.

Now, after reading this passage, you may begin the test.
Today you will be taking the SAT Critical Reading Portion. It will consist of 21 questions and you will have 30 minutes to complete it. A physical copy of the passages will be provided to you and the corresponding questions will be in a quiz found on google drive.

The results of this test are solely dependent upon student ability. Because of this, be sure to thoroughly consider and answer all questions that time permits.

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The results of this test are solely dependent upon student ability. Because of this, be sure to thoroughly consider and answer all questions that time permits.

Before you begin, please read the following passage.

The Power of the Human Brain

The brain is made up of neurons, or nerve cells, that process and transmit electrochemical signals. The human brain has about 100 billion of them.

Each neurons fires (on average) about 200 times per second. And each neuron connects to about 1,000 other neurons. So... every time each neuron fires a signal, 1,000 other neurons get that information.

Let's multiply:

\[
\begin{align*}
\text{100 billion neurons} \\
\times \text{200 firings per second} \\
\times \text{1,000 connections each} \\
= \text{20,000,000,000,000,000 bits of info transmitted per second}
\end{align*}
\]

20 million billion bits of information move around your brain every second.

The Big Picture

How many bits does it take to shape a whole thought? Analyze a complex situation? Probably billions. Scientists still haven't scratched the surface of how many neurons are in the brain.

Plus, consider that your brain is doing all those calculations at the same time... every moment of every day... processing sounds, sights, smells, taste, touch, thoughts

... and 99+% of the work it's doing... you never even notice.

Your brain is fast. Astoundingly fast. And the best part of all... is that we're each in full control of where we direct its focus. Now, after reading this passage, you may begin the test.
Student Participation - Study Disclosure

Thank you for taking part of my study. This study performed to examine the “psychological factors involved in solving verbal problems”. Meaning that this study was dedicated to familiarizing students with the type of “problems that appear on tests you may encounter in the future”. These were very challenging questions and I am incredibly appreciative for your participation and the effort you put forward.

Within this survey there were three prompts, 2 of which activated a race based stereotype that was centered around performance on academic assessments. Please know that any perceived difficulty or underperformance is not something that is a true definition of your ability. Each one of you have the potential and ability to succeed - regardless of any profile that you fall under.

Once again, thank you for participating in my study.