



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Chinmayi Balusu	Project Number S0401
Project Title Gender Differences in Emotional Recognition	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this project is to find out whether gender plays a role in an individual's ability to recognize and identify facial expressions. Participants of two genders, male and female, will be presented a total of 10 images on a computer screen. The images will consist of people with different facial expressions of distinct emotions. The participants will be asked to look at the image presented and then pick the correct emotion out of four possible emotions listed. The answer choices will be similar to each other: for example, if a confused face is shown, the answer choices might be angry, disgusted, impatient, and confused, rather than happy, sympathetic, sad, and confused. This format will require the participant to analyze the picture with greater care before he or she selects an answer.</p> <p>Methods/Materials Computer with excel software, Microsoft Powerpoint software with images and answer choices, lab notebook, pencil, group of 30 participants (15 male and 15 female). Recorded participants' gender, presented images on the computer screen, recorded participants' choices, calculated average accuracy for both males and females using Microsoft Office Excel calculation software.</p> <p>Results The data shows that the males were accurate 64.54 percent of the time while the females were accurate 65.71 percent of the time. There is not much of a difference between the accuracy of the males and females (only 1.17 percent).</p> <p>Conclusions/Discussion The hypothesis that women are better than men at recognizing and correctly identifying facial expressions proved right. There is no difference between the genders when it comes to recognizing and correctly identifying facial expressions, and the slight difference between the accuracy of the males and females may have also been caused by chance. It may have happened that the males and females in the selected sample of people were comparatively equal in terms of recognizing and identifying facial expressions. Additionally, the participants were between ages 13 and 15, and it might be possible that this certain age group is equally good at recognizing and correctly identifying facial expressions.</p>	
Summary Statement This project is about whether or not gender plays a role in an individual's ability to recognize and identify facial expressions.	
Help Received None; I designed and conducted the experiment by myself.	



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Jessica G. Bushman	Project Number S0402
Project Title The Extent and Effect of School Burnout on Adolescents	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Current research indicates rates of depression and anxiety among adolescents, youth ages 13-19, have increased by 70 percent in the past 25 years. Adolescents are repeatedly exposed to school-related pressures and stress, which have been shown to result in depression, anxiety, and/or burnout syndrome (BOS). Adolescents, at rates as high as 20%, have a diagnosable mental health disorder. Studies show that school burnout strongly predicted depressive symptoms later in life. The goal of this study is to explore and explain the experience of burnout syndrome in adolescents. The data obtained in this study will help fill the gap in knowledge that exists regarding the experience of burnout and contribute to a deeper understanding of the extent and effect that burnout has on adolescents for school administrators, faculty, and support specialists. The field of adolescent developmental psychology will gain insight as to how adolescents experience burnout and possible interventions for improving care.</p> <p>Methods/Materials Participants were interviewed in a 15-30 minute span of time, either by telephone or at a mutually agreeable time and neutral location. Upon completion of the interview, the participants later had an opportunity to participate in member checking of the interview transcript. After the data was received it was coded for anonymity and sorted into groups to reflect the most prominent trends.</p> <p>Results Adolescents defined school burnout as the complete loss of motivation due to constantly working, which results in exhaustion, lack of efficiency, the loss of mental stability, and an overwhelming feeling of failure as a student. The data suggests that coping mechanisms which include organizational skills and improving communication within the school environment are imperative to overcoming burnout.</p> <p>Conclusions/Discussion School burnout has an overwhelming presence on school campuses. School burnout causes fatigue, cynicism, and a feeling a failure for the students, but also hinders learning and life satisfaction. The data found can contribute to understanding both the adolescent experience of school burnout and creating interventions for treatment as well as prevention.</p>	
Summary Statement I explored the experience of school burnout in adolescents, while also pinpointing interventions for both prevention and treatment.	
Help Received I created, conducted, and completed the project independently. I did have the psychologist at my school review the questions I asked the interviewees. Additionally, I conducted this research at The Buckley School in a class mentored by Dr. Aidyl Gonzalez-Serricchio.	



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Myra Cheng	Project Number S0403
Project Title Understanding Arithmetic Learning in Young Children through a Neural Network Model of Number Representation	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Numbers are a universal, easily-measured concept taught to children by parents/caregivers. The goal is to understand the effect of different number representations in children's learning of numerical concepts as a mechanism behind learning disabilities like dyscalculia, thus leading to potential development of educational interventions.</p> <p>Methods/Materials Different inputs were used to represent the possible number representations that the child uses: random, weighted (as if fingers are held up cumulatively/non-orthogonal with semantic overlap), and one-by-one (orthogonal with no overlap). The random one is the baseline. With learning rate defined as the number of trials that the model requires before successfully learning to match the input of the number to the concept of the number, I predicted that the widely-used weighted representation will have the lowest learning rate because it simulates magnitude knowledge. I built a supervised learning algorithm in Python to model number learning. The algorithm is based on a neural network using a tanh activation function, backpropagation to calculate weights, and Gaussian noise to account for randomness. The differences in learning rates of numbers were then analyzed.</p> <p>Results On average, the algorithm learned fastest using the orthogonal one-by-one input representation, rather than the hypothesized non-orthogonal weighted representation. This may be due to the lack of semantic overlap, which makes it an easier representation to learn. The most efficient representation is not necessarily the easiest to learn due to its non-orthogonality. (ex. Binary is an efficient representation, but it is not commonly used due to its difficulty and non-orthogonality)</p> <p>Conclusions/Discussion Despite the insight it gave, this project is not sufficient to fully understand how children learn numbers. An element of learning numbers that was not modeled is the interactive correction between the caregiver and child: when the child gets a number wrong, the parent will put emphasis on that number. Other confounding variables need to be considered such as differentiation between the object and language representation of a number. Future directions for this project include mapping these mechanisms to neural pathways and exploring representational effects on higher-level math.</p>	
Summary Statement The effects of different number representations on young children first learning numbers were observed through a computational model, revealing that the fastest learning occurred using an orthogonal representation with no semantic overlap.	
Help Received My mentor, Professor Jeff Shrager, provided the general direction for the overarching project. Dr. Lang Chen and Professor Vinod Menon (Stanford Cognitive and Systems Neuroscience Lab) also provided invaluable guidance.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Marc S. Dennis	Project Number S0404
Project Title Gray-Haired Gamers: The Effect of Video-Gaming on the Physical Coordination of the Aged	
Objectives/Goals As people age, hand-eye coordination generally declines, and quality of life can suffer, as less coordination is associated with falls and other injuries. This project was designed to test whether video games could be used to help people 60+ years of age regain lost hand-eye coordination. A total of 50 participants were tested, with 25 serving as the baseline and 25 playing the video game. Control group subjects stood 6 feet away from a 12-in diameter bucket and attempted to toss 3 balls into the bucket; the outcome was recorded. After 15 minutes with no physical activity, control group subjects attempted again to toss 3 balls into the bucket. The procedure was the same for the test group except that during their 15 minute downtime the subject sat at a TV monitor and used an arcade-style joystick to play the first level of Pacman for the extent of three lives. Results showed a 19% increase in accuracy for the video game group, compared to a 4% increase in accuracy in the control group.	
Abstract	
Summary Statement I created a video game experiment that effectively demonstrated hand eye coordination could be increased in the aged to prevent injuries.	
Help Received I created a project to demonstrate how video game playing increases hand eye coordination in aged. My science teacher reviewed my results.	



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Khushali Desai; Pooja Desai; Aayushi Kapadia	Project Number S0405
Project Title Eye of the Beholder, Mind of the Beheld	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals In this experiment, we will study the difference in the body image perception and self esteem between different ethnic groups and genders. We will also investigate the correlation between body image and self-esteem among all our subjects.</p> <p>Methods/Materials A school official randomly choose forty subjects according to the requirements of the experiment. First, each subject is explained the experimental procedure and asked to sign the consent form. Then, each subject is asked to look in a mirror for 10 seconds measured by a timer. Directly after looking at the mirror, each subject is given the Rosenberg Self-Esteem Scale and Body-Esteem Scale marked with their ethnic group and gender as follows: AAM--African-American Male, AAF--African-American Female, AM--Asian Male, AF--Asian Female, CM--Caucasian Male, CF--Caucasian Female, HM--Hispanic Male, HF--Hispanic Female. The completed tests of each subject are collected and scored all together after everyone has been tested. The scores were recorded in a data table on our laptops. The data is represented in multiple graphs and is analyzed using a 2 Sample T significance test, Chi Squared Test for Association, and a scatterplot with linear regression.</p> <p>Results The results were that there was no significant difference in the body image perception and self-esteem between different ethnic groups. Males had more positive body image perception and self-esteem compared to females. There was a positive correlation between body image perception and self-esteem.</p> <p>Conclusions/Discussion Females are more vulnerable, as shown by our results in the gender differences. Therefore, we can provide outreach and education at school and in the community to empower women and girls to accept themselves as they are. From our results concerning differences in the ethnic groups, it was evident that the outside societal influences are greater than the culture at home. We can attribute our results to the assimilation of ethnic groups into the melting pot of America. Since the outer appearance conveys the first impression for an individual, we need to promote normal, healthy standards and expectations through social media and school. Our experiment focuses on teenagers who are going through the critical phase of identity formation.</p>	
Summary Statement Our experiment studies the difference in body esteem and self esteem between different ethnic groups and genders; we will also study the correlation between self esteem and body image.	
Help Received Ms. Brown, our Community Specialist at Stockdale High School, helped us collect unbiased subjects. Mr. Cantrell, the AP Statistics teacher, verified the statistics used in the project. Our parents helped get supplies.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Sydairee P. Dudley	Project Number S0406
Project Title Investigating the Best Exercise for the Brain	
Abstract Objectives/Goals The objective of this experiment is to compare three different exercises in an effort to discovering the most effective exercise for improving memorization skills for adults 45 and older. Methods/Materials Questionnaire (Slum Test), Pen/Pencil, Manila folders, 12 Volunteers/Participants (45-65 years old), Timer for tests Results The recorded data from the Slum tests, over the time span, illustrated the effects an exercise as intense as dancing has on the older brain. As it depicted, through the graphs, the steady increase of memorization certain participants had as they continued with their exercises. To elaborate, the results of the experiment showed that there was a 75% increase in brain power for those participated in line dancing, 55% for those who did walking and 30% for those who did resistance training. While the control group showed a 5% increase. Conclusions/Discussion Dancing was proven to have the greatest impact on memory for older adults, as the average of the data collected helped represent the growth of the participants hippocampi, which is an organ within the limbic system (within the medial temporal lobe) that has direct relations to a person's memory. This project helps further our knowledge on how the brain functions in older ages and it illustrates ways to lessen the likelihood of obtaining brain diseases.	
Summary Statement My project is about finding the exercise that will have the most impact on the human brain, in relations to improving memory skills, for adults in their mid 40's and older.	
Help Received My advisor helped proof read my report and how I should illustrate my data. She also assisted me with the timing of the Slum Tests and gave me clarifications for what an abstract and and appendix was.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Arnav Gattani; Vittal Thirumalai	Project Number S0407
Project Title Human Behavioral Impact on Water Conservation with the Use of a Water Meter	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals We are experimenting whether the use of a water meter which displays water usage and a corresponding website to record and analyze the data will psychologically impact its user to conserve water. We hypothesize that the use of a water meter in showers will cause a significant decrease in its participant's water usage because they will be more self conscious of how much water they are using and will therefore gradually decrease their water usage.</p> <p>Methods/Materials Informed consent was obtained from randomly selected individuals of varying gender and age. We purchased a garden water meter and customized it using adapters for use in a shower. During the control phase, the water meter is covered so that the participants cannot view the readings displayed on the water meter during their showers. After each shower, the human participant then logs onto the Water 4 All website that we have developed and enters the data under the Control Section. During the experimental phase, the cover on the water meter is removed to test so that the participants can view their water usage while showering. The participant then enters the data into the experimental section of our website which contains graphs and goals of the past water usage of that participant.</p> <p>Results From the data collected from our first group of participants over 8 days, there was an average of over a 20% decrease from the control phase compared to the experimental phase. During our analysis, we also discovered that the participants using an average of over 10 gallons saved an average of around 3.5 gallons on average while the participants using an average of less than 10 gallons saved an average of around 1.5 gallons.</p> <p>Conclusions/Discussion Our results support our hypothesis because on average, participants conserved over 20% of water usage based on the averages of their respective control and experimental phases. Therefore, our experiment shows that the participants were more water conscious of their water usage. If this water usage meter is implemented in the showers of a significant number of households, we believe that this will cause the public to significantly save water which may solve water scarcity issues and cause them to become more water conservation minded.</p>	
Summary Statement We found that when the human participants had access during their showers to view their water meter readings which displays water usage, it significantly caused a decrease in their water usage compared to when they did not have access.	
Help Received We designed, built, and performed the experiments ourselves. Our parents helped us purchase the materials and drove us around so that we could install the water meter in different homes.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Mani Homafar	Project Number S0408
Project Title Working Together: The Effect of Gender on the Efficacy of Group Based Cognitive Tasks	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goals of this research were to determine the effect of gender on the efficacy of group based cognitive tasks, and to identify the potential existence of an age bias conducted in earlier researches.</p> <p>Methods/Materials 20 computers, 40 teenage participants aged 15-18, 18 Verbal Reasoning test questions, 10 Spatial Reasoning test questions, and a timer were used. For the first portion of the project, I recorded individual female and male performance in the Verbal Test and Reasoning Test. For the second part of the research I recorded the difference in effectiveness between groups composed of the same gender and groups composed of opposite gender when working on a cognitive task.</p> <p>Results My research showed that females exhibit improved performance compared to males in both Verbal and Spatial domains. The latter half of the research showed that groups composed of the same gender were more effective at performing the cognitive task when compared to groups of opposite genders.</p> <p>Conclusions/Discussion My results indicate that there might exist an age bias in earlier researches conducted within the Verbal and Spatial domains, as earlier research indicated that males would exhibit improved performance within the Verbal test, while males would perform superior in the Spatial test. No such age bias existed in the latter half, which indicated that in general males and females are more effective at cooperating and synchronizing with others of the same gender.</p>	
Summary Statement I researched the difference in effectiveness of groups composed of the same gender and opposite genders when performing cognitive tasks.	
Help Received None, I recruited the subjects and conducted the experiments by myself.	



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Tanushree V. Jain	Project Number S0409
Project Title Analyzing Human Perspective across Age Groups through Cognitive Psychology	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To be able to understand how society will progress in the future, the biases that certain generations hold must be identified. The goal of this project is to assess bias levels across different age groups through surveys simulating scenarios that are designed to bring out implicit race or gender biases.</p> <p>Methods/Materials Assessed how bias levels vary across age groups using two different surveys created through Google Forms. One of the forms simulated different scenarios with details that would influence implicit gender and race bias, while the other was a control. Responses collected were downloaded to Microsoft Excel and then processed using a self-developed Python code through the software PyCharm. The materials needed for this experiment are a laptop with PyCharm, access to Google Forms, and Microsoft Excel.</p> <p>Results Most data exhibits the trend that as the age groups increase, so do the bias levels. The age group under the category of 10 # 15 year old children, is the least likely to let bias factors influence their decisions. In the Gender Bias categories, participants in this particular age group are 31% likely to favor males, 9% likely to disfavor males, 12% likely to favor females, and 41% percent likely to disfavor females, when compared to the 51%, 7%, 13% and 44% that the oldest age group, 51+, portrayed. For race biases, the 10-15 participants were 19% likely to favor whites, 1% likely to disfavor whites, 13% likely to favor blacks, and 16% likely to disfavor blacks, and the 51+ members were 34%, 0%, 8%, and 34% likely in having implicit bias dictate their decisions in the respective levels. Outliers were observed when taking to account the age group of 21-30 year olds, as they were shown to be the most bias in both Race and Gender.</p> <p>Conclusions/Discussion The hypothesis, #If a person is within a younger age group, then they will be less subjected or inclined to portray biases in society due to the fact that they are more of a global citizen#, was to a great extent supported by the data. The age group falling under the category of 10-15 year old children was the least subjected to allow implicit bias influence their world views. Additionally, it was observed how gender bias levels are consistent through all ages. Even though the favoring and disfavoring of whites and African Americans is still extremely high in society, it is significantly less than that shown in the gender categories.</p>	
Summary Statement I created online surveys that simulate different situations to assess how implicit gender and race bias levels vary across age groups.	
Help Received I created the surveys and the program that analyses the responses myself. However, my science teacher, Mrs. Amacher, helped review the results.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Lane G. Karlitz	Project Number S0410
Project Title Does Study Senses Improve Memory in Educationally Disadvantaged Adults?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project was to see if there is a relationship between my mnemonic mobile application, Study Senses, and the improvement of memorization in educationally disadvantaged adults. Would educationally disadvantaged adults benefit from using Study Senses more or less than the standard population of adults? I hypothesized that using Study Senses will improve memorization accuracy in educationally disadvantaged adults, but the improvement rate would be lower that that of adults whom are not educationally disadvantaged.</p> <p>Methods/Materials Residents (18 - 22) at the Covenant House California, using a within-sample design, were tested on memorization accuracy. Three experimental treatments were: 1) A recording of spoken word. 2) A recording of a study song to a tune that may not be familiar. 3) The Study Senses mnemonic mobile application to select a study song. Immediately after listening to all three recordings, the participants were asked to complete a survey about the terms in the recordings to test their memory.</p> <p>Results After reviewing my results, I found that my hypothesis was supported. Using my Study Senses application will improve memory accuracy in educationally disadvantaged adults, but the rate of improvement would be lower than that of adults whom are not educationally disadvantaged. My 2017 research, surveying educationally disadvantaged adults in residence at the Covenant House California, proved that using Study Senses improved memorization of study terms by 6% in comparison to the memorization of study terms without using Study Senses. The memorization improvement rate from Study Senses is 11% less in the educationally disadvantaged adult population than a standard adult population.</p> <p>Conclusions/Discussion I have gained a better understanding how music and technology together, specifically using Study Senses, improves memorization accuracy with educationally disadvantaged adults. I will continue my research by investigating how Study Senses can benefit the senior population over the age of 75 residing in an assisted living homes or senior living homes.</p>	
Summary Statement My mnemonic mobile application, Study Senses, improves memorization accuracy in a population of educationally disadvantaged adults.	
Help Received Dr. Jessica Postil, Executive Director of Autism Consultants	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Isaac Kim; Rishi Shah	Project Number S0411
Project Title Effects of Motivation on STEM Students	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Every year there are 1.2 million high school dropouts in the United States. The most effective way to reduce this alarming data is to find the most effective form of motivation that keeps students in school. The purpose of our project was to determine the effects of different types of motivation (intrinsic and extrinsic) on STEM students. The extrinsic form of motivation in our project was a group prize and the intrinsic motivation was donation to charity.</p> <p>Methods/Materials A variety of classes, rewards, and STEM related tests were used for this project. Students were tested over multiple days and were given different forms of motivation after the first day of the control (no motivation).</p> <p>Results After all the data was collected and analyzed, we found that in the control group, Class 2 saw the worst improvement in attempted (37%) and correct (82%) scores, where class 4 saw the second to lowest improvement in attempted (40%) and correct (54%) scores. For the group prize, Class 3 saw second to lowest improvement in attempted (54%) and correct (109%) scores, where class 6 saw the lowest improvement in attempted (24%) and correct (46%) scores. For the charity prize, Class 1 saw the highest improvement in attempted (64%) and correct (154%) scores, where Class 5 also saw the highest improvement in attempted (71%) and correct (87%) scores.</p> <p>Conclusions/Discussion Conclusions that can be gathered from this experiment is that motivation in intrinsic means is the most effective form of motivation. Additionally, students who traditionally are not highly motivated are greatly motivated by donating to charity as shown by the greatest improvement from the College Preparatory students. These results prove that charitable motivation is the most effective form of motivation among students. The impact of this project decreases high school dropout rates tremendously.</p>	
Summary Statement Our project examines the effects of different types of motivation on students' performance on STEM related tests.	
Help Received We designed and planned the project, and we also interpreted the results. Teachers from Stockdale High School performed the experiment on their classes.	



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Jonathan Ko	Project Number S0412
Project Title A Study on Impostor Syndrome and Performance	
Abstract Objectives/Goals Impostor syndrome (IS) is a concept that describes high-achieving people who are unable to internalize their accomplishments, and often feel that they are frauds. This study examined the effect of IS or the lack thereof on performance, with the hypothesis that IS decreases performance. Methods/Materials 41 high-achieving individuals, who are taking AP Calculus BC in junior year at a local public high school, were recruited and identified as the IS and No IS groups per their test results on the Clance Impostor Phenomenon Scale. Control and Experimental groups were assigned randomly among the IS and No IS groups. Three similar texts were provided to the specific groups to read: Impostor Repressing (which represses IS feelings) text to the IS-Experimental group, Impostor Priming (which replicates IS feelings) text to the No IS-Experimental group, Control (which has no effect on the mindsets) text to the IS-Control and No IS-Control groups, before a math test was administered. Student's t-tests were used for statistical analysis. Results 25 out of 41 (61.0%) of the high achieving students were identified as frequently having IS feelings. The average math test score (out of 60) was significantly lower ($p=0.003$, $a=0.01$) in the IS-Control group ($n=13$, 23.9 ± 12.0) than in the No IS-Control group ($n=8$, 40.3 ± 10.9). The average score was significantly higher ($p=0.005$, $a=0.01$) in the IS-Experimental group ($n=12$, 39.0 ± 14.8) than the IS-Control group ($n=13$, 23.9 ± 12.0). In the No IS group, the average test score was significantly lower ($p=0.007$, $a=0.01$) in the No IS-Experimental group ($n=8$, 23.5 ± 12.8) than the No IS-Control group ($n=8$, 40.3 ± 10.9). Conclusions/Discussion IS is prevalent in the population studied. Subjects with IS performed worse on the math test than those without IS, supporting the hypothesis. The Impostor Repressing text improved performance in the IS group while the Impostor Priming text decreased the performance in the No IS population. The Impostor Repressing text may be further developed to serve as a way to mitigate the observed negative effects of IS. Future replications of this study with larger sample sizes from various demographics will provide greater understanding of IS.	
Summary Statement I found that impostor syndrome decreases performance, and that this decrease can be rectified with the aid of a simple immersing text.	
Help Received I was able to inform and gather students with the help of the administration and many teachers at my school. Teachers Ms. Ling Ru Katy Kuei and Mr. Yunor Peralta allowed me to use their rooms for testing. Dr. Sonia F. Khan, M.D., F.A.A.P. provided encouragement and suggestions.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Tanner W. Mercer	Project Number S0413
Project Title The Connection between Diabetes and Alzheimer's: Elevated AGEs and Oxidative Stress in the Brain	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this study was to test the cognitive function of 70-85-year old women with Type 2 diabetes compared to those without diabetes.</p> <p>Methods/Materials I recruited a total of 59 participants, 29 diabetic and 30 non-diabetic, by word-of-mouth and social media. In order to measure each participant's cognitive function, I utilized the Self-Administered Gerocognitive Exam (SAGE), which is an exam that measures overall cognitive function and was designed to screen for Alzheimer's. This test was created by Dr. Douglas Sharre at Ohio State University.</p> <p>Results After all of the data was collected, I compared the scores of the two groups using a Student's t-test. From this test, I obtained a p-value of 0.0005, signifying that the non-diabetic had significantly higher scores. Furthermore, I ran another Student's t-test using only the participants who attended college. I did this in order to show that level of education was not a confounding factor in my study. From this test, I arrived at a p-value of 0.014, which still shows a significant difference.</p> <p>Conclusions/Discussion My results show that the women with Type 2 diabetes have significantly decreased cognitive function compared to the women without diabetes. This result suggests that Type 2 diabetes can cause decreased cognitive function. My results also support my hypothesis that the women with diabetes have decreased cognitive capabilities due to the elevated levels of AGEs in their bloodstream, which causes a high level of oxidation that can be associated with Alzheimer's.</p>	
Summary Statement I found that the women with Type 2 diabetes had decreased cognitive function compared to the women without diabetes.	
Help Received I designed the experiment, recruited the participants, and completed the project by myself, but Julian Homburger at Stanford helped me decide which statistical test to run on my data.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Ujjaini Mukhopadhyay	Project Number S0414
Project Title Mindset or Aptitude: What Drives the Learning Capability of High School Students?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this study was to determine whether mindset or aptitude was better indicator of learning ability of high school students.</p> <p>Methods/Materials My AP Bio class participants were offered two short questionnaires to test their mindset and aptitude for abstract reasoning. The mindset questionnaire, based on Professor Carol Dweck's work, consisted of 20 statements and was scored on a 1-4 scale. Questionnaire II was an abstract reasoning test consisting of 10 questions. The participants were assigned an anonymous ID number by the teacher prior to the study. Then, they were given three Sudoku challenges in class on 3 days, 1 week apart. Each challenge was for 10 minutes. The level of the Sudoku challenge was fixed. They were allowed to practice Sudoku at home and report that. Each Sudoku was graded on the number of correct entries. Mindset was retested after Sudoku. Regressions were conducted to understand the effect of mindset and aptitude on the change of the Sudoku score.</p> <p>Results There were 51 participants. Based on the survey, majority were of growth mindset with some fixed ideas. Females scored higher on mindset while males scored higher on the Aptitude. Based on the t-test, participants with growth mindset scored higher than those with fixed mindset at the same aptitude level ($p=0.01$). For the approaching-proficiency participants, based on the regression analysis ($R^2=0.69$), mindset had a significant negative correlation ($p=0$) to growth and insignificant positive correlation ($p=0.21$) to aptitude. Finally, based on regression ($R^2=0.47$), new learners (who scored less than 10 correct on first trial), had a significant negative correlation ($p=0.01$) with mindset and insignificant negative correlation ($p=0.17$) with aptitude. The conjecture is that the mindset scores of the participants were not reflective of their actual behavior (to try) because they were all high school students in AP Bio class. It was however observed that participants with high mindset score and lower aptitude score grew comparable to participants with fixed mindset and high aptitude. Women showed significant change in mindset after the Sudoku.</p> <p>Conclusions/Discussion People with growth mindset and high aptitude learn the most. Students with high aptitude but a fixed mindset performed worse in Sudoku than students with growth mindset. Mindset helps students learn new things and is a stronger predictor for learning.</p>	
Summary Statement The project is to determine whether mindset or aptitude is a better predictor of learning ability of high school students	
Help Received The study was designed by me. I got help in understanding the data from Prof. Regina Langhout, Psychology Department, UCSC. Mr Cahn helped me conduct the study in class and parents helped me with display board.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Karishma Muthukumar	Project Number S0415
Project Title A Novel Cost-Effective Brain Computer Interface (BCI) System with Emoticons: An Approach for Paralyzed Patients	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals There is an increasing need for assistive devices as expressed by patients in critical care, with speech and language difficulties, as well as those with disabilities. As a result, the proposed system intends to bridge the gap in communication. Through this research, I projected to (1) compare the effectiveness of modern picture boards and the proposed emoticon board, (2) determine frequently used expressions of patients with Locked-in Syndrome (LiS), (3) develop a mock board as a prototype for an electronic communication board, and (4) integrate BCI technology to enhance a cost-effective communication system.</p> <p>Methods/Materials The study involved simulating a patient-caregiver interaction as volunteers generated and translated relevant messages. Prior to the study, messages were evaluated for uniformity using the L2 Syntactic Complexity Analyzer. Emoticons were strategically selected and categorized into a computerized system that enabled a maximum of seven emoticons as supported by Miller's Law. Participants (N=12) were randomly assigned to be the patient or the caregiver. The patient was first given a message to generate using the provided board. The caregiver translated the received message into an English sentence, which would be evaluated for accuracy by the patient. The BCI aspect was created using an Arduino micro controller, LCD touchscreen, and an EEG signal acquisition/amplification module and subsequently paired with the emoticon board.</p> <p>Results A total of 120 messages were interpreted; 63.3% of the messages were correctly interpreted using the emoticon board (mean time 112.45 seconds +/- 67.93) and 43.3% were correctly interpreted using the standard (mean time 146.62 seconds +/- 103.01). Even though the time to convey and interpret messages was not statistically different (p=0.1443), the emoticon board proved to be more accurate for decoding messages correctly. The frustration level was significantly lower (p=0.0340) using the emoticon board.</p> <p>Conclusions/Discussion The improved communication board not only addresses the inadequacies of the current system, but also can potentially reduce medical error and prevent serious health complications. The applications for emoticons are widespread as individuals face communication difficulties in the health system.</p>	
Summary Statement This interdisciplinary study has led to the iterative development and simulative testing of an enhanced mode of communication, as enabled by Brain-Computer Interface and an emoticon-based board.	
Help Received Dr. An Do (UCI Department of Neurology; Director of the Brain-Computer Interface Lab) and Colin McCrimmon (MD-PhD student) were supportive in integrating the BCI aspect. The Neuroscience Electronics course material and specific guidance provided by Dr. Do proved to be instrumental.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Elise T. Okayama	Project Number S0416
Project Title Beyond the First Finish Line: Preparing for Life after College	
Abstract Objectives/Goals The objective of this study, is to extrapolate what skills will make graduating college students more valuable to businesses. The overall goal will be to give college students a clear view of what attributes they will need in order to find a good job. Methods/Materials I collected data from two original surveys regarding the valued skills of employees from 2001 and 2017. The first survey asked 32 business professionals their opinion on the value of various key skills, while the other used an analysis of 32 articles from 1996-2006. Both of these data sets were compared in order to extrapolate what skills will be valued in 2031. Economic and social trends were also taken into consideration. Results Based on the trends in the data, I have found that collaboration skills, adaptability, the ability to fit into a companies culture, as well the ability to do multiple varying tasks/jobs will be more desirable to businesses. Conclusions/Discussion Overall, today's employers are not looking for graduating college students with masters or doctorates. Instead, employers are looking for those who are hard working, reliable, adaptable, able to work with others, and have interpersonal skills. Based on this data, I predict that students will need to focus mainly on their interpersonal skills and broad experience, rather than higher level degrees such as masters or a doctorate. Other factors that influence these trends are the increasing cost of higher education and the increasing amount of constantly changing information and market trends.	
Summary Statement The objective of this study, is to extrapolate what skills will make graduating college students more valuable to businesses.	
Help Received Ms. Carson (mentor) and Dr. Swanson (advisor) provided me with guidance and advice on what methods and materials my project should use. Also, as a member of The Center for Advanced Studies and Research, I received additional research experience.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Nitya Parthasarathy	Project Number S0417
Project Title Evaluation of Gender Bias in Social Media Using Artificial Intelligence	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective was to come up with a generic methodology to study bias in social media content. Specifically, the goal was to study the occurrence of gender stereotypes in large social media databases.</p> <p>Methods/Materials The research focuses on two publicly available datasets, the IMDB database of movie reviews (50,000 reviews) and the Amazon movie critique database (random sampling of 25,000 reviews) The first part of this work comprises of a statistical and probabilistic study of stereotype occurrences employing relevant metrics from diverse areas. Next, two algorithms based on Artificial Intelligence (AI) techniques are introduced to further assess and validate the initial results.</p> <p>Results First, I studied the distance of gender words to gender stereotypes using statistical analysis. The results show how close the female gender words are to female gender stereotypes as compared to the male gender stereotypes. For the reviews under study, the statistical results demonstrate that female gender words exhibit distinct closeness/correlation to female stereotypes. Next, I developed machine intelligence algorithms using both Bayesian probabilistic formulae as well as Neural Networks to further check if the gender could explicitly be determined just by observing/analyzing stereotypes in words surrounding the gender word. The results in fact prove that a fairly accurate algorithmic prediction can be made on whether a sentence contains a male or female gender from the surrounding words.</p> <p>Conclusions/Discussion This research introduces novel metrics to study gender bias in any social media content. The conclusions are drawn based on a comprehensive approach with the use of multiple mathematical models, both statistical and algorithmic to provide an accurate and reliable evaluation. The results conclusively show the presence of female gender stereotypes. In fact, the female gender words in a sentence are shown to be accurately predictable. While this is also true for the male gender, the evidence there is not as conclusive as that for the female gender. Note that this method readily can be extended to study age and race related bias and hence is an important advancement in automatically studying all forms of bias or stereotypes in any general class of social media content/tweets/documents.</p>	
Summary Statement My research has led to a set of algorithms which can be applied to detect all forms of bias in social media thereby being an important contribution to bias studies using Artificial Intelligence.	
Help Received I discussed results with Prof. Sameer Singh at UCI to gather new datasets to extend my work.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Marco S. Pizarro	Project Number S0418
Project Title Creativity and Age	
Abstract Objectives/Goals The objective of this study is to investigate the correlation between a person's creativity and their age. Methods/Materials Informed consent was given by approximately 100 test subjects ranging from 9-19 years old. Tested a person's creativity by using JP Guilford's Alternative Uses Task (1967). Microsoft Excel (2016) was used in the statistical analysis portion of the project. Results Overall, the results show that creativity increases with age. The trendline shows an average increase per year of approximately 0.2 creativity quotient points per year. Conclusions/Discussion In the end, I was able to conclude that individuals gain points in their creativity quotient as they get older. This means that people will most likely increase in creativity with age.	
Summary Statement As measured by an alternative uses test, I proved that creativity increases as age increases.	
Help Received I I designed and executed the experiment myself. I got help in the statistical component of the project from Professor Gayle Dow from the Department of Psychology at Christopher Newport University. I also received statistical help from Professor Kevin Grobman from the Department of Psychology at CSUMB.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Gabriel P. Reder	Project Number S0419
Project Title Neurolinguistic Programming's Correlation to Posthypnotic Amnesia	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to see if males or females, whom are both more inclined and not as inclined to posthypnotic amnesia, will be affected by neurolinguistic programming. This will be achieved through three different audio tests with correlating answer sheets.</p> <p>Methods/Materials After intensive research I tested numerous subjects narrowing down to 20 males ((ten inclined to posthypnotic amnesia) and 20 females (ten inclined to posthypnotic amnesia. To find those that were more inclined to posthypnotic amnesia I had the subjects answer a series of questions that indicated if there were inclined or not. Over a three month period I met with each group of participates and had them listen to one story. Upon completion of that story I them had them circle four words out of a list of twenty. This process was repeated in the second and third month with different stories and words.</p> <p>Results The results were that those male subjects that were more inclined to posthypnotic amnesia were effect more by the trigger words linking them to neurolinguistic programming. The women who were more inclined to posthypnotic amnesia had close results with the two other groups falling behind with the males being slightly more inclined than the females.</p> <p>Conclusions/Discussion These results indicated that my hypothesis was correct, those inclined toward posthypnotic amnesia, specifically males, were influenced by neurolinguistic programming more frequently. This studies shows that posthypnotic amnesia is a useful tool for job opportunities, selling points, and every day discussions.</p>	
Summary Statement This project explores the role of posthypnotic amnesia and it's affect on neurolinguistic programming with make and female subjects.	
Help Received Professor Graham Pike and Jane Mathison	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Jack R. Suchodolski	Project Number S0420
Project Title The Effect of Time and Musical Experience on Vocal Pitch Matching	
Abstract Objectives/Goals The objective of this experiment was to determine if musical experience and time had any impact on people's abilities to correctly match a pitch with their voice. Methods/Materials Twenty-five people with 1+ years of musical experience and 25 people with no musical experience participated. Each participant received a video that gave a total of 7 different notes they had to vocally match. For each new note the participant heard, they had to wait an extra 10 seconds before singing it. By the last note, the participants were waiting up to a full minute before being allowed to reproduce the note they heard. Participants recorded themselves on a smart device, and sent in the recordings to be tuned using an electronic chromatic tuner. Results Musically experienced people started with a median range of only 7 hz off from the original pitch and ended with a range of 31 hz. People without musical experience started with a median range of 32.5 hz and ended with a range of 105 hz. This showed that musically experienced people were able to reproduce pitches that were much more in tune than the people with no musical experience. Everyone's pitch gradually continued to worsen as the time duration, in between hearing a note and singing it, increased. Conclusions/Discussion From looking at the collected data, the original hypothesis was confirmed; musically experienced people would be more in tune overall, but everyone's pitch would worsen as time durations increased. This is most likely because musically experienced people have been naturally trained in processing the pitch of notes and matching pitches they hear. And, just like any activity that involves the brain, the more it is repeated, the better neural pathways required for that activity function. One of the natural processes of the brain is to filter out unnecessary information, so the pitch of notes will generally be filtered out over time and the job of remembering that note becomes harder. This explains why everyone's pitch worsened as time durations increased.	
Summary Statement My project tested how people with, and without, musical experience were able to vocally reproduce a pitch they heard over different time durations.	
Help Received I designed the entire experiment and gathered all the data. My honors integrated-science teacher at Redwood High School reviewed my experimental design at the beginning of the project.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) James D. Sunga	Project Number S0421
Project Title Skirts, Music, and the Economy: An Investigative Study on the Correlation Between Music Tempo and GDP Rate	
Abstract Objectives/Goals The objective of this study was to characterize the correlation, if any, between GDP rate and Average Yearly Music Tempo. Methods/Materials Laptop computer with Microsoft Excel & "BPM Counter" by Abyss Media. GDP data was collected from the US Bureau of Economic Analysis. The Top 50 songs from the Billboard Hot 100 for each year were selected and downloaded from youtube, taking advantage of Google's autogenerated channels to avoid copyright infringement. Songs were then processed using "BPM Counter" in order to produce an average beats per minute for each year. (One data point per year) Both data sets were subtracted from their respective best-fit trend-line in order to create "fluctuation" or a sense of relativity. A comparison between de-trended GDP rate and de-trended Average Music Tempo was then made. Results Mathematically: $(\text{de-trended GDP rate}) = -0.4476 * (\text{de-trended Average Music Tempo})$. The correlation factor between de-trended GDP rate and de-trended Average Music Tempo was -0.756. Conclusions/Discussion The correlation factor of -0.756 suggested that music tempo was a strong inverse indicator of economic mood. Tempo fell below its trendline when GDP spiked above its trendline, and tempo spiked above its trendline when GDP rate fell below its trendline. A possible reason for this phenomenon is that people may self-medicate. When the economy is down and feelings are at a low, people may listen to faster, more up-beat music. When the economy is up, then people may unwind and listen to slower, more relaxed music.	
Summary Statement I demonstrated a strong negative correlation between relative music tempo and relative GDP rate.	
Help Received None. I designed and conducted the project myself. Only after the project was finished was I able to ask a few statisticians as to whether or not my data was for sure valid, which to the answer was yes.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Daria V. Syskine	Project Number S0422
Project Title Nonsocial Butterflies: Effects of Social Learning on Flower Foraging in the Nonsocial Cabbage Butterfly (<i>Pieris rapae</i>)	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of the project was to find out if cabbage butterflies demonstrate social learning and, if so, whether cabbage butterflies learn association tasks faster when observing other butterflies than non-living models, when observing models than scent cues, and with scent cues than individually.</p> <p>Methods/Materials Cabbage butterflies were provided with 8% sucrose solution from a yellow plastic flower, training them to forage only from yellow flowers. If butterflies were "demonstrator" butterflies, they were trained to forage only from green flowers. The testing arena contained 6 empty yellow flowers and 6 green flowers with 8% sucrose solution. During the testing of each trial group, 5-7 butterflies were released into the arena. For the scent-cue group, three green flowers had been exposed to "demonstrator" butterflies before experimentation. For the visual-cue group, three green flowers were marked with models. For the demonstrator group, three "demonstrator" butterflies, foraging only from green flowers, were released alongside two testing butterflies. The control group had no cues.</p> <p>Results The presence of "demonstrators" on green flowers increased the probability that naive butterflies would attempt to forage from a green flower ($p=0.0178$). This indicates that the cabbage butterfly, a non-social insect, may be capable of social learning. This experiment did not determine which cue prompts social learning, as there was no significant difference in time until first foraging attempt on a green flower for any cue ($p=0.0874$).</p> <p>Conclusions/Discussion These results, combined with earlier experiments demonstrating social learning in non-social organisms, support the argument that social and asocial learning are based on the same mechanisms. This has implications for fields of research which assume that social learning is distinct from asocial learning, such as those which use animal models to study social learning in humans, indicating that conclusions drawn from such studies may not always be accurate.</p>	
Summary Statement This project determined that the cabbage butterfly, a nonsocial organism, is capable of social learning (learning that results from one organism observing and copying another organism).	
Help Received My mentor, Lora Lerner, advised the project; the design, equipment, and procedure were created by me, but based off of procedures found in earlier research articles.	



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Michelle Y. Wang	Project Number S0423
Project Title Digital vs. Paper: Which One Serves as a Better Form of Standardized Testing?	
Abstract Objectives/Goals The purpose of this experiment was to determine the better format for standardized testing to ensure higher student performance. The P-values from the online test-takers were less than 0.05 for 9-10th graders in science and 11-12th graders in math; thus a significant difference in scores. Methods/Materials Use of Flexiquiz software, Excel, and 9th grade textbooks. Results Online testers in their freshman and sophomore year on science scored significantly higher than paper testers with a p-value that is less than 0.05, possibly due to a more focused environment online whereas the time limit has a better effect on them. The evidence presented in these two areas were strong enough to reject my null hypothesis and create an alternative hypothesis that online testers score exceedingly well on science and math; especially if the science test-takers are freshman and sophomores, and the math test-takers being juniors and seniors. In addition, online testers in math in their junior and senior year scored significantly higher online because they may have more experience due to being in their last years of high school. Conclusions/Discussion The results showed that online test scores are higher, perhaps because they tended to be more focused, intent, and took their time wisely. Juniors and senior math test-takers, and freshman and sophomore science test-takers, had a low P-value; indicating a strong contradiction of my hypothesis as the difference between the scores were quite large. This creates an alternative hypothesis that digital tests do aid in some cases.	
Summary Statement I analyzed the differences between digital and paper testing to ensure better test format; resulting in a rejection of my null hypothesis because online science and math scores were better.	
Help Received Student participation in taking the tests, and my dad helped me proofread my report	